Mississippi Valley Division,
Regional Planning and Environment Division South

Memphis Metropolitan Stormwater – North DeSoto County Feasibility Study, DeSoto County, Mississippi

Draft Feasibility Report with Integrated Environmental Impact Statement

May 2021

Abstract: This Draft Integrated Feasibility Report and Environmental Impact Statement documents the analysis of proposed actions related to the feasibility of flood risk reduction and ecosystem restoration alternatives within DeSoto County, Mississippi. Alternatives, including the proposed Tentatively Selected Plans and the No Action Alternative, are discussed.

Executive Summary

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Regional Planning and Environment Division South (RPEDS), prepared this draft Integrated Feasibility Report and Environmental Impact Statement (draft IFR-EIS) for the Memphis Metropolitan Stormwater-North DeSoto, DeSoto County, Mississippi Feasibility Study. The non-Federal sponsor is the DeSoto County, Mississippi Board of Supervisors. This study is funded through the Consolidated Appropriations Act, 2018, Public Law 115-141, Division D up to $3,000,000 with a 50/50 cost share. A Feasibility Cost Sharing Agreement with DeSoto County Board of Supervisors (sponsor) was executed on September 21, 2018. The draft IFR-EIS and the Tentatively Selected Plan (TSP) reflect sponsor, agency, stakeholders, and public input. It presents solutions to reduce damages from flood risk and channel instability as well as to improve aquatic habitat in DeSoto County.

Study Area

The study area lies in the Horn Lake Creek-Nonconnah and Coldwater River Basins in DeSoto County, Mississippi. This includes Horn Lake Creek and tributaries, Nonconnah River, Camp Creek and Tributaries, Hurricane Creek, Johnson Creek, and numerous tributaries of the Coldwater River watershed in northern DeSoto County, Mississippi. The study area includes the cities of Horn Lake, Southaven, Olive Branch, Walls, and Hernando. The most significant flooding issues occur in the northern part of the county, while channel instability and aquatic habitat degradation is more widespread.

Problems

The problems identified in this study include:

- The risk of flood damages in Horn Lake Creek Basin and the upper Coldwater River Basin.
- The landscape has been heavily developed and has experienced altered hydrology.
- Critical infrastructure, roads, schools, and medical facilities are at risk of rain-driven flooding.
- The inundation of roads during flood events is causing safety issues countywide.
- Channel degradation caused by residential and commercial development, channelization, erosive soils, agricultural practices, and other channel alterations in the DeSoto County watersheds have caused a decline in the ability of streams and adjacent lands to support the requisite functions for fish and wildlife.

Planning Objectives/Constraints

The Federal objective is to identify a flood risk management plan that reasonably maximizes NED benefits.

The flood risk management planning objectives include:

- Reduce flood damages to businesses, residential, and critical infrastructure in Horn Lake and Coldwater Basins in DeSoto County; and
  and
- Reduce risk to human life from flooding and rainfall events throughout the county.

The Federal Objective for Ecosystem restoration is to identify an ecosystem restoration plan that reasonably maximizes NER benefits. The Ecosystem restoration planning objectives include:

- Restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines, which would improve transport of stream flows and sediment over a 50-year period of analysis;
- Improve species richness through channel stabilization and habitat restoration;
- Improve water quality to support aquatic resources.

A planning constraint is a restriction that limits plan formulation or that formulation must work around. It is a statement of things the alternative plans should avoid. Planning constraints identified in this study include:

- Minimize degradation to stream habitat and vulnerable wetland areas;
- Ensure study is compliant with FAA regulations associated with the Memphis International Airport;
- Maintain consistency with DeSoto County Flood Damage Prevention Ordinance;
- Avoid or minimize negative impacts to fish passage; and
- Avoid or minimize negative impacts to cultural, historic, and Tribal resources to a practicable extent.

Alternatives Considered

The planning process included several iterations and evaluated management measures and subsequent alternatives ranging from large regional scale (i.e. across the study area) to smaller localized scale (i.e. at the community level). A nonstructural assessment was also completed that investigated the effectiveness of implementing measures such as structure elevations or flood-proofing, as well as management measures such as flood warning systems.

Twenty-one flood risk management (FRM) measures were evaluated based on the planning objectives, constraints, and opportunities discussed above. The final array of alternatives included a channel enlargement feature that would be located on Horn Lake Creek at River Mile 18.6-19.4, just west (downstream) of the intersection of Hwy 51. In addition to this channel enlargement feature, the project delivery team (PDT) evaluated detention basins in various locations as well as nonstructural alternatives.

Flood Risk Management National Economic Development/TSP

Per USACE guidance (Principles and Guidlines,1983), the PDT identified the alternative that reasonably maximizes net economic benefits consistent with protecting the nation's environment. This plan includes the channel enlargement, a single detention basin on Lateral D (a tributary of Horn Lake Creek), and a nonstructural aggregation to address residual flooding. While this alternative has the greatest net benefits and is the NED plan, the DeSoto County Board of Supervisors identified a larger plan that maximizes annual benefits and would reduce flooding over roadways. The Locally Preferred Plan (LPP) is the FRM TSP and includes the NED plan with two additional detention basins (both would be implemented along tributaries of Horn Lake Creek). The FRM TSP is estimated to produce approximately $4.5 million in annual benefits at an average annual cost of nearly $3.7 million, for a Benefit to Cost Ratio (BCR) of 1.22.

National Ecosystem Restoration TSP

Ecosystem restoration is one of the primary missions of the USACE Civil Works program. The USACE objective in ecosystem restoration planning is to contribute to national ecosystem restoration (NER). Contributions to NER (NER outputs) are increases in the net quantity and/or quality of desired ecosystem resources. Measurement of NER is based on changes in ecological resource quality as a function of improvement in habitat quality and/or quantity and expressed quantitatively in physical units or indexes (but not monetary units)The NER plan maximizes ecosystem restoration benefits compared to costs. The NER plan includes a bank stabilizing system of grade control structures (GCS) coupled with riparian restoration on eleven streams (Camp, Cane, Horn Lake, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creeks). The NER plan is estimated to provide 827 Average Annual Habitat Units (AAHUs) at an average annual cost of $1.7K per AAHU. The total annual cost of the NER plan is $1.4 million.

Timeline

This initial draft IFR-EIS is available for public review and comment beginning May 28, 2021. The official closing date for receiving comments is July 11, 2021, which is 45 days from the date on which the notice of availability of this draft IFR-EIS was published in the Federal Register during the review period. Comments may be mailed to the address listed below or dropped off in person during business hours (Monday through Friday 8 a.m. to 5 p.m. local time). Comments may also be emailed to the email address listed below.

For further information contact the point of contact below before July 11, 2021:

U.S. Army Corps of Engineers
Attention: Environmental Compliance Branch
167 North Main Street
Memphis, TN 38023
Email: CEMVM-DeSoto-Comments@usace.army.mil

Privacy Notice: Persons submitting comments are advised that all comments received will be available to the public, to include the possibility of posting on a publicly accessible website. Commenters are requested not to include personal privacy information, such as home addresses, or home phone numbers, in their comments unless they do not object to such information being made available to the public.

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Introduction

The U.S. Army Corps of Engineers (USACE), Mississippi Valley Division, Regional Planning and Environment Division South (RPEDS), prepared this draft Integrated Feasibility Report and Environmental Impact Statement (draft IFR-EIS) for the Memphis Metropolitan Stormwater-North DeSoto, DeSoto County, Mississippi Feasibility Study. The report and the TSP reflect sponsor, agency, stakeholders, and public input. It presents solutions to reduce damages from flood risk and channel instability as well as to improve aquatic habitat in DeSoto County.

1.1 STUDY SCOPE

The study covers a large area including six river basins, across five counties in two states and as such affords the ability to work with multiple sponsors (Figure 1-1). In this case, the local sponsor is DeSoto County, Mississippi. The initial focal area was identified as the Horn Lake and Coldwater River Basins within the boundaries of DeSoto County. The most significant flooding issues occur in the northern part of the county, while channel instability and aquatic habitat degradation is more widespread throughout. Items contained in the study scope were determined based on the Study Authority, included below, and specifically referenced the need for improvements for flood control, environmental restoration, water quality, and related purposes associated with storm water runoff and management.

1.2 AUTHORITY

This study was conducted in response to the United States House of Representatives Committee on Transportation and Infrastructure resolution on March 7, 1996, regarding the Memphis Metro Area, as follows:

> *The Secretary of the Army reviewed the report of the Chief of Engineers on the Wolf River and Tributaries, Tennessee and Mississippi, published as House Document Numbered 76, Eighty-fifth Congress, and other pertinent reports, to determine whether any modifications of the recommendations contained therein are advisable at this time, with particular reference to the need for improvements for flood control, environmental restoration, water quality, and related purposes associated with storm water runoff and management in the metropolitan Memphis, Tennessee area and tributary basins including Shelby, Tipton, and Fayette Counties, Tennessee, and DeSoto and Marshall Counties, Mississippi. This area includes the Hatchie River, Loosahatchie River, Wolf River, Nonconnah Creek, Horn Lake Creek, and Coldwater River Basins. The review shall evaluate the effectiveness of existing Federal and non-Federal improvements and determine the need for additional improvements to prevent flooding from storm water, to restore environmental resources, and to improve the quality of water entering the Mississippi River and its tributaries.*

1.3 NON-FEDERAL SPONSOR

The non-Federal sponsor (NFS) is the DeSoto County, Board of Supervisors herein (DeSoto County). A Feasibility Cost Sharing Agreement was executed on September 21, 2018. This study is funded through the Consolidated Appropriations Act, 2018, Public Law 115-141, Division D up to $3,000,000 with a 50/50 cost share.

Once construction funds are appropriated for this project, the DeSoto County Board of Supervisors as the Non-Federal Sponsor (NFS), and the Department of the Army would enter into a Project Partnership Agreement (PPA). After the signing of a PPA, the NFS can acquire the necessary land, easements, and rights-of-way to construct the project. Because project features cannot be advertised for construction until the appropriate real estate interests have been acquired, obtaining the necessary real estate in a timely fashion is critical to achieving the project schedule. At the completion of construction, or functional portions thereof, the NFS would be fully responsible for Operations, Maintenance, Repair, Rehabilitation, and Replacement (OMRR&R) of the project or of the completed functional portion of the project.

1.4 STUDY AREA

The study area lies in the Horn Lake Creek-Nonconnah and Coldwater River Basins. This includes Horn Lake Creek and tributaries, Nonconnah River, Camp Creek and Tributaries, Hurricane Creek, Johnson Creek, and numerous tributaries of the Coldwater River watershed in northern DeSoto County, Mississippi (Figure 1-1). The study area includes the cities of Horn Lake, Southaven, Olive Branch, Walls, and Hernando.

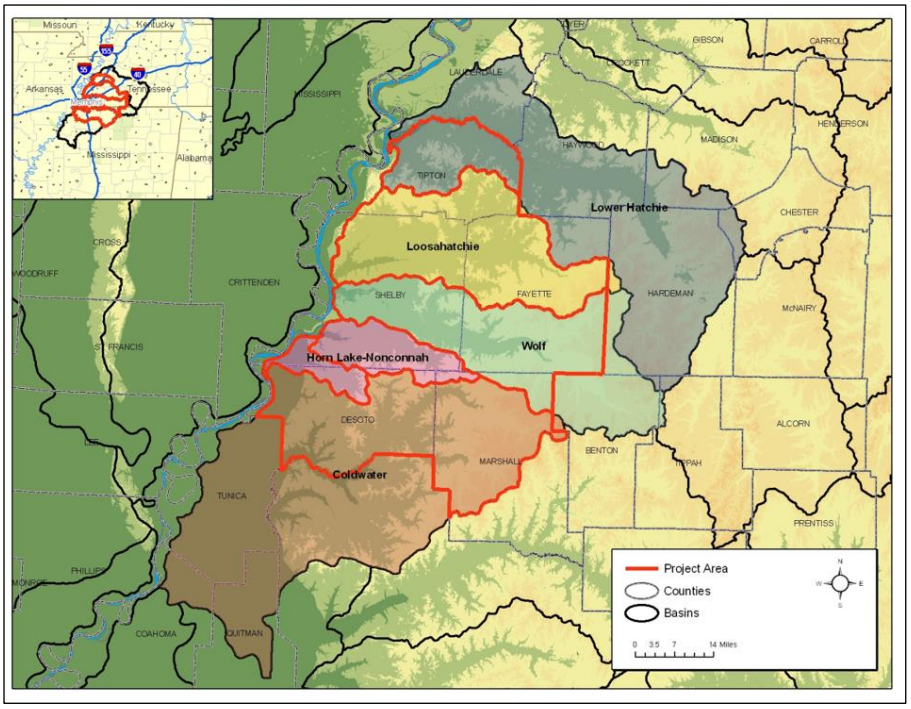

Figure 1-1 Memphis Metro Basins

The most significant flooding to structures occurs in two of the northernmost watersheds, Horn Lake Creek, and the greater Camp Creek watershed. Camp Creek watershed is within the greater Coldwater River Basin. Horn Lake Creek and Camp Creek watersheds make up the specific project area that the team studied and applied flood risk measures (Figure 1-2). Horn Lake Creek is approximately 26 miles in length, crossing the Tennessee -Mississippi State line at stream mile 12.5. Horn Lake Creek has a total drainage area of 54 square miles with 42 square miles in Mississippi. Major tributaries include Rocky Creek, Cow Pen Creek, Lateral D, and Southaven Creek. Horn Lake creek and its tributaries serve as the primary drainage outlets for the cities of Southaven and Horn Lake, Mississippi. These significant features are in the study and project area:

- Interstate 55 bisects the area north to south
- I-69 corridor bisects it east to west
- U.S. Highways 51 and 61 lie in the project area
- Three major rail lines run north-south through the area
- Several large underground pipelines
- An overhead Tennessee Valley Authority transmission line is in the project area
- The study area lies approximately 2 miles south of the runways at Memphis International Airport.

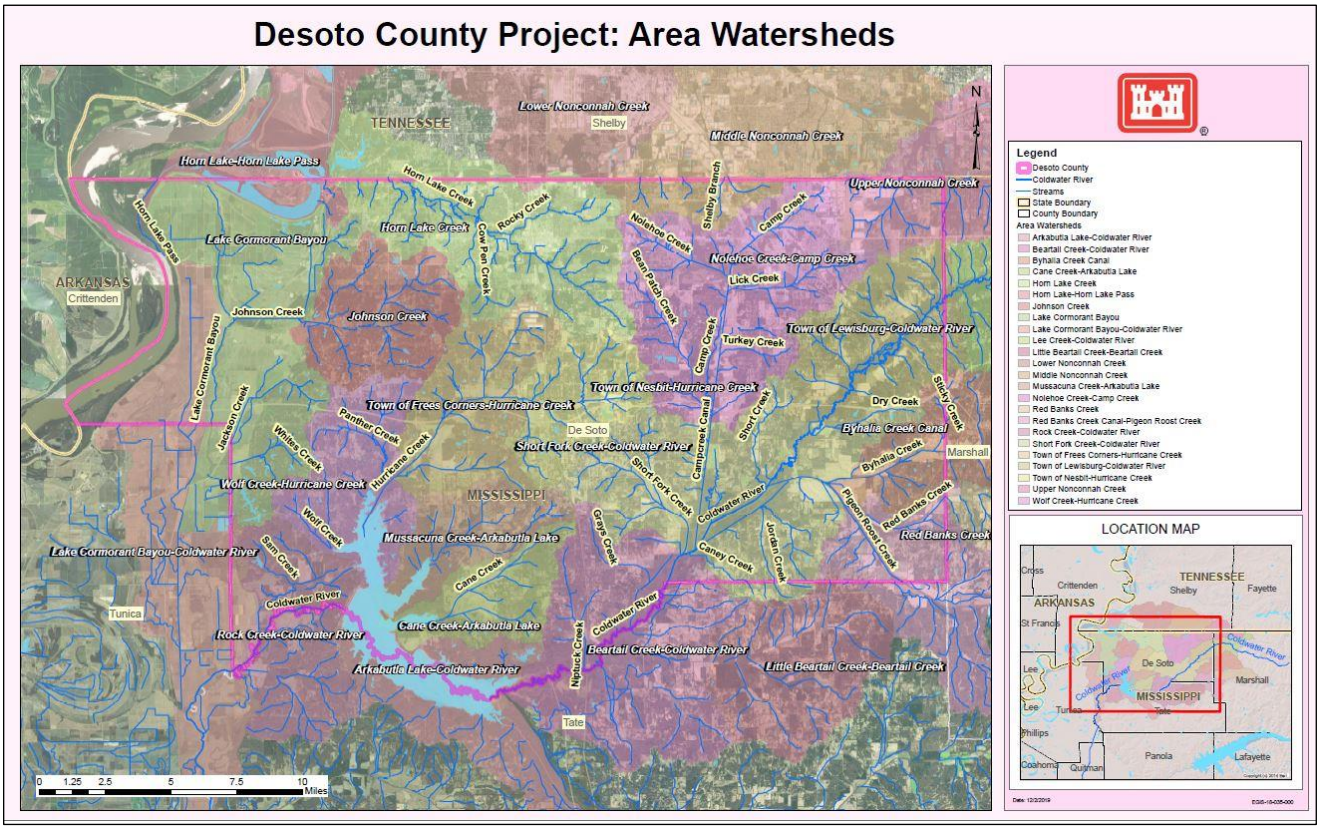

Figure 1-2. DeSoto County Study Watersheds

1.5 PRIOR REPORTS

Several prior reports and studies by USACE as well as other agencies were reviewed and utilized in this report. Information from the documents identified in Table 1-1 was deemed the most significant to problem identification and plan formulation.

Table1-1. Prior Reports and Studies

Project Year	Study/Report/Environmental Document Title	Document Type
1981	Memphis Metropolitan Area Urban Study, (led to next GDM report)	Urban Study
1986	Horn Lake Creek and Tributaries, Phase I General Design Memorandum (GDM)	General Design Memorandum (GDM)
1988	The Horn Lake Creek and Tributaries Including Cow Pen Creek, General Design Memorandum Re-evaluation	General Design Memorandum Re-evaluation
1999	The Memphis Metro Area, Tennessee, and Mississippi Reconnaissance Report	Reconnaissance Report
2005	Horn Lake Creek and Tributaries Tennessee and Mississippi, General Reevaluation Report	General Reevaluation Report
2018	Big Sunflower River Watershed (Quiver River), Mississippi Final Feasibility Report with Integrated Environmental Assessment	Integrated Feasibility Report with EA
2015	Johns Creek Continuing Authorization Project (CAP 205, flood control project)	Continuing Authorities Project Report (CAP) 205
1981	Memphis Metropolitan Area Urban Study, (led to next GDM report)	Urban Study
1986	Horn Lake Creek and Tributaries, Phase I General Design Memorandum (GDM)	General Design Memorandum (GDM)
1988	The Horn Lake Creek and Tributaries Including Cow Pen Creek, General Design Memorandum Re-evaluation	General Design Memorandum Re-evaluation
1999	The Memphis Metro Area, Tennessee, and Mississippi Reconnaissance Report	Reconnaissance Report
2005	Horn Lake Creek and Tributaries Tennessee and Mississippi, General Reevaluation Report	General Reevaluation Report
2018	Big Sunflower River Watershed (Quiver River), Mississippi Final Feasibility Report with Integrated Environmental Assessment	Integrated Feasibility Report with EA
2015	Johns Creek Continuing Authorization Project (CAP 205, flood control project)	Continuing Authorities Project Report (CAP) 205

1.5.1 USACE Constructed Projects

1.5.1.1 The Horn Lake Creek and Tributaries, Tennessee, and Mississippi Project

This project was authorized in 1986, revised in 1988 under a General Design Memorandum, and was completed in 1998 per a Project Cooperation Agreement between the Horn Lake Creek Drainage District Commission and USACE. The completed project included:

- 3.5 miles of selective channel clearing on Horn Lake Creek from Mile 16.75 downstream to Stateline Road, Mile 13.25;
- 2.75 miles of vegetative clearing on upper Horn Lake Creek between Mile 16.75 and 19.50 (Highway 51);
- Vegetative clearing on the lower 0.62 miles of Cow Pen Creek;
- 1.85 miles of channel enlargement on Cow Pen Creek between Mile 0.62 and 2.47, requiring a 35-foot bottom width channel enlargement;
- 2.1 miles of vegetative clearing on the lower end of Rocky Creek downstream to the mouth.

The constructed project provided a 25-year level of protection to existing development along Cow Pen Creek; a 1.1-year level of protection along Horn Lake Creek; and a 1.1 to 2- year level of protection along Rocky Creek. Although hiking/biking trails were proposed along Rocky Creek and Cow Pen Creek, these trails were never constructed.

1.5.1.2 Mississippi Delta Headwaters Project (MDHP)

The Mississippi Delta Headwaters Project was previously referred to as the Demonstration Erosion Control Project (DEC). The purpose of this project is to demonstrate the effectiveness of comprehensive planning by developing and implementing a plan to reduce flooding, erosion, and sedimentation in the Yazoo Basin Foothills area. It is a continuation of joint efforts undertaken by the Vicksburg District of USACE and the Natural Resource Conservation Service (NRCS), U. S. Department of Agriculture, in the Yazoo Basin. Because this project is a part of the Mississippi River and Tributaries, Yazoo Basin Headwater area, there are no local cooperation requirements under Public Law 99-662. This project is ongoing.

1.5.2 Local Ordinances

1.5.2.1 DeSoto County Flood Damage Prevention Ordinance

The purpose of the DeSoto County Flood Damage Prevention Ordinance is to promote public health, safety, and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

- Restrict or prohibit uses that are dangerous to health, safety, and property due to water or erosion hazards, which result in damaging increases in erosion or in flood heights or velocities;

- Require that uses vulnerable to floods, including facilities that serve such uses, be protected against flood damage at the time of initial construction;
- Control the alteration of natural floodplains, stream channels, and natural protective barriers that are involved in the accommodation of floodwaters;
- Control filling, grading, dredging, and other development that may increase erosion or flood damage; and
- Prevent or regulate the construction of flood barriers that would unnaturally divert floodwaters, or which may increase flood hazards to other lands.

A complete copy of the Ordinance can be found at:
https://www.desotocountyms.gov/DocumentCenter/View/254/DeSoto-County-Flood-Ordinance-

Section 2
Problems and Opportunities (Purpose and Need)

2.1 SPECIFIC PROBLEMS AND OPPORTUNITIES

As a result of altered headwater hydrology, major damaging floods occurred in May 2010, May 2011, September 2014, and March 2016. The area received a Presidential Disaster Declaration in 2011. The U.S. Small Business Administration provided Federal assistance after the 2014 flood. Flooding inundates major transportation corridors and several neighborhoods, isolates communities, damages public infrastructure and development (residential, commercial, and industrial), and threatens life safety. Repeated flooding occurs within the Cities of Horn Lake, Southaven, Olive Branch, and Hernando. Drainage of headwaters from rainfall events cause flooding of residential and nonresidential structures downstream in the vicinity of Horn Lake Creek Basin and the Coldwater River Basin. The landscape has been heavily developed and the hydrology has been altered. Critical infrastructure, roads, schools, and medical facilities are at risk of flooding and the inundation of roads during flood events causes safety issues countywide. Flooding directly caused three documented deaths in April 1994, November 2011, and December 2002 in DeSoto County.

Recent development has reduced floodplain and aquatic habitat. Most of the wetlands and bottomland hardwoods have been isolated or drained and developed. Increased runoff is causing channel instability, scouring, and degrading aquatic habitat. In the study area, channel degradation and aggradation caused by residential and commercial development, channelization, erosive soils, agricultural practices, and other channel alterations in the DeSoto County watersheds have caused a decline in the ability of streams and adjacent lands to support the requisite functions for fish and wildlife.

The study would evaluate opportunities to provide FRM alternatives to reduce the risks of flooding to the public and commercial, residential, and critical infrastructure. The study would also look at opportunities that could enhance recreational opportunities and stream and wetland habitats, reduce road closures, and increase accessibility to critical infrastructure, and decrease life safety situations caused by flooding.

2.2 PLANNING GOALS AND OBJECTIVES

There are both FRM and ER goals and objectives identified in this study. Planning objectives represent desired positive changes to future conditions. All the objectives for this study focus on alternatives within the study area and within the 50-year period of analysis from 2025 to 2075.

2.2.1 Flood Risk Management Planning Goals and Objectives

The FRM goal is to develop alternatives to reduce the severity of flood risk and damages to residential, business, and critical infrastructure and the risk to human life. The Federal objective of water and related land resources project planning is to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

The FRM planning objectives for this study include:

- Objective 1. Reduce flood damages to residential and commercial infrastructure in DeSoto County.
  - *Metric 1*: The Project Delivery Team (PDT) will evaluate structure damage at the eight frequency events ranging from .99 AEP (1 yr.) to 0.002 (500yr.);
- Objective 2. Reduce risks to critical infrastructure.
  - *Metric 2*: The PDT will evaluate changes in water surface elevation;
- Objective 3. Reduce risk to human life from flooding and rainfall events throughout DeSoto County.
  - *Metric 3*: The PDT will evaluate post-project changes to the water surface elevation.

2.2.2 Ecosystem Restoration Planning Goals and Objectives

The ecosystem restoration goal is to stabilize channels and connect/improve riparian habitat, which would minimize channel degradation and erosion and support aquatic ecosystem form and function along main stem channels and tributaries in the DeSoto County watersheds.

The ecosystem restoration planning objectives for this study include:

- Objective 4. Restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines to would improve transport of stream flows and sediment over a 50-year period of analysis.
  - *Metric 4*: the PDT will evaluate channel dimensions, sediment transport, channel bed diversity, pools, and fish cover/canopy density, riparian zones and canopy density, habitat units, and turbidity;
- Objective 5. Improve species richness through channel stabilization and habitat restoration.
  - *Metric 5*: the PDT will evaluate sediment inflows to channels, acres of riparian habitat preserved/planted;
- Objective 6. Improve water quality to support aquatic resources.
  - *Metric 6*: the PDT will evaluate suspended sediment, nutrients.

2.3 PLANNING CONSTRAINTS

The study constraints include:

- Minimize degradation to stream habitat and vulnerable wetland areas;
- Ensure study is compliant with FAA regulations associated with the Memphis International Airport;
- Maintain consistency with DeSoto County Flood Damage Prevention Ordinance;
- Avoid or minimize negative impacts to fish passage; and
- To a reasonable extent plan to avoid or minimize negative impacts to cultural, historic, and Tribal resources to a practicable extent.

2.4 PUBLIC SCOPING SUMMARY

General scoping was initiated prior to the National Environmental Policy Act (NEPA) Notice of Intent (NOI) in conformity with 40 CFR 1500-1508. A public website page (https://www.mvm.usace.army.mil/Missions/Projects/North-DeSoto-County-Feasibility-Study)with the study information was established in August 2019. In accordance with NEPA, an NOI to prepare an IFR-EIS was published in the Federal Register on August 9, 2019 (Vol. 84, No. 154). Public scoping meetings were held on December 5, 2018 and August 29, 2019, and public outreach efforts are ongoing. Less than 10 members of the public attended the meetings. During the meetings, members of the communities were able to mark areas of concern on maps and provide written comments. Comments received at the meetings represented concerns about road closures, safety risks, and erosion. No responses by email or regular Postal Service mail were received. DeSoto County also released an online survey, which received approximately 41 responses. These results indicate public concern about flooding in DeSoto County.

Coordination with the interagency team, to include the United States Fish and Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Mississippi Department of Environmental Quality (MDEQ), Mississippi Department of Wildlife Fisheries and Parks (MDWFP), and the Mississippi Emergency Management Agency (MEMA) began in December 2018; and invitations to become cooperating agencies were accepted by the USFWS and the USEPA. An interagency team meeting was held on December 19, 2019. Coordination with the interagency team is on-going. No significant concerns on threatened or endangered species, water quality certification, or other items have been voiced. The MDEQ is concerned that development is on-going in DeSoto County without in-depth planning for future flooding or water quality issues. Also, they are concerned that the areas that are currently being considered may not be available when the project is ready for construction. The MDWFP would like to ensure the appropriate consideration for compensatory mitigation and fish passage in the streams. The USFWS has provided informal coordination regarding the threatened species that could be found within the project areas, as well as potential measures to provide in-stream habitat, such as creating riffles using riprap, strategically sunken coarse woody debris, and creating bank habitat.

The scoping report, which has copies of all written feedback received is included in Appendix F and on the project website (https://www.mvm.usace.army.mil/Missions/Projects/North-DeSoto-County-Feasibility-Study). The USACE has continued coordination and outreach with Federal and state resource agencies. The coordination and outreach with Tribes, agencies, stakeholders, and members of the public will continue throughout the feasibility phase.

Section 3
Inventory and Forecast Conditions

3.1 EXISTING CONDITIONS (AFFECTED ENVIRONMENT) STUDY AREA

The environmental settings section describes the climate, geology, and historic and existing conditions for significant environmental resources including: soils; water quality; vegetative resources; wildlife resources (including birds, mammals, amphibians, and reptiles); water bottoms; threatened and endangered species (T&E); historic and cultural resources; socioeconomic and human resources (population; infrastructure; employment and income); aesthetics (visual resources); recreation; and air quality. In addition, noise, and hazardous, toxic, and radioactive waste (HTRW) are also considered. A resource is considered important if it is recognized by statutory authorities including laws, regulations, Executive Orders (EO), policies, rules, or guidance; if it is recognized as important by some segment of the general public; or if it is determined to be important based on technical or scientific criteria.

3.1.1 Relevant Resources

This section contains a description of relevant resources in the study area. The resources described are those recognized by laws, executive orders, regulations, and other standards of national, state, or regional agencies and organizations; technical or scientific agencies, groups, or individuals; and the general public. Significance based on institutional recognition means that the importance of an environmental resource is acknowledged in the laws, adopted plans, and other policy statements of public agencies, Tribes, or private groups. Significance based on public recognition means that some segment of the general public recognizes the importance of an environmental resource. Significance based on technical recognition means that the importance of an environmental resource is based on scientific or technical knowledge or judgment of critical resource characteristics. Table 3-1 provides summary information of the institutional, technical, and public importance of these resources.

Table 3-1. Relevant Resources in the Study Area

Resource	Institutionally Important	Technically Important	Publicly Important
Wetland and Bottomland Hardwood Resources	Clean Water Act of 1977, as amended; Executive Order 11990 of 1977, Protection of Wetlands; EO 11988, and Fish and Wildlife Coordination Act of 1958.	They provide necessary habitat for various species of plants, fish, and wildlife; they serve as ground water recharge areas; they provide storage areas for storm and flood waters; they serve as natural water filtration areas; they provide protection from wave action, erosion, and storm damage; and they provide various consumptive and non-consumptive recreational opportunities.	The high value the public places on the functions and values that wetlands provide. Environmental organizations and the public support the preservation of marshes.
Upland Forest Resources	Food Security Act of 1985, as amended; the Farmland Protection Policy Act of 1981; and the Fish and Wildlife Coordination Act of 1958, as amended.	They provide habitat for both open and forest-dwelling wildlife, and the provision or potential for provision of forest products and human and livestock food products.	The high value the public places on their present value or potential for future economic value.
Water Quality and Aquatic Resources	Fish and Wildlife Coordination Act of 1958, as amended; Clean Water Act of 1977, as amended.	USACE, FWS, NRCS, EPA, and State DNR and wildlife/fishery offices recognize value of fisheries and good water quality and the national and state standards established to assess water quality.	Environmental organizations and the public support the preservation of water quality, aquatic resources, and the desire for clean drinking water.
Wildlife	Fish and Wildlife Coordination Act of 1958, as amended and the Migratory Bird Treaty Act of 1918.	They are a critical element of many valuable freshwater and marine habitats; they are an indicator of the health of the various freshwater and marine habitats; and many species are important commercial resources.	The high priority that the public places on their esthetic, recreational, and commercial value.
Threatened and Endangered Species and species of concern	The Endangered Species Act of 1973, as amended; and the Bald Eagle Protection Act of 1940.	USACE, USFWS, NRCS, USEPA, MDFWP, and MDEQ cooperate to protect these species. The status of such species provides an indication of the overall health of an ecosystem.	The public supports the preservation of rare or declining species and their habitats.
Air Quality	Clean Air Act of 1963, as amended.	State and Federal agencies recognize the status of ambient air quality in relation to the NAAQS.	Virtually all citizens express a desire for clean air.
Cultural Resources	National Historic Preservation Act (NHPA), as amended, and Section 106 and 110 of the NHPA; the Native American Graves Protection and Repatriation Act of 1990; the Archeological Resources Protection Act of 1979; and USACE's Tribal Consultation Policy (2012).	Federal, State, and Tribal stakeholders document and protect cultural resources including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance based on their association or linkage to past events, to historically important persons, to design and construction values, and for their ability to yield important information about	Preservation groups and private individuals support protection and enhancement of historical resources.

Resource	Institutionally Important	Technically Important	Publicly Important
		prehistory and history.	
Aesthetics	Public makes high demands on recreational areas. There is a high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Mississippi; and the large per-capita number of recreational boat registrations in Mississippi.	Visual accessibility to unique combinations of geological, botanical, and cultural features that may be an asset to a study area. State and Federal agencies recognize the value of beaches and shore dunes.	Environmental organizations and the public support the preservation of natural pleasing vistas.
Recreation Resources	Federal Water Project Recreation Act of 1965 as amended, and Land and Water Conservation Fund Act of 1965 as amended.	Provide high economic value of the local, state, and national economies.	Public makes high demands on recreational areas. There is a high value that the public places on fishing, hunting, and boating, as measured by the large number of fishing and hunting licenses sold in Mississippi; and the large per-capita number of recreational boat registrations in Mississippi.
Socioeconomics	USACE ER 1105-2-100, and National Environmental Policy Act of 1969. Executive Order 12898 of 1994	When an environmental document is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental document will discuss all these effects on the human environment.	Government programs, policies and projects can cause potentially significant changes in many features of the socioeconomic environment.
Environmental Justice	Executive Order 12898 of 1994	E.O. 12898 directs federal agencies to identify and address any disproportionately high adverse human health or environmental effects of federal actions to minority and/or low-income populations,	federal actions can cause disproportionately high adverse human health or environmental effects to minority and/or low-income populations.
Prime and Unique Farmland	Farmland Protection Policy Act of 1981.	State and Federal agencies recognize the value of farmland to produce food, feed, and forage.	Public places a high value on food and feed production.

3.1.1.1 Natural Environment

The study area lies within the Mississippi Valley Loess Plains (MVLP) Ecoregion, which stretches from near the Ohio River in western Kentucky to Louisiana. The loess plains of the ecoregion consist primarily of irregular plains; some gently rolling hills; wide, flat floodplains; and bluffs near the Mississippi River. Thick loess is one of the most distinguishing

characteristics of the MVLP. The bluff hills are located in the western portion of the MVLP in DeSoto County, and contains soils that are deep, steep, silty, and erosive. To the east, upland forests are dominated by oak, hickory, and pine, and to the west on bluffs some mixed and southern mesophytic forests, are the dominant natural vegetation. Agriculture is now the typical land cover in the Kentucky and Tennessee portion of the region, while in Mississippi there is a mosaic of forest and cropland (Chapman et. al., 2004).

Table 3-2 identifies the stream status-including the land cover and Mississippi Department of Environmental Quality (MDEQ) water quality status for streams in the study area.

Table 3-2 Stream Status

Stream	BLH-Wet acreage*	BLH acreage*	Water quality status (MDEQ data)
Horn Lake Creek	349	142	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation
Nonconnah headwaters	213	171	N/A
Camp Creek	308	75	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation
Nolehoe Creek	19	29	N/A
Licks Creek	111	77	N/A
Johnson Creek	189	129	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation
Hurricane Creek	233	77	Biological Impairment: Organic Enrichment/Low DO and Nutrients
Cane Creek	32	35	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation Pesticides
Mussacuna Creek	91	50	Biological Impairment: Organic Enrichment/Low DO and Nutrients Sedimentation
Red Banks Creek	165	7	Biologically Impaired; No TMDL
Short Fork Creek	71	76	Biological Impairment: Sedimentation
Cow Pen Creek			N/A
Rocky Creek			N/A
Total	1781	868	

*Acreage estimates are based on a 328 ft. and on both sides of the stream from National Land use Classification Data.

3.1.1.2 Wetlands and Bottomland Hardwood Forest

As stated in the Mississippi State Wildlife Action Plan (MSWAP) 2015-2025:

> Bottomland hardwood (BLH) forests occur in river floodplains that receive periodic inundation from rivers during heavy rainfall events. Bottomland terraces are irregularly flooded for durations of several days to a month or more. On these lowland sites, the water table remains elevated during the winter and spring seasons and soils remain moist through much of the growing season. Their soils are enriched by the influx of nutrients and sediments during floods.

Agricultural production and residential development have contributed significantly to BLH forest loss. In addition, drainage efforts and improved infrastructure have fragmented the remaining bottomland hardwood forests to the extent that many no longer provide flood water storage, nutrient trapping, groundwater recharge and wildlife habitat. Remnant patches of bottomland forest have been conserved because of their increasing value for outdoor recreation such as fishing, hunting, wildlife viewing and hiking.

The wetlands within DeSoto County provide useful functions, such as detaining precipitation and floodwater, cycling nutrients, exporting organic carbon, maintaining plant communities, and providing habitat for fish and wildlife. However, most wetlands are isolated and/or perched and exist without hydrologic connection to streams and tributaries due to incision, drainage, public infrastructure, and commercial and residential development. The BLH forests exist mainly within the riparian corridor of streams. Approximately 1,781 acres of BLH or other forested wetlands exist within 328 feet of the streams included in the study, see Table 3-2 for acreages specific to each stream. There is a well-documented loss of riparian BLH within the MVLP, which directly contributes to the degradation of streams in the region and in DeSoto County. Bare banks and kudzu dominate much of the stream banks and adjacent habitat, impacting structure and organic materials and limiting colonization by macroinvertebrates, which provide a base for the food chain. In addition, the study area lies within the Mississippi Flyway and loss of BLH has impacted the usefulness of the area for migratory bird species. Incision of streams in DeSoto County has caused a lowering of the water table, causing BLH wetlands to become drier over time. Streams continue to degrade and widen uncontrollably, impacting BLH habitats as well as residential and commercial properties, agriculture, roadways, and bridges.

3.1.1.3 Upland Forest

3.1.1.3.1 *Mesic Upland Forests*

According to the MSWAP 2015-2025:

> Plant communities of mesic habitats in this area are likely to include lower slope/high terrace hardwoods. Hardwood forests in this type are often found on moist portions of upland habitats protected from fire (by slope) and high terraces or ridges of floodplains.

Included in these mesic forests are small seepage slopes or springs. The diversity of the hardwood and pine forest communities have decreased due to land clearing, overcutting, introduction of invasive species (especially Chinese privet), erosion and the suppression of fire over long periods. Being situated on gently sloping landscapes with relatively deep and fertile soil, the mesic forest types were more likely to be converted to agriculture.

The moderately moist and occasionally wet (palustrine) hardwood forest habitats of this type are found on lower slopes and high terraces of streams and rivers of Mississippi. Small drainageways, floodplains, stream terraces, levees, low moist plains, and some lower slopes are landforms that support this vegetation type. The lowlands have soils ranging in textures from clay and silt to, occasionally, sandy loam. The coarser textured soils are usually found on ancient secondary terraces. Although these landforms sometimes flood, they often have deeper soils and receive lateral subsurface seepage and surface runoff from adjacent uplands. Their low position on the landscape ensures that the habitat remains moist during the growing season. This habitat type often has an elevated water table during the late winter and early spring. However, the water table may drop precipitously during early spring growth. Common tree species found in this habitat type may include various species of oak, beech, maple, sweetgum, and hickory.

The upland forested habitats within DeSoto County have been heavily impacted with approximately 868 acres of upland forested lands remaining within 328 feet of the streams included in the study, see Table 3-2 for acreages specific to each stream. Upland forests have been more heavily impacted due to the ease of clearing and use for agricultural, residential, and commercial uses. These forest types are critical in the functioning of the Mississippi River Flyway, as well as providing the required foraging, rest, and reproduction for species within the area.

3.1.1.4 Water Quality and Aquatic Resources

DeSoto County is essentially separated into two 8-digit Hydrologic Units; the Coldwater – 08030204, and the Horn Lake-Nonconnah – 08010211. Channel degradation and aggradation caused by residential and commercial development, channelization, erosive soils, agricultural practices, and other channel alterations in the DeSoto County watersheds have caused a decline in the ability of streams and adjacent lands to support the requisite functions for fish and wildlife.

The streams in DeSoto County that have total maximum daily loads (TMDL) assigned are noted in Table 3-2. The most prevalent water quality concerns as noted from the MDEQ TMDL reports are excessive nutrients, organic enrichment/low dissolved oxygen, and sedimentation. In addition, Red Banks Creek is listed as biologically impaired due to toxicity.

The Coldwater River Basin is located within the larger Yazoo Drainage Basin and is impounded by a flood control dam that changed the hydrologic regime and created Arkabutla Lake. As such, the Coldwater River system is highly modified and fish passage has been blocked. Substrates consist of silty, clay and sand sediments. Streams that flow

into the Coldwater River as well as the Horn Lake – Nonconnah Basin are generally sluggish. Sedimentation appears to have increased over time in the study area's streams due to high stream flows causing erosion and bank failures during flood events along with incision, head-cutting, heavy agricultural practices, and commercial and residential development. In addition, low normal flows, and aggradation in some areas along with bare, unshaded banks, and excess nutrients cause low dissolved oxygen impairing streams for biological use.

3.1.1.5 Wildlife

The streams and forests provide remnant or isolated habitat for a variety of migratory game and non-game birds, mammals, amphibians, and reptiles. However, several factors prevent a connected, functioning ecosystem including (but not limited to) limited primary productivity in many stream reaches, a lack of structure and organic materials, limited colonization by macroinvertebrates, and limited BLH/riparian. Wildlife species and utilization varies from the highly urbanized, to rural, to forested, less developed areas.

Aquatic species endemic to the area, including the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) are threatened by systemic degradation of streams in north Mississippi. Fish passage in the study streams is limited by barriers including perched culverts or bridge stabilization, stream blockages, and sedimentation. Suitable habitat for federally threatened species, northern long-eared bat and wood stork (discussed in more detail below), are scarce. In addition, BLH loss and aquatic instability within the MVLP has impacted the Mississippi Flyway. Species such as warblers, herons, waterfowl, raptors, and many other priority species listed by Audubon, rely on the Mississippi Flyway as a migration corridor, winter resting area and for forage and reproductive purposes. Small mammals are also likely to utilize the forested tracts, which provide a haven from the urban sprawl associated with that area of the County.

For state listed species of concern within 2 miles of each stream basin, see Appendix F.

Threats to wildlife are on-going and include development and associated pollution, agriculture, and human disturbance and modification of natural systems such as channelization, construction of levees and reservoirs, and other flood control projects. Conservation and restoration of remaining habitat along with invasive species control is recognized as a priority conservation action by the Mississippi Department of Fisheries, Wildlife and Parks. Beneficial management actions may include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection (MDFWP, 2016).

3.1.1.6 Threatened and Endangered Species

Threatened and endangered species principally stem from the alteration, degradation, and loss of habitats and from human disturbance. The continued high rate of commercial development throughout continues to reduce available habitat to threatened and endangered species. This creates increased intra- and interspecific competition for rapidly

depleting resources between not only the various threatened and endangered species, but also other more numerous faunae.

According to results obtained from USFWS Information, Planning, and Conservation (IPaC) conservation planning tool, two threatened species may occur within the proposed study area. These species are the northern long-eared bat (*Myotis septentrionalis*) and wood stork (*Mycteria americana*).

The federally threatened northern long-eared bat (NLEB) has been heavily impacted by white-nose syndrome (WNS) and as a result, was listed as threatened by USFWS in January 2016. The WNS is caused by a fungus called *Pseudogymnoascus destructans* and is named after the appearance of a white fuzz that appears on the face, ears, and wings of affected bats. The WNS spreads prolifically among hibernating bats causing them to burn energy stores, leave hibernacula in winter, and is often fatal. Estimates of mortality in affected hibernacula are as high as 90-100 percent. NLEB spend winter hibernating in caves and mines, called hibernacula, using caves or mines with constant temperatures, high humidity, and no air currents. No NLEB hibernacula exist within the study area. In the summer, the NLEB uses trees (live or dead) with exfoliating bark, cracks, or crevices to roost. Maternity colonies generally have 30 to 60 female/juvenile bats at the beginning of the summer. Most female NLEB within a maternity colony give birth around the same time, usually from late May through July, depending on the location of the colony. No known maternity colonies or roost trees are known to exist within the study area.

The NLEB is listed as threatened and USFWS has issued a rule under Section 4(d) of the Endangered Species Act (ESA). "Section 4(d) of the Endangered Species Act directs the Service to issue regulations deemed "necessary and advisable to provide for the conservation of threatened species." The 4(d) rule is used to target the take prohibitions to those that provide conservation benefits for the species. This targeted approach can reduce ESA conflicts by allowing some activities that do not harm the species to continue, while focusing efforts on the threats that make a difference to the species' recovery." (https://www.fws.gov/Midwest/endangered/mammals/nleb/4drule.html).

The U.S. Fish and Wildlife Service (USFWS) originally classified the wood stork as "endangered" in 1984 but reclassified its status to 'threatened' in 2014 after determining that the wood stork is not presently in danger of extinction across its range. This large bodied, heavy-billed, wading bird is the only stork species found in North America, and the only stork species to breed within the United States. In Mississippi, this species can be found in all 85 counties during the nonbreeding season (May-October). Loss of wetland habitat and changes to hydroperiods are the main threat to the wood stork population, as those conditions result in a decline in the numbers of small fish that are the species' primary food base.

The wood stork uses a wide variety of freshwater and estuarine wetlands. The birds feed in freshwater marshes, narrow tidal creeks, and flooded tidal pools. Good foraging conditions are characterized by water that is relatively calm, uncluttered by dense thickets of aquatic vegetation, and having a water depth between 2 and 15 inches deep. Ideally, preferred

foraging wetlands would include a mosaic of emergent and shallow open-water areas. The emergent component provides nursery habitat for small fish, frogs, and other aquatic prey and the shallow, open-water areas provide sites for concentration of the prey during seasonal dry-down of the wetland.

Wood storks also use both natural and man-made impoundments including retention ponds, agricultural and drainage ditches, reservoirs, and reclamation areas. Foraging habitats must both provide the species with enough density and biomass of forage fish and other prey and have vegetation characteristics that allow storks to locate and capture prey. (SLOPES, USFWS).

3.1.1.7 Air Quality

The USEPA, Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards for six principal pollutants, called “criteria” pollutants. They are carbon monoxide, nitrogen dioxide, ozone, lead, particulates of 10 microns or less in size (PM-10 and PM-2.5), and sulfur dioxide. Ozone is the only parameter not directly emitted into the air but forms in the atmosphere when three atoms of oxygen (03) are combined by a chemical reaction between oxides of nitrogen and volatile organic compounds in the presence of sunlight. Motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents are some of the major sources of nitrogen and volatile organic compounds, also known as ozone precursors. Strong sunlight and hot weather can cause ground-level ozone to form in harmful concentrations in the air. The Clean Air Act General Conformity Rule (58 FR 63214, November 30, 1993, Final Rule, Determining Conformity of General Federal Actions to State or Federal Implementation Plans) dictates that a conformity review be performed when a Federal action generates air pollutants in a region that has been designated a non-attainment or maintenance area for one or more National Ambient Air Quality Standards. A conformity assessment would require quantifying the direct and indirect emissions of criteria pollutants caused by the Federal action to determine whether the proposed action conforms to Clean Air Act requirements and any State Implementation Plan.

The general conformity rule was designed to ensure that Federal actions do not impede local efforts to control air pollution. It is called a conformity rule because Federal agencies are required to demonstrate that their actions “conform with” (i.e., do not undermine) the approved State Implementation Plan for their geographic area. The purpose of conformity is to (1) ensure Federal activities do not interfere with the air quality budgets in the State Implementation Plans; (2) ensure actions do not cause or contribute to new violations, and (3) ensure attainment and maintenance of the National Ambient Air Quality Standards.

DeSoto County is currently designated by the EPA as a maintenance area for ozone under the 2015 8-hour standard. DeSoto County has been classified as marginal, which is the least severe classification. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the Mississippi Department of Environmental Quality, Air Quality Division. Federal activities proposed in DeSoto County may be subject to the State’s general conformity regulations as promulgated under LAC 33: III.14.A, Determining Conformity of General Federal Actions to State or Federal

Implementation Plans. A general conformity applicability determination is made by estimating the total of direct and indirect volatile organic compound (VOC) and nitrogen oxide (NOX) emissions caused by the construction of the project. Prescribed de minimis levels of 100 tons per year per pollutant are applicable in DeSoto County. Projects that would result in discharges below the de minimis level are exempt from further consultation and development of mitigation plans for reducing emissions.

3.1.2 Human Environment

3.1.2.1 Geographic Location

The study area extends throughout DeSoto County, Mississippi. This includes Horn Lake Creek, Hurricane Creek, Johnson Creek, and Coldwater River watersheds in northern DeSoto County, Mississippi including the cities of Horn Lake, Southaven, Olive Branch, Walls, and Hernando. The most significant flood risks are in the northern part of the county, but the entire county was considered for flood risk and ecosystem restoration. An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) version 2.0 for the portions of the county impacted by riverine flooding associated with the future without project condition. For this study, the structure inventory was modified to include two major basins: Horn Lake and Coldwater. Horn Lake includes the streams of Horn Lake Creek, Rocky Creek, Cow Pen Creek, and Lateral D. Coldwater includes the streams of Coldwater, Camp, Licks, and Nolehoe. The study area has a total of 4,013 structures in Horn Lake Basin and 973 structures in Coldwater Basin located across the combined 28 study area reaches. Other streams such as Hurricane, Short Fork, Pigeon Roost, Red Banks, Short Fork, Short, and Bean Patch were analyzed, but no flood-prone structures existed at the time of the analysis. Appendix L, Section 1.2 Figure L: 1-1 shows the structure inventory and the boundaries of the county.

3.1.2.2 Land Use

As shown in Table 3-3, 18 percent of DeSoto County is currently developed land. The rest of the land use is split between agricultural land, which includes pasture and hay, and undeveloped land. Undeveloped land is primarily classified as forest, wetlands, and shrubs.

According to local planners, the Horn Lake Creek basin was considered 35 percent developed in the year 2000. Since 2000, the municipalities in North DeSoto County have provided an outlet for commercial and residential development in the Memphis, Tennessee metropolitan area. The commercial acreage for DeSoto County is currently estimated to be approximately 22,762 acres (35.5 square miles) in size. The residential acreage is roughly 90,391 acres (141.2 square miles). The undeveloped acreage is estimated to be 204,846 acres (320.1 square miles). The approximate total land use acres for DeSoto County is 317,999 acres (496.9 square miles). The development in DeSoto County has increased exponentially, with the Horn Lake Drainage Basin expected to be approximately 95 percent developed by the year 2027. With development expected to continue at this rapid pace, future flooding problems are expected to increase.

Table 3-3. Land Use in DeSoto County, MS

Land Class Name	Percentage
Developed Land	18%
Agricultural Land	36%
Undeveloped Land	46%
Total	100%

Source: USGS National Land Cover Database

3.1.2.3 Flood History

DeSoto County experienced some significant flooding and some flash flooding during the 10-year period (1994 to 2004). Table 3-4 summarizes the history and magnitude of the floods that occurred within the 10-year period. Four of the most recent and largest-magnitude floods that occurred in the Horn Lake Creek basin were in November 2001, December 2001, October 2002, and December 2002. Headwater hydrology has been altered and major flood damage occurred in May 2010, May 2011, September 2014, and March 2016, . Three documented deaths occurred in DeSoto County related to flooding.

Table 3-4 History of Flooding in the Horn Lake Creek Basin

Location	Date	Time	Magnitude of Flood	Total Rainfall (in[1])	Injuries Reported	Deaths Reported
Southaven	4/26/94	5:15 pm	Flash Flooding	Not Available	0	1
DeSoto County	4/27/04	9:00 pm	Flash Flooding	Not Available	0	0
Southaven	3/5/1997	9:30 am to 10:30 am	Flash Flooding	Not Available	0	0
DeSoto County	11/28/01 to 11/30/01	6:05 pm to 11:59 pm	Heavy Flooding	8.13	0	1
DeSoto County	12/12/01	2:35 pm	Moderate Flooding	2.32	0	0
DeSoto County	12/15/01 to 12/18/01	8:00 pm to 12:00 pm	Moderate Flooding	2.10	0	0
Southaven	7/12/02	11:00 am to 12:00 pm	Flash Flooding	1.13	0	0
Horn Lake	9/19/02 to 9/20/02	6:00 pm to 11:30 am	Flash Flooding	3.00	0	0
DeSoto County	10/10/02	1:45 am to 6:00 pm	Heavy Flooding	5.62	0	1
Horn Lake	12/19/02	8:30 am to 10:30 am	Flash Flooding	2.77	0	0
Horn Lake	7/18/03	3:40 pm to 5:30 pm	Flash Flooding	Not Available	0	0
DeSoto County	2/15/04	5:15 am to 7:00 am	Flash Flooding	0.45	0	0

[1]Rainfall data reflects total rainfall for the time provided. This data was taken from the closest reporting station in Olive Branch, MS; therefore, the actual rainfall in the Horn Lake Creek Basin, resulting in flooding, could have been higher or lower than the amounts listed. (Data Source: The National Climatic Data Center)

3.1.2.4 Population and Housing

DeSoto County has rapidly grown since 1990 and is forecast to continue growing through 2040. Total number of households also shows a steady increasing trend from 1970 to 2010 and projections through 2040. The 2000 and 2010 estimates for population, number of households and employment are from the U.S. Census and the projections were developed by Moody's Analytics (ECCA) Forecast, which has projections to the year 2045. See Appendix L, Section 1, Tables L: 1-4 and L: 1-5 for Population and Household statistics.

3.1.2.5 Employment Business and Industry Activity

The leading employment sectors are Trade, Transportation and Utilities; Leisure and Hospitality; Government; and Education & Health Services. Appendix L, Section 1.3.1 Tables L:1-7 and L:1-8 show the Labor Force, Employment, Unemployment, and Unemployment Rate for DeSoto County and the State of Mississippi, respectively. DeSoto County has consistently had a lower unemployment rate than the State of Mississippi.

3.1.2.6 Cultural Resources

3.1.2.6.1 *Cultural Background*

Located in DeSoto County, Mississippi, the proposed study area falls within the Gulf Coastal Plain physiographic province (Fenneman 1938). The region is characterized topographically by gently to steeply sloping hills, narrow, winding ridge tops, and numerous small, narrow stream valleys with maximum relief varying from 250 feet to more than 600 feet above mean sea level. The soils developed from weathered loess moving in from steeper areas and Coastal Plain sediments of marine origin (Thomas (1975:39). This region is within the Mississippi Embayment Section of the Western Mesophytic Forest Region as defined by Braun (1950), or the Mixed Mesic Deciduous Region as defined by Shelford (1974).

The actual locations of the study area are mapped within the Loess Hills and the North Central Hills. The Loess Hills is a narrow belt (24 km to 8 km wide) of uplands that borders the Yazoo Basin and the Mississippi River floodplain. The loess sheet was deposited by paleowinds during the Pleistocene era, and it is thickest (24 m) on the west and thins rapidly to the eastern (Stearns 1975). Major cities, such as Memphis, Tennessee are situated on bluffs where the Mississippi River flows adjacent to the Loess Hills. The bluffs are 38 m to 76 m higher than the floodplain. On the west side of the Loess Hills, where the loess is thick and the slopes are steep, the topography is rugged (Fenneman 1938:80).

The North Central Hills is a dissected upland belt measuring 64-120 kilometers wide that is also referred to as the "Red Hills Belt" (Fenneman 1938:73-74). The hills rise some 61-122 meters above the Flatwoods in an escarpment and fall off gently into a lowland to the south (Jackson Prairie). The North Central Hills is a nearly level plain, hence its other name: The North Central Plateau. In places, the dissected topography is quite rough, but some un-dissected uplands remain in Mississippi.

In DeSoto County, the study area falls on two of the seven identified mapping units for the county: Memphis-Loring association and Vicksburg-Collins-Falaya association. The Memphis-Loring soils are found on very gently sloping to moderately steep ridges and slopes. Whiles soils in this association are considered "productive," even relatively minor slopes (5 percent or more) are liable to severe erosion (McNutt et al. 1959). Vicksburg-Collins-Falaya association soils are mostly found on bottoms or floodplains in the Loess Hills. While much of the area under this association is subject to flooding, crops are rarely damaged, and the soils are considered extremely productive (McNutt et al. 1959).

Paleoindian Stage

The Paleoindian stage is estimated to date from 12,000 to 8,500 years B.P. (McGahey 1987) in Mississippi. The socio-political organization of this period is generally assumed to have been of a band level with the subsistence base generally characterized as focusing on large game hunting and gathering. In Mississippi, as noted by McGahey (1996), Paleoindian has its strongest showing in the north-central portion of the state. McGahey (1987) suggests that the apparent relative bias in this distribution is attributable to the excellent modern artifact collecting conditions created by the four USACE lakes in the area, the extensive tracts of cultivated land, and the large number of artifact collectors in this part of the state.

Little is known, beyond generalities, about the Paleoindian time period. McGahey (1987) notes a tendency for a relatively high proportion of high grade, extra-local raw materials within the collections of the distinctive point type associated with the Paleoindian tradition. This same situation is part of a general pattern a described by Goodyear (1979). The majority of the Paleoindian material reported by McGahey (1987) was recovered in the Loess Hills and North Central Hills. However, Connaway (1988) reported 13 Paleoindian components from the northern portion of his survey of braided stream surface along the eastern edge of the Yazoo Basin.

Locating and obtaining information from Paleoindian sites is hampered in part by the topographical setting in which they are usually found. Site on upland land features are subject to heavy erosion, and deflation has contributed to the mixing of components making a discrete Paleo stratum indiscernible. Antithetically, sites located in low-lying areas have been buried under alluvial deposit or erosion runoff.

Archaic Stage

The Archaic stage is marked archaeologically by a change in projectile point styles and the addition of new tool type. The Archaic stage is generally divided into Early, Middle and Late periods. Other researchers prefer the Meso-Indian designation, which includes the period from the close of the Paleoindian to the beginning of Poverty Point (Brain 1971; William and Brain 1983). These three period are generally dated to the pan from the end of the Paleoindian and lasting possibly a late a 1,500 B.C. (Weinstein 1991), although using the construct of the Gulf Formational period, the end date for the Archaic will fall in the neighborhood of 2000. The subsistence base continued to revolve around a mobile hunting and gathering regime, though no longer relying on now-extinct megafauna.

The Early Archaic period in the North Central Hill, while better represented than the preceding Paleoindian is still relatively poorly defined, and material is more abundant east of the Yazoo Basin (McGahey 1987). This increase in sites yielding Early Archaic material over those yielding Paleoindian material is dramatically illustrated by Connaway (1988) survey which resulted in the reporting of 87 Early Archaic components. Recently, the heavy use of Kosciusko quartzite for Pine Tree type point production during the late Early Archaic in north-central Mississippi has been documented (McGahey 1999). Although the reason for such heavy reliance on this material is unclear, McGahey suggests the possibility that environmental condition related to the onset of the Hypsithermal episode could play a role.

The Middle Archaic period is underrepresented in this area. This situation is exacerbated by the possibility that material reported a Morrow Mountain projectile point knife (PP/K), a good marker for the period, may represent part of the reduction sequence of the Late Archaic Shumla or a related type (McGahey 1984). Within the survey area, this period is characterized by the presence of Opossum Bayou Denton, Benton-like, and Cypress Creek-like PP/Ks. Additional markers for this period are ground stone artifacts including pendants and bannerstones (Connaway 1988).

An apparent decrease in local sites of this period is reflected in the findings of Connaway (1988), who reports only 36 components assignable to this period, as well as in the collections examined by Broyles et al. (1982). On the west side of the Mississippi River, Morse and Morse (1983) also note a decrease in site numbers for the period, as well as a shift in the kinds of fauna exploited. McGahey (1968) noted a shift from northern and eastern to more evidence of western influence in point style, a situation also observed west of the Mississippi River (Morse and Morse 1983).

The Late Archaic period in the region was a time of population expansion, and sites of this period are more common than those from preceding periods. This is reflected in Connaway's (1988) sample of 173 components assignable to this period, by far the greatest number for any period represented. There is an apparent population expansion and a developing regime of conspicuous ritual activity.

Research in northeast Louisiana, as well as other parts of the state, is providing information on pre-ceramic, Archaic mound construction (Saunders and Allen 1993, 1994; Saunders et at. 1992, 1994). This research holds promise for providing new insights into the development of mound ceremonialism in the area, and in the eastern United State as a whole.

Gulf Formational Stage

The Gulf Formational stage is a rather dynamic paradigm. This construct has been proposed to include the development and spread of ceramics that occur between the end of the Late Archaic and the development of a fully Woodland pattern (Walthall and Jenkins 1976; Jenkins and Krause 1986). The stage is initially represented in the study area of Poverty Point related cultures.

Information relative to the Poverty Point culture has been reviewed and compiled (Byrd 1991; see also Ford and Webb 1956; Broyles and Webb 1970; Webb 1968, 1977, 1982).

With the development of Poverty Point, we see for the first time extensive, apparently macro-community based architectural construction; organized, concentrated trade; and the introduction of pottery into the area. Hallmarks of Poverty Point include long distance trade for exotic materials, the production of a variety of items from this material, and the construction of mounds and earthworks. Webb (1991) notes a duration of some 1,400 years for this phenomenon, developing by 2,000 B.C. and climaxing by about 1,000 B.C., being replaced by Tchefuncte-Tchula by about 600 B.C.

Poverty Point related material extends up the Mississippi Valley and its tributaries into the Ozarks in southeast Missouri (Morse and Morse 1983). Poverty Point related material is also documented in the Yazoo Basin at a number of sites (Phillips 1970; Connaway et al. 1977; Ford et al. 1955), along the Gulf Coast to Florida (Thomas and Campbell 1991), and throughout southern Mississippi. Within the Loess Bluffs and the North Central Hills, there are only a few sites for which Poverty Point objects and Wheeler series ceramics have been reported. As a result, this is possibly the least understood culture in the area and offers fertile ground for additional research.

Woodland Stage

The Woodland Stage is marked by the widespread use of pottery, a continuation and proliferation of burial mound construction, and further development of conspicuous ritual materials. As with the preceding Archaic, the Woodland stage is divided into Early, Middle, and Late periods. Woodland is subsumed within the Neo-Indian Era (2000 to 1600 B.C) (Brain 1971; Williams and Brain 1983). With the greatly increasing use and stylistic variability of pottery, it is possible to discriminate to a much finer degree the temporal position and cultural variability within the Woodland as compared to proceeding stages. Distinct phases or cultures for this stage have been defined, generally relying on ceramic assemblages, for the Mississippi Valley and, to the east, the Tombigbee Valley, but have not been developed, for the most part, for the Loess Bluffs and North Central Hills.

Mississippian Stage

The Mississippian stage is estimated to fall between A.D. 900 and 1600 and is the final prehistoric stage in the North Central Hills. Subsistence is centered on intensive horticulture, with maize becoming the major crop. The paramount chiefdom, supported by a system of villages, hamlets, and farmsteads, was the sociopolitical system encountered by the de Soto entrada, the first Europeans to enter the general area. With the impact of disease and resulting social disruption, the Natchez to the south of the project area were the only group still exhibiting a Mississippian stage pattern at the time the French entered the region in the 17 century; this group was ultimately expelled by the French in the 18 century.

There is not much in the way of data for Early Mississippian in northwest Mississippi; very few sites have been found and excavated from this time period. This lack of data leads some to feel that the area was uninhabited at this time, although this dearth of information may be because the wrong areas have been examined (McNutt 1996; Williams and Brain 1983).

Historic Stage

The historic stage is generally recognized as beginning with the limited occupation of the region by the French. This was followed by a relatively brief span of Spanish rule, followed by English and then American domination. The native populations of Chickasaw and Choctaw were removed early in the historic period. The latter ceded the area under the conditions of the Treaty of Dancing Rabbit signed in 1830, and the area came under the control of the newly established state of Mississippi. The cession by the Choctaw opened a vast tract to legal settlement by Euro-American immigrants.

Many of the new settlers were from the Georgia and Carolina back country and brought with them the practice of growing short-staple cotton and other crops, including corn, in upland fields; livestock were turned loose to free forage (Otto 1989). They followed a system of clearing the hardwood forests and exposing the soil to erosion (Wharton 1978). The major cash crop, cotton, was transported down the Mississippi River to be sold in New Orleans. The cession of the Choctaw lands coincided with a rise in the price of cotton on the world marked, which accelerated migration to the newly available lands. The populations of Alabama and Mississippi more than doubled during the 1800s (Otto 1989) and continued a steady, though slower, increase until 1920, the first census that showed a decrease since statehood (Burrus 1973).

With the Civil War over, Mississippi began the hard task of reorganization and rebuilding. The lumber industry was one of the firsts to recover. However, agriculture was still the economic base, and cotton was the staple crop. The 1890 U.S. Census indicates that 72.3 percent of employed persons in Mississippi worked on farms (Burrus 1973). By the end of World War I, farmers reached the highest state of prosperity since the Civil War. Then, in 1920, cotton producers made a fatal error by betting against the market. Many farmers were forced to sell, and were already in dire economic straits due to record rainfall and the increased boll weevil population that accompanied it (Giles 1973).

The lumber industry, on the other hand, continued to grow. During the period of 1904-1915, Mississippi was ranked third in the country for lumber production. By the 1920s and 1930s, Mississippi's virgin forests had been severely exploited. Some lumber companies experimented with developing cutover lands for agriculture, but this failed miserably. Faced with the extinction of this importance resource, the state was compelled to act, resulting in some fire protection and establishment of national forests. It was not until the work of the Civilian Conservation Corps that forestry and conservations began making progress. By the 1930s, a transition to use of secondary growth forests had taken place. Drain continued to exceed growth throughout the 1930s and 1940s, but by the 1950s this trend changed (Hickman 1973).

DeSoto County is rich in archaeological and architectural resources. In the Horn Lake Creek drainage area, which encompasses Cow Pen Creek, Rocky Creek, and Lateral D, there have been 27 surveys completed since 1986. There are 17 sites within this watershed including 2 mound centers (22DS500 and 22DS509), 14 ineligible lithic and ceramic

scatters, and 1 unknown aboriginal. None of these sites would be impacted by the project areas.

In the Coldwater River drainage area, there have been 17 surveys since 1979. There are 32 sites within this drainage area, included two eligible sites, 22 DS518, an unknown aboriginal mound site and 22DS746, an historic cemetery. Ten of the sites are ineligible and 20 are unknown or unevaluated. These sites range from lithic and ceramic scatters to historic scatters. None of these sites would be impacted by the project.

There are eight properties and four districts listed in the National Register of Historic Places (NRHP) in DeSoto County. In addition, there are seven Mississippi Landmark Properties within DeSoto County. The majority of these properties and districts are located in Hernando, Mississippi, with one NRHP property and one Mississippi Landmark located in Olive Branch. None of these sites would be impacted by the project. Areas that have not been surveyed within the project study area would be surveyed prior to any future construction. Tables 3-5 and 3-6 identifies previously recorded archeological sites within the study area.

Table 3-5. Previously Recorded Sites within Horn Lake Creek Drainage Study Area

Trinomial	Cultural Affiliation	Site Type	Recommendation
22DS500	Woodland; Mississippian	Mounds and Village site	Eligible
22DS509	Unknown Aboriginal	Two large conical mounds	Eligible
22DS529	Unknown Aboriginal	N/A	Ineligible
22DS530	Unknown Aboriginal	N/A	Ineligible
22DS531	Unknown Aboriginal	N/A	Ineligible
22DS535	Historic, 1920-1940	Widely dispersed sheet midden	Ineligible
22DS584	Unknown Aboriginal	Small lithic scatter	Ineligible
22DS585	Unknown Aboriginal	Small lithic scatter	Ineligible
22DS590	Unknown Aboriginal	Lithic scatter	Ineligible
22DS594	Late Archaic; Early Woodland	Lithic scatter, Tchula-like sherds	Ineligible
22DS595	Unknown Aboriginal	Lithic scatter	Ineligible
22DS596	Unknown Aboriginal	Lithic scatter	Ineligible
22DS610	Unknown Aboriginal	Thin lithic scatter	Ineligible
22DS611	Mississippian	1 flake in plow zone	Ineligible
22DS624	Unknown Aboriginal	1 secondary flake, 1 primary flake, 1 reduced pebble in shovel tests	Unknown
22DS845	Historic	20th Century historic house site	Ineligible
22DS846	Historic	Historic artifact scatter	Ineligible

Table 3-6. Previously Recorded Sites within the Coldwater River Drainage Area

Trinomial	Cultural Affiliation	Site Type	Recommendation
22DS518	Unknown Aboriginal	Mound	*Eligible*
22DS565	Unknown Aboriginal	Lithic scatter	Ineligible
22DS566	Unknown Aboriginal	Lithic scatter	Ineligible
22DS695	Woodland	Lithic and ceramic scatter	Unevaluated
22DS696	Unknown Aboriginal	Lithic scatter	Unevaluated
22DS702	Woodland	Lithic and ceramic scatter	Unevaluated
22DS704	Woodland	Lithic and ceramic scatter	Unevaluated
22DS707	Unknown Aboriginal	Lithic scatter	Unevaluated
22DS708	Unknown Aboriginal	Lithic scatter	Unevaluated
22DS716	Unknown Aboriginal	Lithic scatter	Ineligible
22DS717	Unknown Aboriginal	Lithic scatter	Ineligible
22DS719	Unknown Aboriginal	Lithic scatter	Ineligible
22DS726	Unknown Aboriginal	Lithic scatter	Ineligible
22DS736	20th Century Historic	Historic artifact scatter	Unknown
22DS737	20th Century Historic	House site	Unknown
22DS738	Unknown Aboriginal; Historic	Historic and lithic scatter	Unknown
22DS739	Unknown Aboriginal	Lithic scatter	Unknown
22DS746	Historic	Cemetery	*Eligible*
22DS747	Unknown Aboriginal	Ceramic and lithic scatter	Unknown
22DS749	Unknown Aboriginal; Woodland	Large site; ceramic and lithic scatter	Unknown
22DS750	Historic	One standing and one collapsed structure	Unknown
22DS751	Post Archaic; Unknown Aboriginal; Historic	Multicomponent site	Unknown
22DS752	Historic	Historic artifact scatter	Unknown
22DS758	Historic	Historic artifact scatter	Unknown
22DS759	Historic	Historic artifact scatter	Ineligible
22DS760	Historic	Historic artifact scatter	Unknown
22DS767	20th Century Historic	Two cisterns	Ineligible
22DS777	19th-20th Century Historic	Rural farmstead/tenant house site	Ineligible
22DS783	Unknown Aboriginal	Lithic scatter	Ineligible
22DS786	Mid19th-20th Century Historic	Old McAnninch plantation house site	Unknown
22DS848	Unknown Aboriginal; 20th Century Historic	Multicomponent artifact scatter	Unknown
22DS849	Historic	Historic artifact scatter	Unknown

3.1.2.7 Aesthetics

On the immediate eastern banks of the Mississippi River, the western extent of the study area is within the Mississippi Alluvial Plain ecoregion. This ecoregion characterized by the extensive agricultural bottomland flatlands made possible by channelization and flood control systems, making it one of the more heavily altered ecoregions in the United States. This heavily cultivated landscape consists a patchwork of thin strips of dense bottomland hardwood forests that are juxtaposed with the straight borders and perimeters of neighboring agricultural land and historic development along the river corridor. As the ecoregion transitions eastward from the Mississippi Alluvial Plain, the majority of the study area is within the Mississippi Valley Loess Plains ecoregion. This ecoregion is characterized by the irregular plains and gently rolling hills which are distinguished with thick loess and oak-hickory-pine forests. (Chapman, S.S, Griffith, G.E., Omernik, J.M., Comstock, J.A., Beiser, M.C., and Johnson, D., 2004, Ecoregions of Mississippi, Reston, Virginia, U.S. Geological Survey)

Land use in the study area ranges from a high concentration of deciduous forests that are often bordered by land that is cultivated for crops or pasture. The landscape is defined by its waterways, primarily the Mississippi River and the Coldwater River, which have informed development and circulation routes. Major transportation corridors like I-55, I-69, and I-269 dissect the study area into four nearly equal quadrants with the county seat of Hernando being centrally located within the study area. More developed land uses are situated along this central north-south axis of I-55 and parallel U.S. Highway 51. The majority of developed land-uses remains to the north of the study area and includes the Memphis metropolitan areas of Horn Lake, Southaven, and Olive Branch. These three communities are threaded along the east-west corridor that is Mississippi State Highway 302. Aerial imagery analysis over the last 20 years shows an increase in developed land uses and deforestation concentrated around these Memphis metropolitan areas.

The Great River Road National Scenic Byway provides the primary source of visual access on the West side of the project area and adjoining lands. The designation by the US Department of Transportation Federal Highway Administration recognizes archeological, cultural, natural, recreational and scenic qualities of River Road from Minnesota to Louisiana. Additionally, the Delta Bluffs Scenic Byway is within the study area and provides visual access into the historic communities of Walls and Hernando. This byway is a part of the Mississippi Scenic Byways Program (MSBP) under the Mississippi Department of Transportation (MDOT), which help preserve, enhance, and protect the state's intrinsic resources for visitors and residents of the state.

On the National Register of Historic Places, the National Park Service (NPS) has designated five historic districts within the study area, all of them located in the city of Hernando. The Hernando Commerce Street Historic District, the Hernando Courthouse Square District, the Hernando Northside Historic District, the Hernando South Side (Magnolia) Historic District, and the North Elm Historic District are along the Delta Bluffs Scenic Byway. Seven other significant historic places in the study area dot the landscape and help narrate the county's unique culture and history. DeSoto County Tourism and their "South of the Ordinary"

campaign promotes the county's natural, cultural, and recreational resources. Regional tourism programs include, but are not limited to, www.visitthedelta.com, www.mississippihills.org, www.visitmississippi.org, and www.msdeltaheritage.com

3.1.2.8 Recreation

The study area is within the Mississippi North Delta Planning and Development District and is included in the Mississippi Statewide Comprehensive Outdoor Recreation Plan (SCORP). DeSoto County has 44 active recreation facilities and 30 passive recreation facilities according to Mississippi SCORP "Ensuring Mississippi's Outdoor Legacy" 2019-2024 prepared for the Mississippi Department of Wildlife, Fisheries, & Parks (MDWFP). These 74 facilities are managed by MDWFP resources and/or DeSoto County resources. See Appendix N, Table N: 1-1 for a listing of DeSoto County parks and recreation facilities.

According to the United States Department of the Interior National Park Service Land & Water Conservation Fund (LWCF), 9 recreation projects have been supported between 1965 and 2015. Section 6(f)(3) of the L&WCF Act assures that once an area has been funded with L&WCF assistance, it is continually maintained in public recreation use unless NPS approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. See Appendix N, Table N: 1-2 for a listing of funding from the LWCF within the study area.

"The Outdoor Industry Association reports that active outdoor recreation contributes $8 billion annually in consumer spending to Mississippi's economy and supports 79,000 jobs. These jobs generate $2.1 billion in wages and salaries and produces $620 million annually in state and local tax revenue. The U.S. Census Bureau reports that each year over 1.3 million people participate in hunting, fishing, and wildlife watching in Mississippi contributing $1.1 billion to the state economy." (www.lwcfcoalition.org: State Fact Sheets May 2019)

3.1.2.9 Environmental Justice and other Social Effects

An Environmental Justice (EJ) analysis focuses on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the Federal action, in this case, the proposed flood risk-reduction system alternatives: Three Detention Sites in the HLC Basin (Cow Pen, Rocky, and Lateral D), HLC Channel Enlargement, and the Nonstructural plan. The EJ assessment identifies environmental and demographic indicators for the project alternatives, using the EPA tool, EJSCREEN. If the alternative impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after taking offsetting benefits into account, then there may be a disproportionate finding. Avoidance or mitigation are then required. The following subsections and Appendix M provide information on the low-income and minority population in DeSoto County.

3.1.2.9.1 *Existing Conditions*

DeSoto County, Mississippi is the study area for the flood risk management EJ analysis. For the purpose of this analysis, race, ethnicity, and income data for the county were obtained to determine if there was a high concentration of a minority or low-income population in the area of the Proposed Action. The Affected Environment section describes the low-income and minority and ethnic composition of larger areas within the study area, such as the County, City or Census Designated Place (CDP). Section 4, the Environmental Consequences section, refines the analysis and identifies EJ communities near project sites that may experience impacts from the flood risk reduction measures. Areas with high concentrations of minority or low-income populations are termed "environmental justice (EJ)" communities.

The county is majority white with 30 percent identifying as minority. The largest minority in the county identifies as Black/African American. The largest city in DeSoto County is Southaven, which is home to about 30 percent of the county population. Minority percentages (including Hispanic/Latino ethnicity) is between 327 and 53 percent of the population. Table M:2-1 provides census information for the study area.

Table M:2-1. Census Information: Minority Population in 2017 was $24,600 for a family of four. All of the cities and towns shown in Table M:2-2 also have well under 20 percent of population living below the poverty threshold. A majority of Horn Lake (city) residents identify as a racial or ethnic minority (53 percent).

Table 3-7 Census Information

Location	Total Population*	Population having Income Below Poverty	Percent of Population Below Poverty
DeSoto County	171,725	16,778	9.8%
Southaven (city)	51,993	5,780	11.1%
Lynchburg CDP*	2,371	127	5.4%
Horn Lake (city)	26,587	4,058	15.3%
Olive Branch (city)	35,773	3,109	8.7%

*For Whom Poverty Status is Known
Source: U.S. Census Bureau ACS 2014-2018

Table 3-8 Communities within Study Area

Location	Total Population*	Population having Income Below Poverty	Percent of Population Below Poverty
DeSoto County	171,725	16,778	9.8%
Southaven (city)	51,993	5,780	11.1%
Lynchburg CDP*	2,371	127	5.4%
Horn Lake (city)	26,587	4,058	15.3%
Olive Branch (city)	35,773	3,109	8.7%

*For Whom Poverty Status is Known. Source: U.S. Census Bureau ACS 2013-2017

3.1.2.10 Socioeconomics

3.1.2.10.1 *Population and Housing*

Table 3-9 shows the population trend in DeSoto County and in the State of Mississippi from 1970 to 2010 and projections through 2040. Population is steadily increasing in both DeSoto County and the State of Mississippi. Total number of households (Table 3-10) also shows a steady increasing trend from 1970 to 2010 and projections through 2040.

Table 3-9 Total Population, (Thousands)

	Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
DeSoto County (MS)	36.0	54.1	68.6	108.7	161.8	188.0	217.9	246.3
Mississippi	2,221.1	2,526.7	2,578.9	2,848.4	2,970.3	3,009.5	3,079.6	3,155.1

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

Table 3-10 Number of Households: Total, (Thousands)

	Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
DeSoto County (MS)	9.3	16.3	23.5	39.4	58.0	69.2	83.6	97.9
State	638.1	829.1	913.3	1050.0	1118.0	1176.6	1248.1	1310.7

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

3.1.2.10.2 *Employment, Business, and Industrial Activity*

Table 3-11 shows the growth of non-farm payroll over the last four decades and projections through 2040. Total nonfarm payroll employment is the number of paid US workers in all

businesses, excluding those who work for farms, serve in the military, volunteer for nonprofit organizations, and perform unpaid work in their own household. Self-employed, unincorporated individuals are excluded as well. The leading employment sectors for DeSoto County are Trade, Transportation and Utilities; Leisure and Hospitality; Government; and Education & Health Services. Tables 3-12 and 3-13 show the Labor Force, Employment, Unemployment, and Unemployment Rate for DeSoto County and the State of Mississippi, respectively. DeSoto County has consistently had a lower unemployment rate than the State of Mississippi. The labor force shows a steady increase over the period and projected through 2040.

Table 3-11. Employment: Nonfarm Payroll, (Thousands) for Desoto County

	Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Natural Resources and Mining	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.02
Construction	0.22	0.68	0.98	1.90	1.86	2.32	2.83	3.54
Manufacturing	2.65	3.76	6.24	7.07	3.68	4.64	5.04	5.48
Trade, Transportation, Utilities	1.14	2.59	5.10	9.13	14.29	20.74	24.56	28.89
Information	0.05	0.07	0.13	0.21	0.19	0.25	0.30	0.35
Financial Activities	0.35	0.46	0.69	1.06	1.64	1.61	1.95	2.34
Prof. and Business Services	0.53	0.77	1.90	3.11	4.03	6.87	8.77	11.17
Education & Health Services	0.09	0.31	1.24	2.57	5.57	7.25	9.14	11.19
Leisure and Hospitality	0.46	0.79	1.47	4.00	6.99	10.27	12.89	16.03
Other Services (no Public Administration)	0.15	0.22	0.41	1.19	1.40	1.77	2.06	2.34
Government	1.60	2.09	2.37	3.84	6.75	7.57	8.94	10.17
Total Nonfarm payroll	7.28	11.76	20.54	34.08	46.42	63.30	76.49	91.52

U.S. Bureau of Labor Statistics: Census of Employment & Wages (QCEW - ES202); Moody's Analytics (ECCA) Forecast

Table 3-12. Labor Force, Employment, Unemployment, and Unemployment Rate for Desoto County

	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Labor Force, (Ths.)	37.38	59.23	79.62	89.12	103.05	119.81
Employment, (Ths.)	35.39	57.81	73.68	84.88	98.02	114.02
Unemployment, (Ths.)	2.00	1.42	5.94	4.24	5.03	5.79
Unemployment Rate, (%)	5.34	2.39	7.46	4.75	4.88	4.83

BLS; Moody's Analytics (ECCA) Forecast

Table 3-13 Labor Force, Employment, Unemployment, and Unemployment Rate for State of Mississippi

	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
Labor Force, (Ths.)	1,183.98	1,319.27	1,306.61	1,269.67	1,312.42	1,389.67
Employment, (Ths.)	1,094.04	1,248.24	1,170.88	1,187.34	1,224.16	1,296.76
Unemployment, (Ths.)	89.94	71.03	135.73	82.33	88.26	92.90
Unemployment Rate, (%)	7.60	5.38	10.39	6.48	6.73	6.69

BLS; Moody's Analytics (ECCA) Forecast

3.1.2.10.3 *Community and Regional Growth (Income)*

Per Capita Income is a proxy for community and regional growth. Community and regional growth also track with population and employment trends described in the preceding sections. Table 3-14 shows the growth in per capita since 1970 and projections through 2040.

Table 3-14. Income: Per Capita, ($) for DeSoto County, MS

Dec-1970	Dec-1980	Dec-1990	Dec-2000	Dec-2010	Dec-2020	Dec-2030	Dec-2040
3,003	8,405	16,666	26,480	31,722	41,159	52,607	69,432

U.S. Census Bureau (BOC); Moody's Analytics (ECCA) Forecast

3.1.2.11 Geology and Soils

The majority of the study area lies within the loess plains of the MVLP. Physiography of the loess plains ecoregion is evidenced by dissected irregular level to gently rolling plains; wide, flat floodplains; and low gradient silt and sand bottomed streams. Geology within the area consists of Quaternary loess with alluvial silt and sand in floodplains, some Quaternary and Tertiary sandy clay decomposition residuum and Tertiary (Eocene) sand and clay. Common soil series include Grenada, Loring, Calloway, Memphis, Providence, and on floodplains Oaklimeter, Ariel, Falaya, Collins, and Waverly. Elevations typically range from 70-630 feet above mean sea level. (Chapman et. al., 2004).

A portion of the study area extends into the bluff hills of the Mississippi Valley Loess Plain (MVLP). This ecoregion is dissected by hills, ridges and irregular plains. Steep hillsides and narrow valleys to the west transition to smoother terrain to the east. Streams are moderate to low gradient with sand, silt and occasional gravel substrate. Quaternary loess is often 30-50 feet thick or more, with Tertiary (Eocene to Miocene) sand, silt, and clay. Common soil series expected within the region include Memphis, Loring, and Natchez. Common soils on floodplains may include Adler and Collins soils. Elevations range from approximately 60-360 feet above mean sea level (Chapman et. al., 2004).

3.1.2.12 Prime and Unique Farmland

The Farmland Protection Policy Act of 1981 (FPPA) was enacted to minimize the extent that Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses, and to assure that Federal programs are administered in a manner that, to the extent practicable, would be compatible with state, unit of local government, and private programs and policies to protect farmland.

Under this policy, soil associations are used to classify areas according to their ability to support different types of land uses, including urban development, agriculture, and silviculture. The USDA NRCS designates areas with particular soil characteristics as either "Farmland of Unique Importance," "Prime Farmland," "Prime Farmland if Irrigated," or variations on these designations. Prime farmland, as defined by the FPPA, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. Farmland of unique importance is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, drought-prone, and less productive, and cannot be easily cultivated as compared to prime farmland (NRCS 2016).

Prime and unique farmlands are located within DeSoto County, Mississippi. Coordination regarding exact acreage and locations is on-going.

3.1.2.13 Climate and Climate Change

The 2014 USACE Climate and Resiliency Policy Statement states that "USACE shall continue to consider potential climate change impacts when undertaking long-term planning, setting priorities, and making decisions affecting its resources, programs, policies, and operations."

The 2015 review conducted by the USACE Institute for Water Resources (IWR) summarizes the available literature on climate change for the Lower Mississippi River Region, which includes the Horn Lake Creek Basin. Climate trends are included in detail in Climate Appendix H. There is the consensus and evidence pointing to an increasing precipitation trend and less evidence in observed data pointing to trends in temperature or temperature maximums in the region. There is some evidence that hydrology and streamflow are increasing in the region, but unclear evidence whether temperature is increasing or decreasing.

Projections indicate a strong consensus of an increase in projected temperature of approximately 2 to 4 degrees Celsius by the late 21st century. There is some consensus that precipitation extremes may increase in future both in terms of intensity and frequency, however, in general projections of precipitation have been shown to be highly variable across the region. There is some consensus that streamflow is projected to decrease in the region. However, very few conclusions can be drawn regarding future hydrology in the

region largely due to the substantial amount of uncertainly in these projections when coupling climate models with hydrology models.

3.2 FUTURE WITHOUT PROJECT CONDITIONS

NEPA requires that in analyzing alternatives to a proposed action, a Federal agency must consider an alternative of "No Action." The future without project (FWOP) conditions apply to when the proposed action would not be implemented and the predicted environmental restoration benefits, flood risk reduction benefits, etc. would not be achieved.

Without implementation of the proposed action, other Federal, state, local, and private restoration efforts may still occur within or near the proposed project area. Section 1.5 of this report discusses ongoing programs and potential projects in the study area for floodplain related activities. None of the proposed projects are currently in construction, and if they were implemented, would have only localized flood risk reduction within the study area. The projects/programs would have the potential to reduce the number of eligible structures for the nonstructural portion of the TSP.

The following assumptions are part of the projected without-project condition:

- According to local planners, the Horn Lake Creek Basin was considered 35 percent developed in the year 2000.
- DeSoto County experienced some significant flooding and some flash flooding during the 10-year period (1994 to 2004). Four of the most recent and largest-magnitude floods that occurred in the Horn Lake Creek basin were in November 2001, December 2001, October 2002, and December 2002. Table 3-4 summarizes the history and magnitude of the floods that occurred within the 10-year period.
- Some developments are located very close to the top banks of Horn Lake Creek. More residences and businesses are located within the 100-year floodplain than when the 1993 Flood Insurance Rate Maps were completed.
- Attempts by adjacent business owners and the cities of Southaven and Horn Lake, Mississippi to clean out the channel from debris and overgrowth has not done a lot to alleviate flooding to residences and businesses, or the overtopping of roads in the area.
- The Horn Lake Drainage Basin is expected to be approximately 95 percent developed by the year 2027 and is expected to remain at this percentage until the year 2050 and beyond. This projection is based on proposed changes in land use and population increases.
- In proportion to this increase in development, the area is expected to see an increase in flow discharges. Table 3-15 shows a comparison of the 100-year discharges at various locations for 2002 existing conditions versus 2027 future without project conditions.

Table 3-15 Comparison of 100-year Discharges

Location	Stream Mile	Drainage Area (Square Mile)	100-Year Discharges	
			Year 2002	Year 2027
Mississippi River F/P	8.4	54.5	19,800	20,600
Stateline Road	12.5	41.6	18,500	20,300
ICRR	18.2	18.2	14,700	16,200
Highway 51	19.4	22.4	15,600	17,000
Interstate 55	21.2	13.1	9,700	12,400
Elmore Road	22.2	7.4	6,000	7,700

3.2.1 Relevant Resources-Future Without Project (FWOP)

This section contains a description of relevant resources in the study area (see Table 3-1) in a future within which the proposed action would not be implemented and the predicted environmental restoration benefits, flood risk reduction benefits, etc. would not be achieved.

3.2.1.1 Natural Environment

3.2.1.1.1 *Wetlands and Bottomland Hardwood Forest*

Under the FWOP, wetlands and BLH forest are expected to remain relatively stable. Continued draining and/or clearing of wetlands and BLH within DeSoto County may continue; however, as the majority of the land that can be used for commercial and residential purposes has been developed, and regulatory requirements have been put in place the remaining area is protected or would likely require mitigation for additional impacts.

3.2.1.1.2 *Upland Forest*

Under the FWOP, upland mesic forests are expected to be cleared for commercial and residential purposes. This expected trend would cause the continued degradation of foraging, cover, and reproductive habitat for wildlife. The Mississippi Flyway would also continue to degrade placing further stress and competition on species.

3.2.1.1.3 *Water Quality and Aquatic Resources*

Under the FWOP, water quality and aquatic resources are expected to remain impaired with continued sedimentation, low dissolved oxygen, excess nutrient problems. This expected trend would cause increased or steady sedimentation issues to continue over time in the study streams due to high stream flows during flood events. Erosion and bank failures along with incision, head-cutting, heavy agricultural practices and commercial and residential development would be expected to continue. In addition, low normal flows and aggradation in some areas along with bare, unshaded banks would continue to impair streams for biological use.

3.2.1.1.4 *Wildlife*

Under the FWOP, wildlife habitat and usage would continue to be limited and likely decline as forested areas, aquatic resources, and water quality continue to decline in quality and quantity, as described in previous sections.

3.2.1.1.5 *Threatened and Endangered Species*

The two federally listed species within the range of the study, northern long-eared bat and wood stork, would not be directly impacted or benefitted under the FWOP; however as with any population in the vicinity, continued habitat decline would prevent a stable ecosystem that could support these species.

3.2.1.1.6 *Air Quality*

Under the FWOP, Desoto County would remain classified as marginal for ozone, the least severe classification. This classification is the result of area-wide air quality modeling studies, and the information is readily available from the Mississippi Department of Environmental Quality, Air Quality Division.

3.2.1.2 Human Environment

The population of DeSoto County is projected to continue to steadily grow (as illustrated in Appendix L-Economics, section 1.3) under the FWOP. The Horn Lake Drainage Basin in particular is expected to be approximately 95 percent developed by the year 2027 and is expected to remain at this percentage until the year 2050 and beyond. This projection is based on proposed changes in land use and population increases. In the absence of a project, flooding would continue and with development expected to continue at this rapid pace, future flooding problems would likely increase.

3.2.1.3 Cultural Resources

Under the FWOP, impacts to cultural resources, where applicable, would continue to occur from erosion and urban development.

3.2.1.4 Aesthetics

Communities within the study area would continue to be at risk from high water events induced by rainfall events under the FWOP. Visual resources would continue to evolve from existing conditions as a result of both land use trends and natural processes over the course of time. Communities near waterways would continue to experience high water events seasonally due to stormwater inputs from development adding to, and at times exceeding, the pre-development capacity.

3.2.1.5 Recreation

Under the FWOP, communities within the study area would continue to be at risk from high water events induced by stormwater inputs. Recreational resources would continue to be

influenced by existing conditions as a result of both land use trends and natural processes over the course of time.

3.2.1.6 Environmental Justice

Under the no action alternative, there would be no federal action (construction of flood risk reduction measures) and therefore there would be no additional impacts to minority or low-income communities. The study area would continue to experience damages from rainfall and roads would continue to experience flooding during high water events as they do today.

3.2.1.7 Geology and Soils

No changes to geology and soils is anticipated under the FWOP.

3.2.1.8 Prime and Unique Farmland

Under the FWOP, prime and unique farmland would continue to be impacted by the uncontrolled widening of streams.

Section 4
Formulate Alternative Plans

Plan formulation supports the USACE water resources development mission. A systematic and repeatable planning approach is used to ensure that sound decisions are made. The Principles and Guidelines describe the process for Federal water resource studies. It requires formulating alternative plans that contribute to Federal objectives. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

The initial plan formulation strategy was to focus on regional solutions (e.g., dams, detention basin, and channel improvement) followed by formulation based on economics damage centers (e.g., where the greatest consequences are) minimizing structure damage, life loss, and/or more local protection. These measures were developed based on previous reports and studies, NFS information, stakeholder/public input, new hydrology and hydraulics, geotechnical assessments, a screening process that includes evaluation of completeness, effectiveness, acceptability and efficiency, as well as professional judgment. This section also describes the plan formulation process, to identify the TSP, which includes development of cost estimates and economic analysis.

The PDT identified measures and alternatives that would reduce flood damages to businesses, residents, and infrastructure in DeSoto County, which would be measurable by evaluating structural damages. In addition, measures and alternatives were evaluated based on their ability to reduce risks to human life from flooding and rainfall events, and risks to critical infrastructure, both of which would be measurable by evaluation of changes to water surface elevation at flood prone intersections. The critical infrastructure present includes hospitals, schools, electric substations, and emergency services (fire, police, EMS). The PDT identified the critical work plan areas, or areas where structural damages were expected to occur in the Horn Lake Creek Basin and the Upper Coldwater Basin. The PDT began formulation with a review of the concepts in the 2005 Horn Lake Creek Study. The 2005 plan focused entirely on the area known as Bullfrog Corner within the Horn Lake Creek Basin. The 2005 plan included detention for downstream inducements, channel enlargement and stabilization along Horn Lake Creek (HLC), stabilization of Rocky Creek at its confluence with HLC, and clean out of a diversion ditch and placement of a weir and berm on the drainage ditch just upstream of Bullfrog Corner. While the 2005 plan was screened, many of the individual measures of that alternative were retained. The PDT evaluated five types of structural measures (detention basins, channel modifications, re-routing flows, levees and removing constrictions) and both physical and non-physical nonstructural measures.

The PDT also identified measures and alternatives that would reduce channel instability and to improve aquatic habitat. The PDT worked with a team from the Engineering Research and

Development Center (ERDC) to develop a multi-scale Watershed Assessment model. This Stream Condition Index (SCI) model, was formulated, tested and refined to:

1. Determine existing conditions
2. Identify problems in the watershed
3. Prioritize stream segments for restoration
4. Recommend structural and nonstructural restoration design
5. Provide numerical assessment of alternatives for planning purposes

SCI is a visual, multi-metric assessment tool using metrics to characterize the hydro-geomorphology, water quality, plant habitat and animal habitat of a selected stream reach.

This model can show ecosystem restoration benefits gained from bank stabilization/ grade control projects.

4.1 MANAGEMENT MEASURES

The plan formulation process utilized the best available information at this phase of the study to identify a TSP. However, during the final phase of this feasibility study, additional analyses would be completed to refine the design and cost estimates of the features included in the TSP. The revised design and costs would be incorporated into the numerical modeling (Hydraulics and Economics) in order to develop an accurate assessment of the performance and cost-effectiveness of the plan which would be included in the Final IFR & EIS.

4.1.1 Flood Risk Management Measures

The PDT developed a mixture of nonstructural and structural measures to best address the flooding concerns. The measures were evaluated by a screening process based on the planning objectives, constraints, as well as the opportunities and problems of the area. Twenty-one nonstructural and structural measures (Table 4-1) were evaluated. The unshaded cells in the table are the measures that were carried forward and used to create alternatives. A general description of the measures that were considered are described below.

Nonstructural Measures: reduce the human exposure or vulnerability to a flood hazard without altering the nature or extent of the flood hazard. Nonstructural alternatives could be used in conjunction with any of the structural flood mitigation alternatives to optimize the cost/benefit ratio.

- Non-physical: Consists of flood warning system/evacuation plans. Adequate land use and floodplain management development regulations already exist and do not warrant further evaluation.

- Physical: Consists of property acquisition (buyouts), relocation, elevation, and/or flood proofing of structures.

Structural Measures: Physical modifications designed to reduce the frequency of damaging levels of flood inundation

Detention Basins: regional, below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates. Can involve either one large upstream detention basin and/or smaller detention basins located upstream of existing infrastructure.

Channel modifications: There are numerous possible variations of this measure, including improving or enlarging the channel with and without concrete and/or rock stabilization.

Re-routing flows: Includes modifying channel to re-route flow of stream to reduce water surface elevation during flood events, as well as diverting flow to stormwater ditch during flood events.

Levees: An earthen embankment, floodwall, or similar structure along a waterway whose purpose is flood risk reduction or water conveyance could be constructed to protect communities and other significant structures and/or lands. This could also be combined with channelization.

Removing Constrictions: this includes bridge modification and removal, as well as dredging, clearing, and snagging within the stream.

*Table 4-1. DeSoto County Flood Risk Management Measures**

Measure ID		Description	Type	Location
Detention	1	Large Scale Reservoir (Conceptual)	Removed large portion of peak flows to determine if effective	in Horn Lake Creek
	6	Sewerage Lagoon	Detention to handle inducements from the 2005 plan	NW of Bullfrog Corner
	9	Rocky Creek	Detention	Elmore Rd
	10	Horn Lake Creek	Detention	Elmore Rd.
	11	Lateral D	Detention	Church and Airways
	12	Cow Pen	Detention	Nail and Hurt Rd Detention
	13	Horn Lake Creek	Detention	Goodman at Hwy 51
	N/A	Airways and I-55	Detention	Airways and I-55 near Tanger
	N/A	Detention with berms	Detention with berms	Same locations as measure 9-12
Remove Constrictions	N/A	Bridge Modification/Removal	Remove and replace	Railroad, Hwy 51, Elmore Rd.
	N/A	Clearing and Snagging	dredge, clear and snag	HLC and tributaries
Nonstructural	N/A	Zoning Ordinances	FEMA/Sponsor responsibility	HLC and Coldwater
	N/A	Buy Outs	If qualify	HLC and Coldwater
	N/A	Flood Proofing Commercial Structures	Wet or Dry	HLC and Coldwater
	N/A	Elevate Residential Structures	25, 50, 100 yr.	HLC and Coldwater
	N/A	Elevate Roads and Bridges	Not within USACE authority	HLC and Coldwater
Levees and Floodwalls	15A	Rocky Creek Ring Levee at Shelby Apartments	Around Communities	RC just north of confluence with HLC
	15B	Rocky Creek Levee 2 b/w I-55 and Airways	Around Communities	RC b/w I-55 and Airways
	15C	Horn Lake Creek Levee 1 b/w Airways and Elmore	Around Communities	HLC b/w Airways and Elmore
	15D	Horn Lake Creek Levee 2 around bullfrog corner	Around Communities	HLC @ Hwy 51 and Goodman
	N/A	Horn Lake Creek Drainage Ditch Levee	Blocks flows down Bull Frog Drainage Ditch	large levee ringing Bullfrog Corner from I55 S. of Goodman Rd to RR
Channel Enlargement	18	HLC Channel enlargement	with rip rap	RM 18.86-19.41
	N/A	HLC Channel enlargement large	No concrete lining, move sewer interceptor	RM 19.41-19.82
	N/A	HLC Concrete Lined	with concrete lining	RM 19.41-19.82
Rerouting flows	N/A	Re-route HLC at RR bridge	Likely to induce flooding on Horn Lake Creek between Hwy 51 and the Railroad Bridge	
	N/A	Berm with a diversion weir, side slope 1:4, crown width of 10. Ditch bottom width of 20' side slope of 1:2.5.	Remove channel obstructions along ditch south of Goodman Road at Hwy 51	RM 18.80 – 19.91

Note: Shaded cells are measures that were not carried forward during the screening process.

4.1.2 Ecosystem Restoration Measures

Seventeen streams were evaluated for ecosystem restoration. Streams included in the initial formulation included four streams that drain west into Mississippi River including: Horn Lake Creek, Cow Pen Creek, Rocky Creek and Nonconnah Creek and thirteen streams that drain south into the Coldwater Basin and ultimately to Arkabutla Lake including: Coldwater River, Lick Creek, Nolehoe Creek, Camp Creek, Hurricane Creek, Cane Creek, Mussacuna Creek, Johnson Creek, Cuffawa, Short Fork, Red Banks, Pigeon Roost, and Byhalia. These streams are identified on the Figure 4-1.

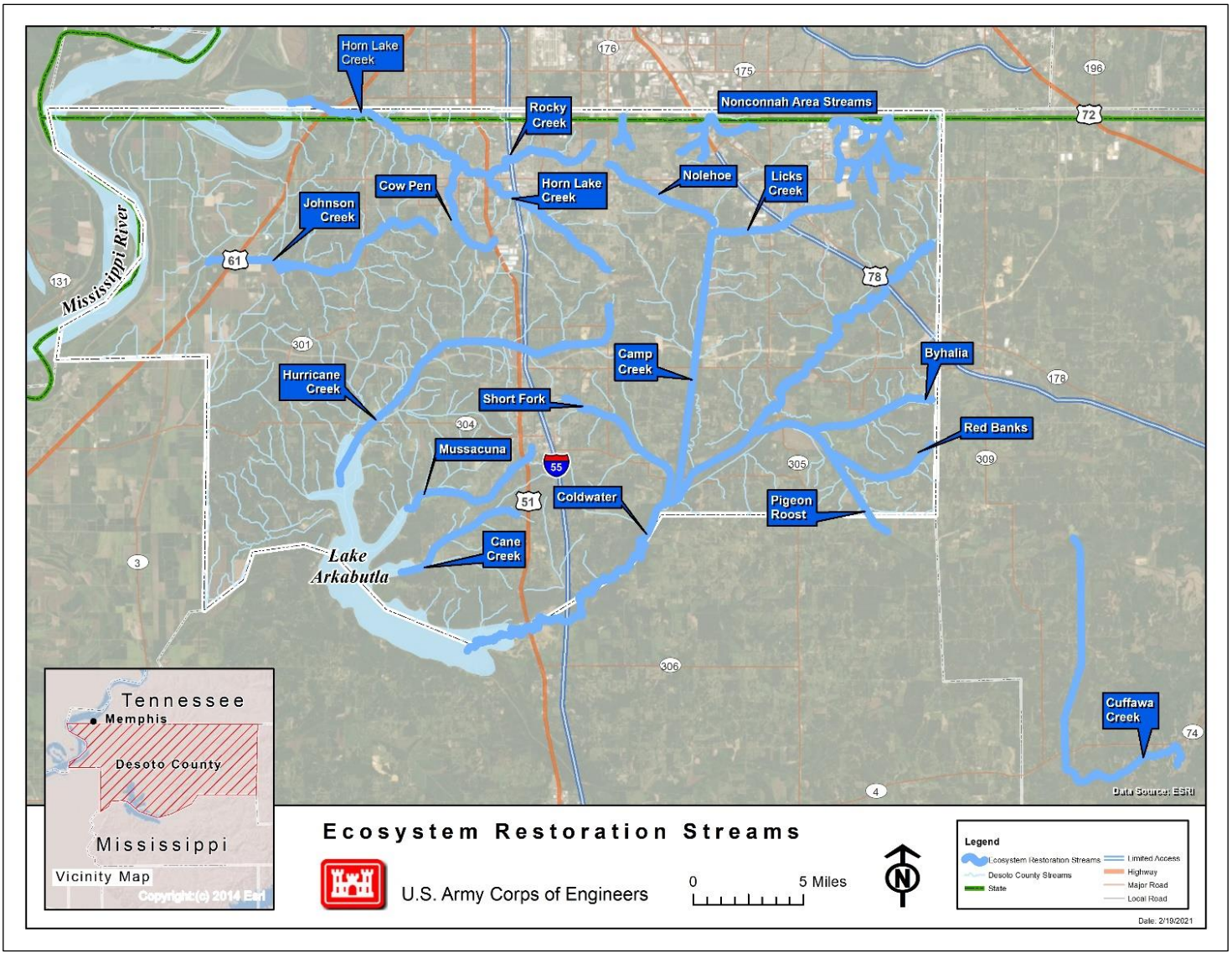

Figure 4-1. DeSoto County Streams Evaluated for Ecosystem Restoration

Nine Ecosystem Restoration Measures considered by the PDT are identified in Table 4-2 and described below.

Grade control: The GCS include a variety of rock or concrete structures constructed across the channel and anchored in the streambanks to provide a hard point in the streambed that resists the erosion forces of the degradational zone and maintains a streambed elevation. GCS considered include both high and low drop structures.

Bank stabilization: bank protection methods that may prevent erosion and bank slips, and to reduce the hydraulic load acting on the soil. Those considered include: Rip Rap placement, lateral stone toe protection, synthetic erosion control products, and placement of riser pipes.

Terrestrial habitat construction: restoration of lands adjacent to stream banks to stabilize soils, and reforest with native vegetation to improve foraging, cover, and reproductive habitats.

In-stream maintenance: Clearing, snagging, or channel excavation to reduce impediments to flow.

In stream habitat construction: Creation of aquatic habitat through the construction of in-stream structural measures such as detention ponds and terraced bank lines.

Table 4-2. Ecosystem Restoration Measures Evaluated

Type	ID	Description	Location	Screened (S); Retained (R)
Grade Control	ER-1	Low Drop Structures	All streams	R
	ER-2	High Drop Structures	All Streams	S
Bank Stabilization	ER-3	Riser pipes	All streams	R
	ER-4	Lateral stabilization with stone toe protection	All streams	R
	ER-5	Rip Rap	All streams	R
Terrestrial Habitat Construction	ER-6	Riparian Buffer Strips	All streams	R
In-stream maintenance	ER-7	Clearing and Snagging	All streams	S
In-stream habitat Construction	ER-8	Streambank terracing	All streams	S
	ER-9	In-line detention	Horn Lake Basin	R

4.2 SCREENING CRITERIA

4.2.1 Flood Risk Management Screening Criteria

The PDT developed a mixture of nonstructural and structural measures to best address the flooding concerns. The measures were evaluated by a screening process based on the planning objectives, constraints, as well as the opportunities and problems. Twenty-one measures (Table 4-1) were evaluated including both nonstructural and structural measures. Measures were screened based on their ability to deliver on the objectives and their cost effectiveness (if costs far outweighed benefits and the Benefit-cost ratio was less than 1). Nonstructural was identified as optimal at the 0.04 Annual Exceedance Probability (AEP) frequency ("25 yr.") and as a result all other frequencies were screened.

4.2.2 Ecosystem Restoration Screening Criteria

The primary ecosystem restoration objective is to restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines which would improve transport of stream flows and sediment. The initial screening criteria was to retain for further evaluation those streams that were considered as degradational. Streams were evaluated using light detection and ranging (LIDAR) and Geographic Information Systems (GIS) data. If a stream was identified as stable, with a stable plan form geometry, then this stream was screened out for ecosystem restoration. Initial discussions with the sponsor and field visits allowed the PDT to identify nine streams that were degradational. Further conversations with stakeholders representing the six drainage districts in the region added five additional streams into consideration. Of the added five only four flowed within the boundary of DeSoto County and of those four only two were identified as degradational within DeSoto County.

4.3 SCREENING OF MEASURES

4.3.1 Flood Risk Reduction Management Measure Screening

Twenty-one individual flood risk reduction measures were considered and of those, sixteen were screened and removed from consideration. Measures were screened if they were incomplete and did not meet one of the study objectives, cost more than they benefited (or had a B/C<1), or violated a constraint.

4.3.2 Ecosystem Restoration Measure Screening

Ecosystem restoration management measures were developed for the remaining 11 streams through a brainstorming process led by team's environmental lead along with partners at the ERDC. Alternative plans were identified using a channel stability assessment completed by the ERDC. This method uses existing LIDAR data to assess the stream corridor conditions based on analysis of the longitudinal profile and cross-sections.

4.4 DEVELOPMENT OF ALTERNATIVE PLANS

4.4.1 Flood Risk Management Alternative Plans

Alternatives were assembled through the plan formulation process, including alternatives for no-action and nonstructural. Alternative plans were identified using one or more of the retained management measures that were carried forward after the initial measure screening evaluation. The team assembled eight nonstructural, eight structural, and two combined nonstructural/structural alternatives. The 18 alternatives were further evaluated using the screening criteria laid out previously Table 4-2 to develop the final array of alternatives. The unshaded cells in Table 4-3 are the alternatives that were carried forward.

Table 4-3. Initial Array of Alternatives

Alt ID	Description	Measures Included	Primary Screening Criteria	B/C Ratio
NS -25yr	0.04 AEP Nonstructural Aggregation	Elevating Residential and Flood proofing Commercial Structures in the 25 Year Floodplain	Most efficient and effective nonstructural aggregation (highest net benefits)	1.34
NS-50yr	0.02 AEP Nonstructural Aggregation	Elevating Residential and Flood proofing Commercial Structures	0.04 AEP Nonstructural had the highest net benefits	1.02
NS-100yr	0.01 AEP Nonstructural Aggregation	Elevating Residential and Flood proofing Commercial Structures	0.04 AEP Nonstructural had the highest net benefits	0.85
6	Basin Wide Bermless Detention	All Detention Combined (alt ID 9-12)	Inefficient	N/A
7	2005 Plan	Combination of channel enlargement, diversion, berm and weir, and detention	channel enlargement was effective and retained, while all other individual measures were screened (ineffective)	2.57
9	Rocky Creek Detention	Detention Basin on Rocky Creek	Maximizes Net Benefits-effective	1.06
10	Horn Lake Creek Detention at Elmore	Upstream detention basin at Elmore Road	Elmore detention cost prohibitive-inefficient	0.77
11	Lateral D Detention	Detention on Lateral D. near Airways	Maximizes Net Benefits-efficient and effective	2.08
12	Cow Pen Creek Detention	Detention on Cow Pen Creek near Nail and Hurt Rd.	Retained-NFS would like to explore optimizing the design to address roadway flooding	.75
14	Horn Lake Creek Berm Drainage Ditch Levee	Drainage ditch, small levee blocking water from entering stormwater drainage ditch south of Bullfrog	Induces flooding	N/A

Alt ID	Description	Measures Included	Primary Screening Criteria	B/C Ratio
		Corner		
16	Horn Lake Creek Drainage Ditch Levee and Detention Combo 1	Drainage Ditch Levee, Horn Lake Detention and Rocky Creek Detention	Negative Net Benefits - Elmore detention cost prohibitive; levee causes inducements	0.75
17	Multi Detention with Drainage Ditch Levee Combo 2	Levee+ 4Detention: Bullfrog Levee, HLC detention at Elmore, Rocky Creek Detention, Cow Pen detention, Lat D detention	Negative Net Benefits - Elmore detention cost prohibitive; levee causes inducements	0.80
18	Horn Lake Creek Channel Enlargement	River mile 18.86-19.41	This is the most viable feature included in the 2005 Plan (#7)-efficient, effective	2.33
19	Multi Detention without Levee Combo 3	4 Detention only: Horn Lake Detention, Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention	updated costs show that Elmore is cost prohibitive (inefficient)	0.62
20	Three Detention sites	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention	NFS requests retaining each detention to address roadway flooding	.85
21	Three Detention sites+ Horn Lake Creek Channel Enlargement 18.86-19.41	Rocky Creek Detention, Cow Pen Creek Detention and Lateral D Detention+ HLC Channel Enlargement with Rip Rap	Maximizes Net Benefits-efficient and effective, acceptable	1.10
22	Extended Horn Lake Creek Channel Enlargement	Extended Channel Enlargement with Rip Rap (18.60-19.41)	Maximizes Net Benefits--efficient and effective	2.35
23	Horn Lake Creek Channel Enlargement +Lateral D detention	Extended HLC Channel Enlargement +Lateral D Detention (Plan 11+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.64
24	Extended Horn Lake Channel Enlargement with Cow Pen Detention	Extended HLC Channel Enlargement +Cow Pen Detention (Plan 12+22)	Maximizes Net Benefits -efficient and effective, acceptable	1.65
25	Extended Horn Lake Channel Enlargement with Rocky Detention	Extended HLC Channel Enlargement +Rocky Creek Detention (Plan 9+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.34
26	Extended Horn Lake Channel Enlargement with 2 detention basins	Extended HLC Channel Enlargement +Cow Pen Detention + Lateral D Detention (Plan 11+12+22)	Maximizes Net Benefits-efficient effective, acceptable	1.37
27	Extended Horn Lake Channel Enlargement with 3 Detention basins	Extended HLC Channel Enlargement +Cow Pen Detention +Rocky Creek Detention+ Lateral D Detention (Plan 9+11+12+22)	Maximizes Net Benefits-efficient and effective, acceptable	1.11

Note: Shaded cells are alternatives that were not carried forward during the screening process.

4.4.2 Ecosystem Restoration Alternative Plans

Five restoration alternatives were considered on each of the 11 streams identified as needing bank stabilization. Those alternatives included:

1. Grade control alone
2. Riparian restoration alone, at the maximum quantity identified using NLCD data
3. Grade control + maximum riparian acreage restored
4. Grade control + riparian immediately adjacent to grade control
5. Grade control + 25% of riparian acreage available adjacent to grade control

Table 4-4 Ecosystem Restoration Alternatives

Alternative ID	Description	Creek	Screened (S) or Retained (R)	Reason Screened
HLC-1A	5 new GCS structures, rehab of 5 existing structures, replacement of 5 existing structures	Horn Lake	S	Structure 12 sits in footprint of FRM alternative
HLC-1B	14 GCS	Horn Lake	R	
HLC-2	255 acres of Riparian Restoration	Horn Lake	S	Acreage thought to be unattainable
HLC-3	14 GCS+255 acres of Riparian Restoration	Horn Lake	S	Acreage unfeasible
HLC-4	14 GCS+17 acres of Riparian Restoration	Horn Lake	R	
HLC-5	14 GCS +64 acres of Riparian Restoration	Horn Lake	R	
NON -1	7 GCS	Nonconnah	R	
NON-2	426 acres of riparian restoration	Nonconnah	S	Acreage unfeasible
NON-3	7 GCS+426 acres of riparian restoration	Nonconnah	S	Acreage unfeasible
NON-4	7 GCS+5 acres of riparian restoration	Nonconnah	R	
NON-5	7 GCS+107 acres of riparian restoration	Nonconnah	R	
CP-1	7 GCS	Camp	R	
CP-2	392 acres of riparian restoration	Camp	S	Acreage unfeasible
CP-3	7 GCS +392 acres of riparian restoration	Camp	S	Acreage unfeasible
CP-4	7 GCS +47 acres of riparian restoration	Camp	R	
CP-5	7 GCS +98 acres of riparian restoration	Camp	R	
LC-1	3 GCS	Lick	R	
LC-2	142 acres riparian restoration	Lick	S	Acreage unfeasible
LC-3	3 GCS+142 acres riparian restoration	Lick	S	Acreage unfeasible
LC-4	3 GCS+11 acres riparian restoration	Lick	R	
LC-5	3 GCS+36 acres riparian restoration	Lick	R	
NL-1	11 GCS	Nolehoe	R	

Alternative ID	Description	Creek	Screened (S) or Retained (R)	Reason Screened
NL-2	129 acres of riparian restoration	Nolehoe	S	Acreage unfeasible
NL-3	11 GCS+129 acres of riparian restoration	Nolehoe	S	Acreage unfeasible
NL-4	11 GCS+17 acres of riparian restoration	Nolehoe	R	
NL-5	11 GCS+32 acres of riparian restoration	Nolehoe	R	
HC-1	9 GCS	Hurricane	R	
HC-2	638 acres of riparian restoration	Hurricane	S	Acreage unfeasible
HC-3	9 GCS+638 acres of riparian restoration	Hurricane	S	Acreage unfeasible
HC-4	9 GCS+22 acres of riparian restoration	Hurricane	R	
HC-5	9 GCS+160 acres of riparian restoration	Hurricane	R	
CN-1	9 GCS	Cane	R	
CN-2	263 acres of Riparian Restoration	Cane	S	Acreage unfeasible
CN-3	9 GCS+263 acres of Riparian Restoration	Cane	S	Acreage unfeasible
CN-4	9 GCS+6 acres of Riparian Restoration	Cane	R	
CN-5	9 GCS+66 acres of Riparian Restoration	Cane	R	
MC-1	3 new GCS	Mussacuna	R	
MC-2	226 acres of riparian restoration	Mussacuna	S	Acreage unfeasible
MC-3	3 new GCS +226 acres of riparian restoration	Mussacuna	S	Acreage unfeasible
MC-4	3 new GCS +9 acres of riparian restoration	Mussacuna	R	
MC-5	3 new GCS +57 acres of riparian restoration	Mussacuna	R	
JC-1	11 new GCS	Johnson	R	
JC-2	426 acres of riparian restoration	Johnson	S	Acreage unfeasible
JC-3	11 new grade control structures +468 acres of riparian restoration	Johnson	S	Acreage unfeasible
JC-4	11 new GCS +43 acres of riparian restoration	Johnson	R	
JC-5	11 new GCS +122 acres riparian restoration	Johnson	R	
RB-1	5 new GCS	Red Banks	R	
RB-2	192 acres riparian restoration	Red Banks	S	Acreage unfeasible
RB-3	5 new GCS +192 acres of riparian restoration	Red Banks	S	Acreage unfeasible
RB-4	5 GCS +24 acres of riparian restoration	Red Banks	R	
RB-5	5 GCS + 48 acres of riparian restoration	Red Banks	R	
SF-1	9 GCS	Short Fork		
SF-2	423 acres of riparian restoration	Short Fork	S	Acreage unfeasible
SF-3	9 GCS +423 acres of riparian restoration	Short Fork	S	Acreage unfeasible
SF-4	9 GCS + 12 acres riparian	Short Fork	R	
SF-5	9 GCS + 106 acres riparian	Short Fork	R	

4.5 SCREENING OF ALTERNATIVES

4.5.1 Flood Risk Management Alternative Plan Screening

Corps planning guidance requires that plans be evaluated against four criteria listed in the Principles and Guidelines: completeness, effectiveness, efficiency, and acceptability. Other criteria deemed significant by participating stakeholders are also used to evaluate alternatives. The screening criteria represent the most critical factors to be considered in selecting plans for further evaluation. The following criteria were used to assess the overall characteristics of each alternative measure to identify those most likely to meet the project purpose and objectives. Screening of alternatives was done using the formulation criteria including effectiveness, efficiency, acceptability, and completeness. Measures are screened based on the set of criteria described in Table 4-5.

Table 4-5. FRM Screening Criteria

Screening Criteria	Plan Specific Metrics
Effectiveness: the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities	Reducing damage to structures Reducing water surface elevation
Efficiency: the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment	Cost effective Create or enhance stream and wetland habitats; Cultivate recreational opportunities.
Acceptability: the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public; and compatibility with existing laws, regulations, and public policies	Avoid or minimizes negative impacts to •T&E and protected species; •Critical habitat •Water quality (Sediment TMDL) •Cultural, historic, and Tribal resources
Completeness: whether plan includes all elements necessary to achieve the objectives.	1) Reduce risk to human life from flooding and rainfall events; 2) Reduce flood damages to businesses, residents; and 3) Reduce risks to critical infrastructure

Twelve alternatives were retained during initial screening (table 4-4, unhighlighted cells). Those were combined to develop an immediate array of flood risk reduction alternatives. Alternative 1A-Rocky Creek, Cow Pen Creek and Lateral D detention basins, was identified as inefficient and incomplete. However, all other alternatives, include those that included

these basins in combination with nonstructural (1B), or channel enlargement (2A) were found to be efficient, effective, and acceptable. The intermediate array of flood risk alternatives is identified in Table 4-6.

Table 4-6 Intermediate Array of Flood Risk Alternatives

Alt ID	Description	B/C
No Action	USACE would take no action to address flood risks, but other entities may implement some projects.	N/A
1A	3 detention sites (Cow Pen, Lateral D and Rocky)	0.85
1B	3 detention sites (Cow Pen, Lateral D and Rocky), plus 25 YR Nonstructural	1.33
2A	3 detention sites (Cow Pen, Lateral D, and Rocky) plus HLC Channel Enlargement 18.86-19.41	1.41
3A	Channel Enlargement RM 18.86-19.41	3.58
3B	Channel Enlargement RM 18.86-19.41 plus 25 YR Nonstructural	1.89
4A	25 YR Nonstructural Aggregation	1.34
4B	50 YR Nonstructural Aggregation	1.02
5A	Extended Horn Lake Channel Enlargement 18.6-19.4	2.35
5B	Extended Horn Lake Channel Enlargement+ 25 YR Nonstructural	1.29
6A	Extended Horn Lake Channel Enlargement+ Lateral D Detention	1.64
6B	Extended Horn Lake Channel Enlargement+ Lateral D Detention+ 25 YR Nonstructural	1.41
7A	Extended Horn Lake Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural	1.12

4.5.2 Ecosystem Restoration Alternative Plan Screening

Screening of ecosystem restoration alternatives was done using the formulation criteria including effectiveness, efficiency, acceptability, and completeness. Measures are screened based on the set of criteria described in Table 4-7.

Table 4-7. NER Screening Criteria

Ecosystem Restoration Screening Criteria	Plan Specific Metrics
Effectiveness: the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities	Restores and protects aquatic habitat by stabilizing bank lines
Efficiency: the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment	Cost effective--Provides non cost related benefits (reduces sediment loading and loss of streamside acreage); Cultivate recreational opportunities.
Acceptability: the workability and viability of the alternative plan with respect to acceptance by state and local entities and the public; and compatibility with existing laws, regulations, and public policies	Avoid adversely affecting fish passage; Avoid or minimizes negative impacts to cultural, historic, and Tribal resources; Avoid adversely affecting human life or inducing additional flood risk.
Completeness: whether plan includes all elements necessary to achieve the objectives.	Restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines which would improve transport of stream flows and sediment over a 50 period of analysis; Improve species richness through channel stabilization and habitat restoration; Improve water quality to support aquatic resources.

4.6 FINAL ARRAY OF FLOOD RISK MANAGEMENT PLANS

The final array of FRM alternatives carried forward for consideration are presented in Table 4-8 and the location of the structural alternatives are presented in Figure 4-2. The PDT identified the channel enlargement as the most efficient and effective measure to reduce flooding on Horn Lake Creek. However, channel enlargement alone was identified as incomplete because it would not reduce flood damages on the tributaries of Horn Lake Creek. Those alternatives that were identified as being efficient, effective, acceptable, and that showed potential for being complete when combined were carried through into the final array analysis.

Table 4-8. Final Array of Flood Risk Management Plans

Alt ID	Description	B/C
No Action	USACE would take no action to address flood risks	N/A
4A	25 YR (0.04 AEP) Nonstructural Aggregation	1.34
5A	Extended Horn Lake Enlargement 18.6-19.4	2.35
5B	Extended Horn Lake Channel Enlargement+ 25 YR (0.04 AEP) Nonstructural	1.29
6A	Extended Horn Lake Channel Enlargement+ Lateral D Detention	1.64
6B-NED	Extended Horn Lake Channel Enlargement+ Lateral D Detention+ 25 YR Nonstructural	1.41
7A-LPP	Extended Horn Lake Channel Enlargement + Cow Pen, Lat D, Rocky Detention+ 25 YR Nonstructural	1.12

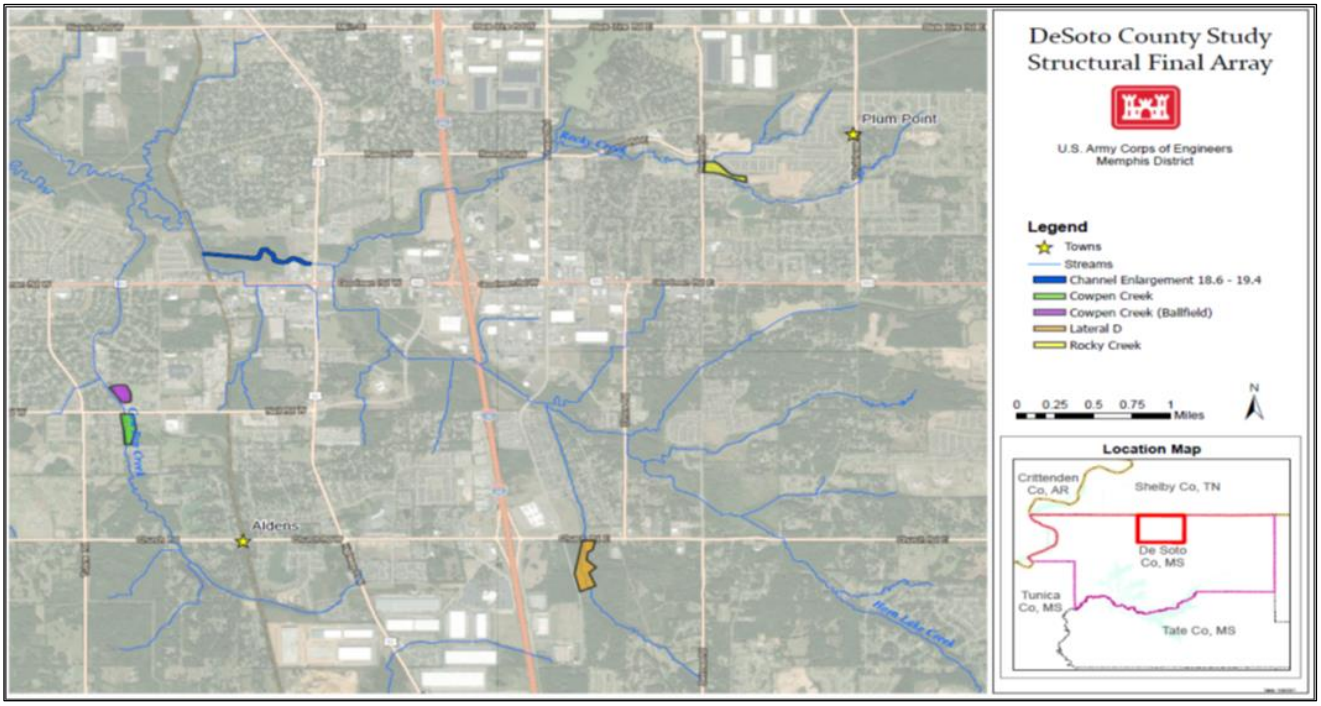

Figure 4-2. DeSoto County Flood Risk Management Structural Final Array

4.6.1 No Action Alternative

Under the No Action Alternative, no risk reduction would occur. DeSoto County would continue experiencing damages from rainfall. This would be exacerbated as development continues throughout the region.

4.6.2 Plan 4A - Nonstructural Alternative Plan

A nonstructural assessment (Appendix L-Economics section 2.2) was completed that evaluated the effectiveness of implementing measures such as structure elevations,

relocations, and flood-proofing. An inventory of residential and non-residential structures was developed using the National Structure Inventory (NSI) version 2.0 for the portions of the study area impacted by flooding. Independent aggregated floodplains were analyzed using HEC-FDA for nonstructural measures. The 0.04 Annual Exceedance Probability (AEP), or 25-year floodplain, was identified as the optimal nonstructural plan.

This alternative addresses every structure receiving damages at the existing 0.04 AEP event. This alternative when implemented alone assumes that:

- 104 residential structures would be raised to the future 100-year stage up to 13 feet.
- 38 nonresidential structures would be floodproofed up to 3 feet.

4.6.3 Plan 5A - Extended Channel Enlargement

A channel enlargement along Horn Lake Creek (HLC) would be constructed downstream of Goodman Road in Horn Lake, Mississippi. The channel bottom would be enlarged from stream mile 18.6 to mile 19.41 (0.8-mile) from the current approximated width of 15-25 feet to 40 feet. The creek banks would be constructed for stability at a slope of approximately 3-foot horizontal to 1-foot vertical (3H:1V). The HLC channel enlargement would require tree clearing of approximately 10 acres along one bank of HLC for access, bank stabilization, and excavation. The enlargement and slope flattening would require approximately 95,000 cubic yards of excavation, all of which would be disposed off-site. Approximately 22,750 tons of riprap would be placed to prevent scour damage. The riprap would be placed in a 3-feet deep layer on the channel bottom and 5 feet up both streambanks. The riprap would be placed over approximately 6,000 tons of filter material. The upper banks would be protected with 18,780 square yards of turf reinforcing mat. The nonstructural aggregation feature would reduce stages during the 0.01 AEP event for 158 structures with an average reduction of 0.75 foot. During the 0.04 AEP event this feature would reduce stages for 125 structures with an average reduction of 1 foot. The channel improvements would be optimized during feasibility-level design.

This plan reduces existing condition damages on Horn Lake Creek by 64 percent, but less than 5 percent on each of the tributaries (Rocky, Lateral D, and Cow Pen Creeks).

4.6.4 Plan 5B – Plan 5A with 4A

The extended channel enlargement measure is the same as described in section 4.6.3 above and is combined with the 0.04 AEP Nonstructural aggregation which reduces stages during the 0.01 AEP event for 158 structures with an average reduction of 0.75 feet. During the 0.04 AEP event, this alternative reduces stages for 125 structures with an average reduction of 1 foot. The extended channel enlargement plus nonstructural (plan 5B) alternative eliminates structural damages:

- During the 0.01 AEP event on 30 structures
- During the 0.04 AEP event on 22 structures

95 percent of damages reduced are concentrated in the bullfrog corner area on HLC

4.6.5 Plan 6A – Plan 5A with Lateral D Detention Basin

The extended channel enlargement measure is the same as described in section 4.6.3 above and is combined with the top performing detention basin, located on the Lateral D tributary to HLC in Southaven, Mississippi. The inline detention basin would encompass approximately 22 acres of bottomland hardwoods (BLH) that would require clearing. The bottom area of the detention basin would be approximately 16 acres. The area would be excavated to a depth of approximately 10 feet with 3H:1V side slopes. Approximately 350,000 cubic yards would be excavated to create the maximum storage of 177-acre-feet detention basin. A 500-linear foot outlet embankment would be constructed to include a 48-inch reinforced concrete pipe (RCP) outlet with a 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 300.0 (the 0.50 annual chance exceedance (ACE) event, or 2-year flood). The current design assumes replanting approximately 10 percent, or 2.2 acres with native vegetation of the area that would be cleared.

4.6.6 Plan 6B – Plan 5B with 6A

Plan 6B has been identified as the NED Plan, and combines the previously described extended channel enlargement, nonstructural and Lateral D Detention Basin. By combining these features, the plan further reduces expected annual damages on Lateral D up to 84 percent.

4.6.7 Plan 7A – Plan 6B with Rocky Creek and Cow Pen Creek Detention Basins

Plan 7A has been identified as the LPP, and adds two detention basins to the previously described combinations. One detention basin along Cow Pen Creek totals approximately 20 acres (2 pools), and one along Rocky Creek totals approximately 9 acres. The detention basins would reduce the peak of high-water events and reduce residual flood risk. In addition, the detention basins assimilate polluted waters including nutrient reduction and store sediment from surrounding developed areas, thus improving downstream water quality. These basins further reduce structural damages on each of the tributaries and were retained at the request of the DeSoto County Board of Supervisors (the non-federal sponsor, NFS). During alternative analysis the PDT identified the extended channel enlargement as the most efficient and effective “anchor” measure, and that combining this channel enlargement with other features works to reduce residual damages. The residual damages on Horn Lake, Rocky, Lateral D, and Cow Pen Creeks can be reduced by one of two optimization methods through either detention or nonstructural.

The Rocky Creek in-line detention basin would total approximately 9 acres and would require approximately 7.5 acres of tree clearing and excavation to a depth of approximately 10 feet. The pool bottom area would encompass approximately 6 acres. The dry detention basin would have a single pool elevation of approximately 302.0. Slopes would be constructed at approximately 3H:1V for stability. A downstream embankment would be

constructed and extend approximately 500 linear feet. The embankment would include a 48-inch RCP outlet and 100- linear foot overflow spillway armored with approximately 6,000 tons of riprap placed over approximately 1,500 tons of filter material on the downstream side. The current design assumes replanting with native vegetation of approximately 10 percent, or 0.9 acre, of the area that would be cleared.

The Cow Pen Creek detention basin would total approximately 20 acres in two pools (a 12-acre upstream pool and an 8-acre downstream pool) and would require approximately 8.5 acres of tree clearing (upstream pool only) and excavation to a depth of approximately 10 feet. The upper pool would have a bottom elevation of 262.0 with a bottom area of 10 acres, and slopes would be constructed at 3H:1V back to the existing grade. A 500-linear feet embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear feet overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 272.0, approximately at the 0.50 ACE event. The maximum storage of 108 acre-feet requires approximately 175,000 cy of excavation which would be disposed of off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

The downstream Cow Pen detention basin would be offline and encompass approximately 8 acres. The basin would have a bottom elevation of 258.0 with a bottom area of approximately 6 acres. Slopes would be constructed up to the existing grade at 3H:1V. A 500-linear foot embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 680 tons of filter material. An inlet sill would require an additional 800 tons of riprap. The 100-feet wide spillway would operate at elevation 268.0, approximately at the 0.50 ACE event. The maximum storage of 68 acre-feet requires approximately 115,000 cubic yards of excavation that would be disposed of off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

4.7 FINAL ARRAY OF ECOSYSTEM RESTORATION PLANS

Stakeholder engagement helped the PDT to identify streams of concern throughout DeSoto County. Stream and ecosystem degradation were the subject of numerous meetings with the NFS, city planners, engineers, and local leaders. Throughout the study the PDT continued to use several forms of data (detailed in Appendix A, B, and C) to determine whether each stream was degradational and in need of ecosystem restoration.

Measures which were combined into alternatives include:

Grade control structures- these were identified as systems of structures paired with various stabilization techniques such as stone toes, channel training structures, and pool and riffle components.

Riparian buffer strips- varying sizes and locations of reforestation were evaluated. Riparian and potentially reforestable acreages were determined using National Land Cover Data mapping within 328 feet of each stream. Categories assumed to be reforestable include cultivated crops, barren land, hay/pasture, herbaceous, and shrub/scrub.

4.7.1 No Action Alternative

This alternative would result in no features of the project being constructed. All future without project conditions are discussed in Section 3. With the no action alternative, streams would continue to destabilize, widen, and banks would continue to erode causing continued impacts from sedimentation, excess nutrients and low dissolved oxygen. In addition, the widening would cause continued impacts to infrastructure, such as bridges and roads as well as residential property. Without construction of the NER Plan, it is estimated that approximately 282 acres of land adjacent to the final array of streams could be lost due to erosion and bank failures.

4.7.2 Alternative 1 – System of Grade Control Structures

Alternative 1 on each of the eleven streams includes a system of GCS and their associated bank stabilization measures (rip rap, longitudinal stone toe protection) needed to stabilize the degrading stream reach. The expected AAHUs and proposed number of GCS for each stream in Alternative 1 are shown in Table 4-9.

Table 4-9. Ecosystem Restoration Alternative 1

Stream	Alt. ID	# GCS	# Annual Average Habitat Units (AAHUs)
Camp	CP-1	7	24
Cane	CN-1	9	3
Hurricane	HN-1	5	6
Lick	LC-1	2	3
Nonconnah	NO-1	6	1
Mussacuna	MC-1	2	3
Horn Lake	HL-1	14	45
Nolehoe	NL-1	11	28
Johnson	JC-1	11	20
Red Banks	RB-1	5	10
Short Fork	SF-1	9	6

4.7.3 Alternative 4 – Alternative 1 with Associated Riparian Plantings

Alternative 4 on each of the eleven streams includes the system of GCS identified in Alternative 1 in addition to the reforestation of cultivated crops, barren land, hay/pasture,

herbaceous, and shrub/scrub within the proposed GGS system reach. The expected AAHUs, proposed number of GCS, and riparian reforestation acreage for each stream in Alternative 4 are shown in Table 4-10.

Table 4-10 Ecosystem Restoration Alternative 4

Stream	Alt. ID	# GCS	Riparian Reforestation (acres)	Annual Average Habitat Units (AAHUs)
Camp	CP-4	7	47	61
Cane	CN-4	9	6	9
Hurricane	HN-4	5	17	25
Lick	LC-4	2	11	11
Nonconnah	NO-4	6	5	6
Mussacuna	MC-4	2	9	11
Horn Lake	HL-4	14	17	60
Nolehoe	NL-4	11	18	43
Johnson	JC-4	11	43	59
Red Banks	RB-4	5	24	28
Short Fork	SF-4	9	12	17

4.7.4 Alternative 5 – Alternative 1 with Restoration of 25 Percent of Reforestable Riparian Acreage

Alternative 5 on each of the eleven streams includes the system of GCS identified in Alternative 1 in addition to the reforestation of 25 percent of cultivated crops, barren land, hay/pasture, herbaceous, and shrub/scrub within 328 feet of each stream. The expected AAHUs, proposed number of GCS, and riparian reforestation acreage for each stream in Alternative 5 are shown in Table 4-11.

Table 4-11 Ecosystem Restoration Alternative 5

Stream	Alt. ID	# GCS	Riparian Reforestation (acres)	# AAHU
Camp	CP-5	7	98	98
Cane	CN-5	9	66	54
Hurricane	HN-5	5	160	140
Lick	LC-5	2	36	24
Nonconnah	NO-5	6	107	75
Mussacuna	MC-5	2	57	40
Horn Lake	HL-5	14	64	101
Nolehoe	NL-5	11	32	54
Johnson	JC-5	11	122	113
Red Banks	RB-5	5	48	46
Short Fork	SF-5	9	106	84

4.8 ALTERNATIVES ELIMINATED FROM DETAILED ER ANALYSIS

4.8.1 Alternative 2– Stand Alone Riparian Reforestation

Riparian Reforestation alone (without in-stream stabilization) would provide a significant amount of habitat; however, without stabilization of the channel these channels would continue to incise and degrade. This alternative was considered incomplete as the planning objectives noted in Section 2.2.2 (Objective 4. Restore and protect aquatic and riparian ecosystems by decreasing channel slopes and stabilizing bank lines and Objective 5. Improve species richness through channel stabilization and habitat restoration) and was therefore screened from detailed analysis.

4.8.2 Alternative 3 – Alternative 1 Restoration of 100 Percent of Reforestable Riparian Acreage

It was determined that 100 percent of potentially reforestable lands were not likely to be available from willing sellers, land costs would be exorbitant, and other agencies, private landowners, and municipalities may have programs and/or motivation to reforest some of this acreage outside of the scope of this project. This led the team to conclude that this highest level of riparian restoration was not likely to be attainable or acceptable.

4.9 SYSTEM OF ACCOUNTS

To facilitate alternative evaluation and comparison of the alternatives, the P&G lays out four Federal accounts that are used to assess the effects of the final array of alternatives. The accounts are NED, Environmental Quality (EQ), Regional Economic Development (RED), and Other Social Effects (OSE). Table 4-12 compares the four Federal accounts against the economically justified alternatives in the revised final array. This is a summary of the highest-ranking alternatives by account:

- **NED Account** - The intent of comparing alternative flood risk reduction plans in terms of NED account was to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects were considered to be increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. Alternative 6B ranked higher in this account based on the higher net benefits captured.
- **EQ Account** - The EQ account was another means of evaluating the plans to assist in making recommendations. The EQ account was intended to display the long-term effects that the alternative plans may have on relevant environmental resources. The Water Resources Council defined relevant environmental resources as those components of the ecological, cultural and aesthetic environments that, if affected by the alternative plans, could have a material bearing on the decision-making process. Alternative 4A ranked higher due to the lower amount of environmental impacts.
- **RED Account** - The RED account was intended to illustrate the effects that the proposed plans would have on regional economic activity, specifically, regional income and regional employment. Alternative 4A ranked higher due to the increased amount of impacts prevented in DeSoto County.
- **OSE Account** - The OSE account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic and man-made and natural resources. Table 4-10 compares the completeness and effectiveness by measurement of the four accounts (national economic development, environmental quality, regional economic development, and other social effects). Plan 7A ranked higher due to the reduction in roadway flooding which is an important objective and is the driving factor in choosing a locally preferred plan.

Table 4-12 System of Four Accounts

Final Array of FRM Alternatives	National Economic Development (NED)	Environmental Quality (EQ)	Regional Economic Development (RED)	Other Social Effects (OSE)
4A -0.04 AEP Nonstructural Aggregation	Avg. Annual Benefits 2.83M Avg. Annual Costs 2.26M Net benefits 570K BCR 1.25 Rank 6	Smallest construction footprint Rank 1	Total Local Economic Impact $82.4M Total Local Jobs Created 802 Rank 1	Nonstructural aggregation reduces the risk of structural damages but does not reduce flooding on roadways. A human impact to EJ resources is not expected. No buy outs or relocations are projected as of now. Rank 6
5A - Extended Channel Enlargement	Avg. Annual Benefits 2.04M Avg. Annual Costs 832K Net benefits 1.21M BCR 2.46 Rank 3	Second smallest construction footprint Rank 2	Total Local Economic Impact $8.2M Total Local Jobs Created 64 Rank 6	Channel enlargement reduces stages on Horn Lake Creek but does not reduce inundation of roadways along tributaries. Rank 5
5B - Extended Channel Enlargement + 0.04 AEP Nonstructural	Avg. Annual Benefits 4.20M Avg. Annual Costs 2.49M Net benefits 1.71M BCR 1.69 Rank 2	Rank 3	Total Local Economic Impact $66.3M Total Local Jobs Created 649 Rank 3	Channel enlargement reduces stages on HLC and NS reduces residual structural risk, but this plan does very little to reduce inundation of roadways on tributaries. Rank 4
6A - Extended Channel Enlargement + Lateral D Detention	Avg. Annual Benefits 2.53M Avg. Annual Costs 1.53M Net benefits 995K BCR 1.65 Rank 4	Detention Basin requires removal of mature trees Rank 4	Total Local Economic Impact $16.1M Total Local Jobs Created 126 Rank5	This plan reduces flood stages in the Bullfrog Corner area and along Lateral D. However, roadways remain at risk of inundation along Cow Pen Creek. Rank 3
6B - Extended Channel Enlargement + Lateral D Detention+ 0.04 AEP Nonstructural	Avg. Annual Benefits 4.36M Avg. Annual Costs 2.64M Net benefits 1.73M BCR 1.66 Rank 1	Detention Basin requires removal of mature trees Rank 5	Total Local Economic Impact $63.5M Total Local Jobs Created 634 Rank4	This plan reduces flood stages in the Bullfrog Corner area and along Lateral D. However, roadways remain at risk of inundation along Cow Pen Creek. Rank 2
7A- Extended Channel Enlargement + Lateral D +Rocky Creek +Cow Pen Detention + 0.04 AEP Nonstructural	Avg. Annual Benefits 4.50M Avg. Annual Costs 3.70M Net benefits 804K BCR 1.22 Rank 5	Largest Construction Footprint Rank 6	Total Local Economic Impact $79.9M Total Local Jobs Created 798 Rank 2	This plan reduces stages on over roadways on each of the tributaries. Rank 1

4.10 BENEFIT/COST ANALYSIS

The cost analysis of the FRM plans was completed utilizing HEC-FDA. The parametric cost table comparing the final array of FRM alternatives is reflected in Table 4-13.

Table 4-13 Final Array of FRM Alternatives

Plan	4A - 25YR Nonstructural Aggregation	5A - Extended Channel Enlargement	5B - Extended Channel Enlargement + 25YR Nonstructural	6A - Extended Channel Enlargement + Lateral D Detention	6B – NED Extended Channel Enlargement + Lateral D Detention + 25YR Nonstructural	7A- LPP Extended Channel Enlargement + Lateral D Detention +Rocky Creek Detention +Cow Pen Detention +25YR Nonstructural
First Cost	$63,944,321	$6,546,189	$53,400,137	$17,875,739	$49,122,188	$61,839,471
Interest During Construction	$197,674	$82,000	$255,759	$223,000	$317,407	$655,392
Estimated Annual Costs						
Annualized Project Costs	$2,262,000	$495,000	$2,153,000	$899,000	$2,004,000	$ 2,493,000
Annual OMRR&R	$0	$337,000	$337,000	$632,000	$632,000	$1,202,000
Total Annual Costs	$2,262,000	$832,000	$2,490,000	$1,531,000	$2,636,000	$3,695,000
Average Annual Benefits						
Total Annual Benefits	$2,832,000	$2,044,000	$4,201,000	$2,526,000	$4,363,000	$4,499,190
Net Annual Benefits	$570,000	$1,212,000	$1,711,000	$995,000	$1,727,000	$804,190
Benefit to Cost Ratio	1.25	2.46	1.69	1.65	1.66	1.22

National Economic Development Plan

The NED identified from the final array of FRM alternatives is a combination of the Horn Lake Creek Channel Enlargement (RM 18.6-19.4) combined with the Lateral D Detention basin, and an optimized nonstructural plan aggregated by floodplain. The 25 yr.

nonstructural aggregation will be refined by assessing the channel enlargement as the new base condition for the hydrology. The TSP is not the NED Plan. The non-Federal sponsor has identified final array plan 7A as the locally preferred plan. This is a justified plan, that includes all component measures included in the NED plan (Horn Lake Creek Channel Enlargement (RM 18.6-19.4) combined with the Lateral D Detention basin, and an optimized nonstructural plan aggregated by floodplain) as well as two additional detention basins (Cow Pen and Rocky Creek Detention basins). The Tentatively Selected FRM Plan has the greatest total annual damages reduced at a total of $4,499,190.

4.11 ECOSYSTEM RESTORATION PLAN INCREMENTAL COST ANALYSIS

National Ecosystem Restoration Plan

The cost effectiveness-incremental cost analysis (CE-ICA) was used to identify the NER Plan. A detailed accounting of the CE-ICA is available in Appendix L-Economics Section 7.3 Figures L:7-2 and L: 7-3. The NER plan includes a “best buy” alternative for each of the 11 degraded streams. The NER (Table 4-14) plan has a total cost of $35,16,479 with a benefit of 827 average annual habitat units.

Table 4-14 National Ecosystem Restoration Plan

Stream	Plan ID	Description	AAHU	Cost
Camp Creek	CP-5	7 GCS + 98 acres riparian	98	$2,821,909
Cane Creek	CN-5	9 GCS + 66 acres riparian	54	$1,918,299
Horn Lake Creek	HLC-5	14 GCS+ 64 acres riparian	101	$7,998,941
Hurricane Creek	HC-5	9 GCS+ 160 acres riparian	140	$4,289,688
Johnson Creek	JC-5	11 GCS+ 122 acres riparian	113	$4,212,848
Lick Creek	LC-5	3 GCS+ 36 acres riparian	24	$1,128,677
Mussacuna Creek	MC-5	3 GCS+ 57 acres riparian	40	$1,555,173
Nolehoe Creek	NL-5	11 GCS +32 acres riparian	54	$3,123,021
Nonconnah Creek	NoN-5	7 GCS+107 acres riparian	65	$2,447,898
Red Banks	RB-5	5 GCS + 48 acres riparian	46	$1,866,539
Short Fork	SF-5	9 GCS+ 106 acres riparian	84	$3,802,485
TOTAL NER PLAN			**827**	**$35,165,479**

4.11.1 Technical significance of the NER Plans

The Ecosystem Restoration Plans identified as best buys have average annual costs per average annual habitat units that are highly competitive verses other restoration studies across the country, with a $2,900 cost/unit. As a result, the PDT recommends proceeding with the best buy plan, Alternative 5, for each of the 11 creeks to form the NER Plan. The

technical significance of this 11-stream restoration plan is described below (the definitions of the technical criteria are included in italics).

Scarcity-*a measure of a resource's relative abundance within a specified geographic range.*

The NER Plan would:

- Reforest ~895 acres of riparian buffers with native vegetation, once fully implemented;
- Stabilize and restore ~28 miles (~187 acres) of in-stream habitat within the Mississippi Valley Loess Plain (MVLP) ecoregion.

Representativeness-*a measure of a resource's ability to exemplify the natural habitat or ecosystems within a specified range.*

Implementation of the project would restore many of the streams in DeSoto County to a stable and representative condition of the MVLP.

Status and Trends-*the occurrence and extent of the resource over time, how it has changed.*

Implementation of the project would arrest stream bed degradation and allow for the improvement of foraging, cover, and reproductive habitats in the area.

Connectivity-*the potential for movement and dispersal of species throughout a given area of ecosystem, considered in the context of a landscape or watershed.*

Implementation of the NER plan would:

- Reconnect approximately 90 stream miles in DeSoto County
- Provide riparian corridors that could connect streams to larger forested blocks and wetlands
- Reconnect isolated stands of habitat to allow movement and dispersal of species throughout the project area
- Design of structures would allow for the improvement of fish passage in the streams.

Limiting Habitat-*habitat that is essential for the conservation, survival, or recovery of one or more species.*

Implementation of the NER plan would provide:

- Stream stabilization that would promote re-colonization of hydrophytic and riparian vegetation contributing to healthy and diverse ecotones.
- Grade control and bank stabilization structures along with riparian habitats which would provide structure and restore function for/with macroinvertebrates.
- Reforestation providing foraging habitat, as well as introducing important coarse woody debris and organic materials into the streams.

Biodiversity-*a measure of the variety of distinct species and the genetic variability within them.*

Implementation of the NER plan would protect or provide habitat that would provide these benefits:

- Endemic and/or species in need of conservation, include the Yazoo darter and Yazoo shiner, Southern red-bellied dace, and Piebald madtom (currently petitioned for listing under the ESA).
- Northern long-eared bat (NLEB) would benefit from reforestation (roosting).
- NLEB and wood stork would benefit from grade control and bank stabilization techniques: aquatic insect habitat and pooling habitat.
- Reforestation of acreage within the Mississippi Flyway is beneficial to neo-tropical migratory birds and would promote forage and resting habitat.

Section 5
Evaluate Alternative Plans

This section describes the environmental consequences associated with implementing the final array of alternatives and contains a brief summary of the effects of the proposed alternatives. The analyzed alternatives include FRM and ER plans. The USACE formed a multi-disciplinary team to conduct a study on streams in DeSoto County to help identify problems and opportunities, as well as quantify expected impacts and benefits on the study streams and adjacent habitat based on the proposed alternatives. The Multi-Scale Watershed Approach (MSWA) was developed by ERDC and revised for use in DeSoto County, Mississippi. The MSWA established a means of utilizing readily available data and surface investigations to create an overall knowledge base focusing on watershed problems and opportunities. The outcome of MSWA can become the principle component of the decision-making process enabling water resource managers to make scientifically defensible decisions, and is the basis of categorizing and quantifying environmental impacts and benefits expected to be incurred from the final array of alternatives discussed below. From the watershed perspective, the cause and effect relationships between land use, water quality and quantity, in-channel and riparian conditions, and biotic responses are representative of the ecological condition of the watershed. Further information regarding the MSWA is included in Appendix A of this document.

5.1 EVALUATING FLOOD RISK MANAGEMENT (FRM) ALTERNATIVES

5.1.1 No Action Alternative

This alternative would result in no project construction. There would be no impacts to the physical and natural environment. All future without project conditions are discussed in Section 3.2. With implementation of the no action alternative, communities within the study area would continue to be at risk from high water events induced by stormwater inputs.

5.1.2 Plan 4A - Nonstructural Alternative Plan

Alternative 4A, as described in Section 4.6.2, would result in a fully nonstructural alternative that would raise 104 residential structures to the future 100-year stage up to 13 feet, and flood-proof 38 businesses within the 25 year floodplain to the future 100-year stage up to 3 feet. Nonstructural aggregation reduces the risk of structural damages but does not reduce flooding on roadways.

5.1.2.1 Relevant Resources Affected

This nonstructural alternative-plan 4A was determined to have no effect on the natural environment or cultural resources within DeSoto County. The effects to the human environment are discussed below.

5.1.2.1.1 *Aesthetics*

Elevating and floodproofing homes would not impact view sheds into any surrounding areas. In cases where a home or land acquisition may take place, this could indirectly impact visual resources by removing a viewer from a given area. In areas where there is public access from a street or roadway, these nonstructural elements would not change the view shed. Houses being raised are currently present, their elevation would change, but the site is still occupied either way. In the case of a home acquisition, if a home is removed and open land is created, this could be considered a benefit to drivers looking for natural scenery or a loss to an established neighborhood. Therefore, there are no direct, indirect or cumulative impacts from implementing this alternative

5.1.2.1.2 *Recreation*

The nonstructural plan would have no impact to recreational resources depending on the methods used. A direct impact from flood proofing recreational buildings is that recreational use would be temporarily unavailable during flood proofing work. An indirect impact of elevating structures is that building costs of future recreational buildings could limit the number of facilities being constructed. There are no cumulative impacts.

5.1.2.1.3 *Environmental Justice*

At this time in the planning process, all structures within the 25-year flood zone are located in economically justified reaches and would be voluntarily flood-proofed or elevated; therefore, all residents within the reaches, irrespective of race, ethnicity, or income, would be able to choose to participate in the plan. These nonstructural measures may provide the sparsely populated area of minority and low-income populations with beneficial flood risk reduction equivalent to structural measures, which are not economically justifiable due to the sparse populations scattered over a large area. Despite existing base floor elevations differing among individual structures, structure-raising would provide the same level of risk reduction benefits per structure at year 2075 (end of the period of analysis).

How the implementation of the NS plan might impact low-income and minority communities is not yet known at this point in the planning process. The NS plan consists of elevating eligible residential structures in the 0.04 AEP (25-year) floodplain. An eligible structure is, among several criteria, one that is engineeringly sound and capable of being elevated. Additionally, while the eligible structure is being elevated, residents of that structure are required to relocate to temporary quarters. Minority and low-income tenants living in rental properties may experience benefits if the property owner chooses to participate in the plan, and that under those circumstances they would not be responsible for temporary relocation costs.

Low-income owners will be responsible for the costs associated with the elevation--costs associated with having their structure repaired so it can be elevated or the relocation costs during elevation. Those residential structures not meeting the soundness criteria and owners who cannot afford the repairs or who cannot afford to relocate during elevation will remain at grade and would be exposed to higher risk for flooding. Although homeowners would be

responsible for costs associated with repairs to ensure a structurally-sound home prior to elevation and would be responsible for temporary relocation costs during elevation, all other eligible costs of elevating structures, including the cost to elevate the structure, would not be borne by any single individual or the community; rather, these costs would be part of the proposed project costs.

The implementation plan for the NS alternative may cause high, adverse disproportionate impacts to low-income residents. A more refined assessment to identify high, adverse disproportionate impacts can be completed during PED (when housing not engineeringly-sound will be identified) and if necessary, develop a mitigation plan through public outreach of EJ communities and meetings.

5.1.3 Plan 5A – Extended Channel Enlargement

Alternative 5A, as described in Section 4.6.3, would result in the construction of a channel enlargement which would increase the bottom width of Horn Lake Creek from approximately 15-25 feet to approximately 40 feet for approximately 0.8-mile from stream mile 18.86 to Mile 19.41. The creek banks would be constructed for stability at a slope of approximately 3-feet horizontal to 1-foot vertical (3:1). The enlargement and slope flattening would require approximately 95,000 cubic yards of excavation, all of which would be disposed off-site. Approximately 22,750 tons of riprap would be placed to prevent scour damage. The riprap would be placed in a 3-feet deep layer on the bottom and 5 feet up both banks. The riprap would be placed over approximately 6,000 tons of filter material. The upper banks would be protected with 18,780 square yards of turf reinforcing mat. Feasibility level design would require careful attention to this site.

The current condition of the proposed enlargement area is a low to moderate quality stream with a moderate riparian corridor. The existing riparian SCI score for this section of stream is 0.31, and the in-channel score is 0.4. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.95 over a period of 50 years. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.85, or 8.5 Average Annual Habitat Units (AAHU), or a total of approximately 425 habitat units over 50 years is expected due to impacts from riparian tree clearing. The unit termed Average Annual Habitat Units (AAHU) is the product of Stream Condition Index (SCI) scores and area of impact or improvement annualized over a 50-year period. Therefore, approximately 8.5 AAHUs, or a total of approximately 425 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Horn Lake Creek channel enlargement.

Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, there is an SCI increase from 0.4 to approximately 0.7 resulting in a gain of 203 habitat units over a 50-year period. Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project.

5.1.3.1 Relevant Resources Affected

5.1.3.1.1 *Wetlands and Bottomland Hardwood Forest*

A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.85, or 8.5 Average Annual Habitat Units (AAHU), or a total of approximately 425 habitat units over 50 years is expected due to impacts from riparian tree clearing. This determination was made using the National Land use Classification Data. Wetland delineations were not conducted. Further fieldwork may result in a determination that some portion of the forested area is not forested wetland, adjustment of compensatory mitigation may be required as more detailed fieldwork is conducted.

5.1.3.1.2 *Water Quality and Aquatic Resources*

Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, there is a gain of 397 AAHU over 50 years.

Water quality within the stream including sedimentation, low dissolved oxygen, and excess nutrient would be expected to improve over time with the implementation of the project.

5.1.3.1.3 *Wildlife*

This alternative would improve the in-stream habitat, as discussed in 5.4.1.2. As tree clearing is expected to occur along one bank, the stream would be left shaded avoiding a portion of the potential impacts to the stream and the associated wildlife. Impacts to wildlife including a variety of migratory game and non-game birds, mammals, amphibians, and reptiles would occur due to a loss of forested habitat. As discussed previously, BLH loss and aquatic instability has impacted the Mississippi Flyway. The loss of average annual habitat units due to tree clearing is described above in Section 5.4. However, these impacts would be mitigated by reforesting an appropriate acreage adjacent to HLC, or within the HLC Basin. In addition, beneficial management actions may include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP.

5.1.3.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this coordination.

5.1.3.1.5 *Aesthetics*

The proposed channel enlargement would be visible from Mississippi Highway 51 and adjacent, developed land uses. Approximately 0.5 miles of creek with forested banks would be cleared, widened, and lined with riprap. Vegetation and associated habitat would no longer interact at the water's edge in the creek as riprap would now clearly delineate the edge.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the channel enlargement and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk reduction efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Similar water training devices in waterways would continue to interrupt the interaction of vegetation and associated habitat at the water's edge as shorelines and banks are defined and reinforced by efforts to reduce flood risk.

5.1.3.1.6 *Recreation*

The proposed channel enlargement could directly impact land used by the City of Southaven's Cherry Valley Park and Greenspace located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by Cherry Valley Park and Greenspace. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property. Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3 for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by *Cherry Valley Park and Greenspace*. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the land used by the City of Southaven's *Cherry Valley Park and Greenspace*

5.1.3.1.7 *Environmental Justice*

The HLC Channel Enlargement Extended alternative would not result in disproportionate significant environment effects on minority or low-income populations. An area that is 0.5 miles around the channel enlargement was identified as the geographic area where potential construction-related disruptions may occur.

The population within 0.5 miles of the proposed channel enlargement is predominately white, with 28 percent of the population identifying as minority. The census block groups that are within 0.5 miles of the channel enlargement are not considered low-income, having less than 20 percent of the households living below poverty. Neither the minority percentage or the low-income percentage meet or exceed the thresholds (as described in the first paragraph of Section 2) that are used to identify EJ communities.

These construction disruptions are temporary. There are no permanent high, adverse direct or indirect impacts from the HLC Channel Enlargement.

Minority and Low-income areas within the larger study area would experience the flood risk reduction benefits associated with the improvement.

5.1.4 Plan 5B – Plan 5A with 4A

Alternative 5B, as described in Section 4.6.4, would result in the construction of a Horn Lake Creek channel enlargement along with the Nonstructural Plan. The benefits, relevant resources affected, environmental impacts and estimated compensatory mitigation is described previously in section 5.3.

5.1.5 Plan 6A – Plan 5A with Lateral D Detention Basin

Alternative 6A, as described in Section 4.6.5, would result in the extended channel enlargement along Horn Lake Creek described above, in addition to the construction of the Lateral D Detention Basin. The Lateral D Detention Basin would be in-line with the stream, a tributary to HLC. The full basin would encompass approximately 22 acres of mostly BLH forested land, the bottom area is approximately 16 acres. Tree clearing would be required for the full acreage mentioned, and excavation would be required to a depth of approximately 10 with 3-feet horizontal to 1-foot vertical side slopes. A 500-linear feet outlet embankment would be constructed to include a 48-inch reinforced concrete pipe (RCP) outlet with a 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 300.0 (the 0.50 annual chance exceedance (ACE) event, or 2-year flood). The maximum storage of 177 acre-feet would require approximately 350,000 cubic yards of excavation. The basin would be turfed and may include limited tree and shrub plantings at the edge of a low-flow channel. The excavated material is expected to be disposed of off-site. A gravel-surfaced access road and security fence would be installed along the perimeter of the basin. The detention design would be optimized during feasibility-level design. A new existing-conditions survey would provide the data necessary to finalize design elevations. Special consideration would be given to transitioning into and out of the detention basin, managing overflow, and protecting the channel from scour.

Currently, no environmental features have been incorporated into the design of the Lateral D detention basin; however, as the project progresses, additional wetland features, microtopography work, and/or tree planting may be incorporated, reducing the amount of off-site compensatory mitigation required. The existing condition of the proposed Lateral D detention basin is a moderate to high quality forested area with an SCI score of 0.8,

producing approximately 17.7 AAHUs. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.95 over a period of 50 years. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.85, or 18.7 AAHU, or a total of approximately 1,045 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, approximately 18.7 AAHUs, or a total of approximately 1,045 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Lateral D detention basin.

5.1.5.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect on: Prime and unique farmland; Upland Forest.

5.1.5.1.1 *Wetlands and Bottomland Hardwood Forest*

Impacts to relevant resources for the HLC channel enlargement are detailed previously in Section 5.4, and are not reiterated here, but are included by reference for this alternative. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.85, or 18.7 AAHU, or a total of approximately 1,045 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, approximately 18.7 AAHUs, or a total of approximately 1,045 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Lateral D detention basin.

5.1.5.1.2 *Water Quality and Aquatic Resources*

Water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project, as the detention basins would be expected to assimilate pollution and store sediment from surrounding developed areas, improving downstream water quality.

Existing water quality problems within the stream including sedimentation, low dissolved oxygen and excess nutrient problems would be expected to improve over time with the implementation of the project. Erosion and bank failures associated with incision, head-cutting, and commercial and residential development would also be expected to improve.

5.1.5.1.3 *Wildlife*

Impacts to relevant resources for the channel enlargement are detailed above in Section 5.4, and are not reiterated here, but are included by reference for this alternative. Impacts to wildlife including a variety of migratory game and non-game birds, mammals, amphibians, and reptiles would occur due to a loss of forested habitat, as discussed above. As discussed previously, BLH loss and aquatic instability has impacted the Mississippi Flyway. Impacts to wildlife would be mitigated by reforesting an appropriate acreage adjacent to HLC, Lateral D, or within the HLC Basin. In addition, beneficial management actions may include items such

as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP

5.1.5.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. Most of area impacted by this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document.

5.1.5.1.5 *Aesthetics*

Extended Horn Lake Channel Enlargement impacts are described in section 5.4.1.5, and impacts of the detention basin include:

During construction, visual resources could be temporarily impacted by construction activities related to implementing the smaller detention sites on Horn Lake Creek tributaries and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk reduction efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Deforestation of localized stands of forest vegetation for developed land uses would continue to drive woodland wildlife habitats further away from development.

5.1.5.1.6 *Recreation*

The proposed channel enlargement could directly impact land used by the City of Southaven's Cherry Valley Park and Greenspace located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by Cherry Valley Park and Greenspace. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property. Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3 for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by Cherry Valley Park and Greenspace. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to

recreational resources that may be impacted within the land used by the City of Southaven's Cherry Valley Park and Greenspace.

The proposed detention site at Lateral D should not have any impacts to recreational resources.

5.1.5.1.7 *Environmental Justice*

The impacts associated with the extended channel enlargement are identified in section 5.4.1.7.

Detention basins are considered as measures to reduce the risk of flooding in the study area. The Lateral D Detention basin is a regional, below grade structure, designed to attenuate flood peaks and release downstream at non-damaging flow rates.

There are no direct impacts to EJ communities from construction of the Lateral D basin. Only the area within 1.0 miles of the Lateral D detention basin is home to an EJ community. A 1-mile radius is used to identify EJ communities since the construction activities may be more substantial than those activities used for the channel enlargement.

Over 50 percent of the population within 1.0 miles of the Lateral D basin identifies as being minority. This area is not a low-income community with well under 20 percent households in the area having incomes below poverty. This community may experience temporary indirect impacts from the construction of the Lateral D basin and are not considered high, adverse impacts. Best Management Practices will be implemented that will minimize/reduce or avoid traffic and noise disturbances such as using traffic routes to reduce neighborhood disturbance or limiting construction activities to daytime to reduce noise impacts. Direct impacts may occur, for example, when the footprint of the structural alternative, the detention basin, encroaches onto privately-owned land which may be acquired to construct the basin. All the lands needed for the detention basin are currently vacant of residential structures.

Positive indirect impacts include a decrease in risk of flood damage for minority and/or low-income populations in the study area. Adverse, indirect impacts to EJ communities may occur when the construction activities, such as transportation, noise, dust and air quality impacts, affect nearby minority or low-income communities near the site.

The EJSCREEN tool, developed by EPA, uses environmental and demographic indicators to help identify environmental risks to communities. Environmental Indicators, presented in Appendix – M: Environmental Justice Table M:3-1, that are above the 80th percentile in the state or USA, is according to EPA, the percentile where one could expect environmental concerns. EJSCREEN is presented in the appendix for each detention basin impact area. Best management practices would be utilized to avoid, reduce, and contain temporary impacts to human health and safety.

Construction activities that may impact transportation routes, possibly causing minor delays, would be temporary. Several impact avoidance features are included as integral

components of the proposed action to minimize impacts to vehicular transportation. Specific routes would be designated for construction-related traffic to minimize residential disturbance and traffic congestion. USACE contracts would designate specific routes for construction-related traffic to avoid residential areas and EJ communities, to the maximum extent practicable, and staging areas for construction equipment and personnel would be located away from heavily populated areas. Streets that would serve construction-related traffic would be resurfaced, if needed and as appropriate, prior to initiation of construction activities, and maintenance of those streets would be provided during the project construction period. Appropriate detour signage would be placed in order to preserve access to local streets during construction activities. Off-street parking would be provided for construction workers, and shuttle vans would be used to transport construction workers to the work sites, if necessary. Streets that are damaged by any and all construction activities would be repaired.

Air quality Impacts to EJ communities are expected to be minor and short term. Temporary increases in air pollution could occur from the use of construction equipment (combustible emissions). Combustible emission calculations were made for standard construction equipment, such as bulldozers, excavators, pumps, front end loaders, backhoes, cranes, and dump trucks. Analyses were made for the type of equipment, duration of the total number of days each piece of equipment would be used, and the number of hours per day each type of equipment would be used. DeSoto County is currently designated by the Environmental Protection Agency as a maintenance area for ozone under the 2015 8-hour standard. DeSoto County has been classified as marginal, which is the least severe classification.

EJ communities within 1.0 miles of the Lateral D Detention Basin:

Several Environmental Indicators, presented in Appendix – M: Environmental Justice Table M: 3-1 and M: 3-5, are above the 80th percentile in the State or USA, which is according to EPA, the percentile where one could expect environmental concerns. Particularly for the Lateral D site, the EJ index for traffic proximity and volume is in the 96th percentile in the State of Mississippi. Only 4 percent of communities in the state have worse traffic volume than the community around the Lateral D site.

There are no residential communities on any side of the proposed site. Over 50 percent of the population within 1.0 miles of the site identify themselves as being minority. This area is not a low-income community with well under 20 percent households in the area having incomes below poverty.

5.1.6 Plan 6B – Plan 5B with 6A

Alternative 6B is the NED Plan, and is described in Section 4.6.6 with impacts to relevant resources for the channel enlargement detailed previously in Section 5.4 and 5.6. This action would result in the extended channel enlargement along Horn Lake Creek, the construction of the Lateral D Detention Basin, and the Nonstructural Plan, all described above. Compensatory mitigation would be required to offset impacts is also described above.

5.1.7 Plan 7A – Plan 6B with Rocky Creek and Cow Pen Creek Detention Basins

Alternative 7A is the LPP and is described in Section 4.6.7. This action would result in the NED Plan along with two additional detention basins along Cow Pen Creek and Rocky Creek. Relevant resources and associated impacts for the NED plan are not reiterated here, but are summarized below, and included by reference.

The Rocky Creek in-line detention basin would total approximately 9 acres and would require approximately 7.5 acres of tree clearing and excavation to a depth of approximately 10 feet. The pool bottom area would encompass approximately 6 acres. The detention basin would have a single pool elevation of approximately 302.0. Slopes would be constructed at approximately 3H:1V for stability. A downstream embankment would be constructed and extend approximately 500 linear feet. The embankment would include a 48-inch RCP outlet and 100- linear foot overflow spillway armored with approximately 6,000 tons of riprap placed over approximately 1,500 tons of filter material on the downstream side. The current design assumes replanting with native vegetation of approximately 10 percent, or 0.9 acre, of the area that would be cleared.

The existing condition of the Rocky Creek detention basin is a moderate-quality forested area with an SCI score of 0.54, producing approximately 4.1 AAHUs. It is expected that the future without construction of the proposed project would see no increase or decrease in habitat value over a period of 50 years, as the adjacent areas are highly developed. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.4, or 3.3 AAHU, or a total of approximately 165 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, approximately 3.3 AAHUs, or a total of approximately 165 habitat units must be replaced to prevent a loss of ecosystem function due to the proposed construction of the Rocky Creek detention basin.

The Cow Pen Creek detention basin would total approximately 20 acres in two pools (a 12-acre upstream pool and an 8-acre downstream pool) and would require approximately 8.5 acres of tree clearing (upstream pool only) and excavation to a depth of approximately 10 feet. The upper pool would have a bottom elevation of 262.0 with a bottom area of 10 acres, and slopes would be constructed at 3H:1V back to the existing grade. A 500-linear foot embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 500 tons of filter material on the downstream side. The spillway would operate at elevation 272.0, approximately at the 0.50 ACE event. The maximum storage of 108 acre-feet requires approximately 175,000 cubic yards of excavation which would be disposed of off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

The downstream Cow Pen detention basin would be offline and encompass approximately 8 acres. The basin would have a bottom elevation of 258.0 with a bottom area of approximately 6 acres. Slopes would be constructed up to the existing grade at 3H:1V. A

500-linear feet embankment would be constructed on the downstream end of the detention basin and would include a 48-inch RCP outlet and 100-linear foot overflow spillway armored with approximately 2,000 tons of riprap over approximately 680 tons of filter material. An inlet sill would require an additional 800 tons of riprap. The 100-foot wide spillway would operate at elevation 268.0, approximately at the 0.50 ACE event. The maximum storage of 68 acre-feet requires approximately 115,000 cy of excavation which would be disposed of off-site. The current design assumes replanting with native vegetation of approximately 10 percent, or 1.2 acres, of the area that would be cleared.

The existing condition of the proposed upstream detention basin is a low-quality forested area with an SCI score of 0.36, producing approximately 3.1 AAHUs. It is expected that the future without construction of the proposed project would see an increase in habitat value, estimated to increase the SCI to approximately 0.5 over a period of 50 years. A reduction of SCI to approximately 0.1 is expected with construction of the proposed project, resulting in an index reduction of approximately 0.4, or 3.4 AAHU, or a total of approximately 170 habitat units over 50 years is expected due to impacts from tree clearing. Therefore, approximately 3.4 AAHUs, or a total of approximately 170 habitat units must be replaced to prevent a loss of habitat due to the proposed construction of the Cow Pen Creek detention basin. The downstream detention basin is currently the site of a baseball or softball field, and currently has little ecological value; therefore, no compensatory mitigation is proposed for that site.

5.1.7.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

This alternative was determined to have no effect on the following resources: Prime and unique farmland; Upland Forest.

5.1.7.1.1 *Wetlands and Bottomland Hardwood Forest*

With implementation of the proposed LPP, the USACE has determined that a total of approximately 48 acres of BLH tree clearing would be required. As a result of the implementation of the LPP approximately 8.5 AAHUs for the Horn Lake Creek channel enlargement would be lost due to tree clearing. In addition, losses of 18.7 AAHUs within the Lateral D detention basin, 3.3 AAHUs within the Rocky Creek detention basin, and 3.4 AAHUs within the Cow Pen detention basin would be incurred. A total of approximately 33.9 AAHUs or approximately 1,695 habitat units over a period of 50 years would be required to be replaced with compensatory mitigation actions to prevent the loss of ecosystem functions. Currently, no environmental features have been incorporated into the design of the detention basins with the exception of the approximately 5.1 acres of replanting along the channels post-construction; however, as the project progresses, additional wetland features, microtopography work, and/or tree planting may be incorporated, reducing, or possibly eliminating, the amount of off-site compensatory mitigation required for the detention basins. Gravel-surfaced access roads and security fences would be installed along the perimeter of the basin for the safety and security of local residents. All excavated material is expected to be disposed of off-site, and is assumed to be placed in an upland area where no impacts would occur. The channel enlargement and detention basin designs

would be optimized during feasibility-level design. A new existing-conditions survey would provide the data necessary to finalize design elevations. Special consideration would be given to transitioning into and out of the detention basins, managing overflow, and protecting the channel from scour.

5.1.7.1.2 *Water Quality and Aquatic Resources*

Overall, water quality and aquatic resources would be expected to improve as compared to the existing conditions and future without project. Due to the improvement of channel planform, bank stability, habitat diversity, and fish cover, there is a gain of 397 AAHU over 50 years for the HLC channel enlargement. While there is a total loss of 1,182 AAHUs due to the tree clearing for the selected alternative, the water quality and aquatic resources are expected to improve with the reduction of sedimentation and the assimilation of pollution.

5.1.7.1.3 *Wildlife*

This alternative would permanently impact approximately 48 acres of forested habitat, causing impacts to several species, as noted previously. In addition, temporary impacts from increased turbidity and disturbance would occur; however, the stream would return to normal post-construction. Compensatory would fully mitigate impacts to wildlife. Beneficial management actions may include items such as protection of large diameter trees and snags, restoration of channel depth and flow, reintroduction of stream sinuosity and microtopography, and floodplain reconnection as described in the Mississippi SWAP.

5.1.7.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction, see Appendix F for specifics on this document.

5.1.7.1.5 *Aesthetics*

Extended Horn Lake Channel Enlargement 18.6-19.4

The proposed channel enlargement would be visible from Mississippi Highway 51 and adjacent, developed land uses. Approximately 0.5 miles of creek with forested banks would be cleared, widened, and lined with riprap. Vegetation and associated habitat would no longer interact at the water's edge in the creek as riprap would now clearly delineate the edge.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the channel enlargement and by transport activities needed to move equipment and materials to and from the site. This temporary impact would

most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk reduction efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Similar water training devices in waterways would continue to interrupt the interaction of vegetation and associated habitat at the water's edge as shorelines and banks are defined and reinforced by efforts to reduce flood risk.

Detention site (Lateral D)

The proposed detention sites would directly impact visual resources as localized stands of forest vegetation would be removed and clear-cut detention basins would remain in place. These detention basins would be slightly recessed in grade and be vegetated with low-growing grasses. At times, these basins would detain water during high-water events long enough for water levels to recede. Visual resources from the immediate roadways and adjacent, developed land uses would be altered from woodland wildlife habitat to low-lying grasslands for foraging wildlife habitat. Waterfowl habitat may be present during high-water events.

During construction, visual resources could be temporarily impacted by construction activities related to implementing the smaller detention sites on Horn Lake Creek tributaries and by transport activities needed to move equipment and materials to and from the site. This temporary impact would most likely affect visual resources from the immediate roadways and adjacent, developed land uses.

Cumulative impacts to visual resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk reduction efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River. Deforestation of localized stands of forest vegetation for developed land uses would continue to drive woodland wildlife habitats further away from development.

25 YR Nonstructural

Elevating and floodproofing homes would not impact view sheds into any surrounding areas. In cases where a home or land acquisition may take place, this could indirectly impact visual resources by removing a viewer from a given area. In areas where there is public access from a street or roadway, these nonstructural elements would not change the view shed. Houses being raised are currently present, their elevation would change, but the site is still occupied either way. In the case of a home acquisition, if a home is removed and open land is created, this could be considered a benefit to drivers looking for natural scenery or a loss to an established neighborhood**.**

5.1.7.1.6 *Recreation*

Extended Channel Enlargement

The proposed channel enlargement could directly impact land used by the City of Southaven's *Cherry Valley Park and Greenspace* located at 7505 Cherry Valley Drive. The proposed channel enlargement is on the southeast perimeter of land used by *Cherry Valley Park and Greenspace*. The channel enlargement footprint does not currently see a high level of user activity as most recreational use occurs in the northwest sector of the property. Access to the Horn Lake Channel within the property is limited to foot traffic. See Appendix N, Figure N-3 for Recreation at Channel Enlargement.

The proposed channel enlargement could indirectly impact land used by *Cherry Valley Park and Greenspace*. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed channel enlargement and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed channel enlargement. Future feasibility and design of the proposed channel enlargement site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the land used by the City of Southaven's *Cherry Valley Park and Greenspace.*

Detention sites (Cow Pen, Lateral D and Rocky)

The proposed Cow Pen Creek detention site would directly impact the City of Horn Lake's Wooten Park, 2690 Nail Rd W, and *Kentwood North*, 2622 Brachton Cv E. Wooten Park features a playground, paved walking trails, pavilion with picnic tables, restrooms, swings and baseball fields which are within the footprint of the proposed Cow Pen Creek Detention site. Kentwood North offers swings, a slide and picnic tables which are within the footprint of the proposed Cow Pen Creek Detention site. The proposed Rocky Creek detention site would directly impact the City of Southaven's *Central Park* located at 7505 Stonegate Boulevard. *Central Park* features a playground, pavilion, backstops, disc golf, and walking trails which are partially within the footprint of the proposed Rocky Creek detention site. See Appendix N, Figure N-4 for Recreation at Cow Pen Creek Detention Site.

The proposed detention site at Lateral D should not have any direct impacts to recreational resources.

The proposed Rocky Creek detention site is east of Greenbrook Softball Complex located at 800 Stonewood Dr. and separated by Swinnea Road. Central Park is also partially within the footprint of the proposed Rocky Creek detention site. During construction, recreational resources could be temporarily impacted by construction activities related to implementing the proposed Rocky Creek detention site and by transport activities needed to move equipment and materials to and from the site. Dust and associated noise may temporarily impact those recreational facilities that are in the vicinity of the proposed detention site. Future feasibility and design of the proposed site would incorporate best management practices with sensitivity to recreational resources that may be impacted within the City of

Southaven's Central Park and Greenbrook Softball Complex. See Appendix N, Figure N-5 for Recreation at Rocky Creek Detention Site.

Cumulative impacts to recreational resources would be the additive combination of impacts by this and other Federal, state, local, and private flood risk reduction efforts, including, but not limited to the Mississippi River Levee and the Arkabutla Lake reservoir on the Coldwater River.

25 YR Nonstructural

The nonstructural features would have no impact to recreational resources depending on the methods used. A direct impact from flood proofing recreational buildings is that recreational use would be temporarily unavailable during flood proofing work. An indirect impact of elevating structures is that building costs of future recreational buildings could limit the number of facilities being constructed.

5.1.7.1.7 *Environmental Justice*

HLC Channel Enlargement (Extended):

All communities would experience the flood risk reduction benefits associated with the improvement. The EJ impact area around the channel enlargement is 0.5 miles because the type of construction activities would create interruptions and noise to surrounding neighborhoods. The population within 0.5 miles of the proposed channel enlargement is predominately white, with 28 percent of the population identifying as minority. The census block groups that are within 0.5 miles of the channel enlargement are not considered low-income, having less than 20 percent of the households living below poverty. Both EJ and non EJ communities would be impacted by the temporary, indirect impacts of constructing the enlargement.

Three detention sites:

Cow Pen, Lateral D and Rocky Creek detention basins are considered as measures to reduce the risk of flooding in the study area. Detention basins are regional, below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates.

The detention basin alternatives would not result in disproportionate significant adverse environment effects on minority or low-income populations. Only the area within 1.0 miles of the Lateral D detention basin is home to an EJ community. A 1-mile radius is used to identify EJ communities since the construction activities may be more substantial than those activities used for the channel enlargement.

Over 50 percent of the population within 1.0 miles of the Lateral D basin identifies as being minority. This area is not a low-income community with well under 20 percent households in the area having incomes below poverty. This community may experience temporary indirect impacts from the construction of the Lateral D basin and are not considered high, adverse impacts. Best Management Practices will be implemented that will minimize/reduce or avoid

traffic and noise disturbances such as using traffic routes to reduce neighborhood disturbance or limiting construction activities to daytime to reduce noise impacts. There are no EJ communities within 1.0 miles of the other two basins.

Several environmental indicators as reported by EPA (Table M3-4 in the Environmental Justice Appendix M) are elevated in the 1-mile radius around the detention ponds and 0.5 miles around the HLC Channel Enlargement. When an area has an elevation of an environmental indicator, care should be taken by the Federal agency to minimize construction related emissions. Specifically, diesel, particulate matter, and ozone are all elevated in the four areas or are at or above the 80th percentile in the state. Best Management Practices will be utilized to avoid, minimize or reduce air quality impacts. Air quality in general is discussed in the Air Quality section of this report.

Additionally, all the lands needed for the detention basins are currently vacant of residential structures. Positive indirect impacts include a decrease in risk of flood damage for minority and/or low-income populations in the study area.

0.04 AEP Nonstructural plan (NS):

At this time in the planning process, all structures within the 25-year flood zone are located in economically justified reaches and would be voluntarily flood-proofed or elevated; therefore, all residents within the reaches, irrespective of race, ethnicity, or income, would be able to choose to participate in the plan. These nonstructural measures may provide the sparsely populated area of minority and low-income populations with beneficial flood risk reduction equivalent to structural measures, which are not economically justifiable due to the sparse populations scattered over a large area. Despite existing base floor elevations differing among individual structures, structure-raising would provide the same level of risk reduction benefits per structure at year 2075 (end of the period of analysis).

How the implementation of the NS plan might impact low-income and minority communities is not yet known at this point in the planning process. The NS plan consists of elevating eligible residential structures in the 0.04 AEP (25-year) floodplain. An eligible structure is, among several criteria, one that is engineeringly sound and capable of being elevated. Additionally, while the eligible structure is being elevated, residents of that structure are required to relocate to temporary quarters. Minority and low-income tenants living in rental properties may experience benefits if the property owner chooses to participate in the plan, and that under those circumstances they would not be responsible for temporary relocation costs.

Low-income owners will be responsible for the costs associated with the elevation--costs associated with having their structure repaired so it can be elevated or the relocation costs during elevation. Those residential structures not meeting the soundness criteria and owners who cannot afford the repairs or who cannot afford to relocate during elevation will remain at grade and would be exposed to higher risk for flooding. Although homeowners would be responsible for costs associated with repairs to ensure a structurally-sound home prior to elevation and would be responsible for temporary relocation costs during elevation, all other eligible costs of elevating structures, including the cost to elevate the structure, would not be

borne by any single individual or the community; rather, these costs would be part of the proposed project costs.

The implementation plan for the NS alternative may cause high, adverse disproportionate impacts to low-income residents. A more refined assessment to identify high, adverse disproportionate impacts can be completed during PED (when housing not engineeringly-sound will be identified) and if necessary, develop a mitigation plan through public outreach of EJ communities and meetings.

5.2 EVALUATING ECOSYSTEM RESTORATION (ER) ALTERNATIVES

5.2.1 No Action Alternative

This alternative would result in no features of the project being constructed. All future without project conditions are discussed in Section 3. With the no action alternative, streams would continue to destabilize, widen, and banks would continue to erode causing continued impacts from sedimentation, excess nutrients, and low dissolved oxygen. In addition, the widening would cause continued impacts to infrastructure, such as bridges and roads as well as residential property. Without construction of the NER Plan, it is estimated that approximately 282 acres of land adjacent to the final array of streams could be lost due to erosion and bank failures.

5.2.1.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

5.2.1.1.1 *Wetlands and Bottomland Hardwood Forest*

Wetlands and BLH forests would continue to be impacted by the existing conditions of the streams and adjacent land in the project areas without the construction of the project. In addition, as erosion and bank failures continue additional BLH/riparian forests would continue to fall into the streams causing additional scouring.

5.2.1.1.2 *Water Quality and Aquatic Resources*

Water quality and aquatic resources would continue to be impacted by problems within the stream including sedimentation, low dissolved oxygen and excess nutrient problems would be expected to improve over time with the implementation of the project. Erosion and bank failures along with incision, head-cutting, and commercial and residential development would also be expected to continue.

5.2.1.1.3 *Wildlife*

Without construction of the project, wildlife would continue to be impacted by the instability of the habitat in streams and adjacent lands. Steep banks limit wildlife access to the stream and the lack of in-stream structure limits utilization by macroinvertebrates impacting the food chain, as well as the reproductive needs of several aquatic species. The lack of forested habitat would continue to impact the Mississippi Flyway and limit organic input into the

streams (such as leaf pack). Lack of cover also impacts the ability of species to move between areas limiting species dispersal.

5.2.1.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction, See Appendix F for specifics on this document.

5.2.1.1.5 *Aesthetics*

With the no action alternative, communities within the study area would continue to be at risk from high water events induced by rainfall events. Visual resources would continue to evolve from existing conditions as a result of both land use trends and natural processes over the course of time. Communities near waterways would continue to experience high water events seasonally due to stormwater inputs from development adding to, and at times exceeding, the pre-development capacity.

5.2.1.1.6 *Recreation*

With the no action alternative, communities within the study area would continue to be at risk from high water events induced by stormwater inputs. Recreational resources would continue to be influenced by existing conditions as a result of both land use trends and natural processes over the course of time.

5.2.1.1.7 *Environmental Justice*

Under the No Action Alternative, no risk reduction would occur. There would be no direct impact on minority and/or low-income population groups under this alternative.

5.2.2 Alternative 1 - Grade Control

Alternative 1 would result in the construction of a total of 81 low-drop GCS within 11 streams totaling approximately 149 AAHUs (Table 4-9). Stream reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix A). With implementation of Alternative 2, the degradational areas of the streams within the study area would be stabilized, reducing sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well as residential property. It is estimated that Alternative 2, would retain approximately 282 acres of land adjacent to the final array of streams.

5.2.2.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

5.2.2.1.1 *Wetlands and Bottomland Hardwood Forest*

With implementation of Alternative 1, approximately 282 acres of land would be retained, some of which would include BLH; however, it is difficult to quantify that BLH acreage at this point in the study. It is likely that some BLH clearing would occur for the construction of the GCS; however, that acreage is not yet determined and would likely be outweighed by the acreage that would be retained by the introduction of grade control in the streams.

5.2.2.1.2 *Water Quality and Aquatic Resources*

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control would reduce water quality problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 149 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the study area by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of the low-drop GCS and bank stabilization would allow for the improvement of fish passage in the streams. Alternative 2 would provide connection in ~90 stream miles in DeSoto County, reconnecting impacted, and degrading stream reaches to the Coldwater River, Lake Arkabutla, and the MAP ecoregion (depending on the geographic of the streams and the direction of flow).

5.2.2.1.3 *Wildlife*

Construction of Alternative 2 would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species. Aquatic species endemic to the area as well as Federally threatened species (NLEB and wood stork) are impacted by systemic degradation of streams and adjacent habitat. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

5.2.2.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish

protocols for additional surveys prior to construction, see Appendix F for specifics on this document.

5.2.2.1.5 *Aesthetics*

Grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams. However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities

5.2.2.1.6 *Recreation*

The 88 proposed GCS are to occur within 11 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures. Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

5.2.2.1.7 *Environmental Justice*

Grade control would not cause direct impacts to EJ communities in the study area. GCS would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Indirect impacts would occur and relate to the materials and equipment used to construct the plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced stabilization of the creeks.

5.2.3 Alternative 4 - Alternative 1 with Associated Riparian Plantings

Alternative 4 would result in the construction of a total of 81 low-drop GCS and reforestation of approximately 214 acres would be implemented within 11 streams totaling approximately 329 AAHUs (Table 4-10). Reforestation was determined using NLCD estimates of land cover within 328 feet of the stream on both banks in the reach where grade control is proposed. The land-use types that are considered reforestable include cultivated cropland, hay/pasture, shrub/scrub, barren land, and herbaceous. Areas that were not considered reforestable include developed areas (i.e. residential and commercial), forested land, emergent wetlands, etc. As plans develop, additional information would be provided on where reforestation would occur. For each stream, the benefits of different percentages of reforestation (10 percent, 25 percent, 50 percent, 75 percent, and 100 percent) were calculated using the Multi-scale Watershed Assessment model. Screening of alternatives is described in Section 4. Steam reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix C). With implementation of Alternative 4, the degradational areas of the streams within the study area would be stabilized, reducing sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to

quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well as residential property. With construction of the NER Plan, it is estimated that approximately 282 acres of land adjacent to the final array of streams would be saved due to erosion and bank failures.

5.2.3.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

5.2.3.1.1 *Wetlands and Bottomland Hardwood Forest*

With implementation of Alternative 4, approximately 214 acres of native BLH species would be planted along the 11 study streams within the stream reaches where grade control is proposed. Alternative 4 would provide riparian corridors that would connect isolated stands of suitable habitat to larger forested blocks and wetlands. Approximately 282 acres of land would be retained, some of which would include BLH; however, it is difficult to quantify that BLH acreage at this point in the study. It is likely that some BLH clearing would occur for the construction of the GCS; however, that acreage is not yet determined and would likely be outweighed by the acreage that would be retained by the introduction of grade control in the streams.

For acreage and AAHUs of each stream, refer to Table 4-10. A total of approximately 180 AAHUs would be restored due to reforestation of the reforestable acreage associated with the implementation of grade control (discussed further in Section 5.8.1.2). Reforestation of these acres would improve the Mississippi Flyway by increasing the acreage of BLH (a limiting habitat type), improving forage capacity, and cover and reproductive habitat. Alternative 4 would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

5.2.3.1.2 *Water Quality and Aquatic Resources*

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control, as well as reforestation, would reduce water quality problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 149 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Based on the acreage of land that is estimated to be retained due to the GCS, an additional 135 AAHUs are expected to be retained from benefits associated with BLH reforestation. Water quality and aquatic resources would improve with the construction of the low drop GCS. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the NER Plan by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of the GCS and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in approximately 90 stream miles in DeSoto County, reconnecting impacted and degrading stream reaches to the Coldwater River, Lake

Arkabutla, and the Mississippi Alluvial Plain (MAP) ecoregion (depending on the geographic of the streams and the direction of flow).

5.2.3.1.3 *Wildlife*

Construction of the NER Plan would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several aquatic species. Aquatic species endemic to the area as well as Federally threatened species (NLEB and wood stork) are impacted by systemic degradation of streams and adjacent habitat. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

The increase of approximately 214 acres of forested habitat would improve the Mississippi Flyway and increase organic input into the streams (such as leaf pack). The NLEB as well as neo-tropical migratory birds would benefit from the reforestation within the project area. Both NLEB and wood stork would benefit from the addition of GCS, which would increase habitat for aquatic insects and pooling habitat. An increase of cover also improves the ability of species to move between areas limiting species dispersal. Reforestation and the reduction of stream degradation would increase biodiversity and improve the ability of species to utilize the study area.

5.2.3.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

5.2.3.1.5 *Aesthetics*

The proposed riparian buffer strips and grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams. However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

5.2.3.1.6 *Recreation*

<u>Riparian Buffer Strips</u>

The proposed riparian buffer strips are to occur along land uses related to agriculture and land that is barren or unforested. The reforestation measure would maintain and improve

wildlife habitat on 213 acres along 11 streams. Recreational activities such as bird watching, fishing, and hunting would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

The 88 proposed GCS are to occur within 11 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures. Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

5.2.3.1.7 *Environmental Justice*

Grade control with associated riparian restoration would not cause direct impacts to EJ communities in the study area. Grade structures would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Riparian plantings would take place along streams abutting agricultural lands or vacant lands. Indirect impacts would occur and relate to the materials and equipment used to construct the plan causing temporary minor construction-related impacts to nearby residents. Positive long-term benefits would accrue to the area from enhanced habitat creation and stabilization of the creeks.

5.2.4 Alternative 5 - Alternative 1 with Restoration of 25 Percent of Reforestable Riparian Acreage

GCS combined with 25 percent of the available riparian restoration was identified as the NER Plan and is the tentatively selected plan TSP for the ecosystem restoration component of the project. This alternative would result in the construction of a total of 81 low-drop GCS and reforestation of approximately 896 acres would be implemented within 11 streams totaling approximately 827 AAHUs (Table 4-11) Reforestation was determined using NLCD estimates of land cover within 328 feet of the stream on both banks. The land-use types that are considered reforestable include cultivated cropland, hay/pasture, shrub/scrub, barren land, and herbaceous. Areas that were not considered reforestable include developed areas (i.e. residential and commercial), forested land, emergent wetlands, etc. As plans develop, additional information would be provided on where reforestation would occur. For each stream, the benefits of different percentages of reforestation (10 percent, 25 percent, 50 percent, 75 percent, and 100 percent) were calculated using the Multi-scale Watershed Assessment model. Screening of alternatives is described in Section 4. Steam reaches that were determined to be degradational were determined using fluvial geomorphology, as described in Appendix C). With implementation of the NER Plan the degradational areas of the streams within the study area would be stabilized, reducing sedimentation. In addition, it is expected that excess nutrients may also be reduced as the erosion of adjacent lands would be reduced, although this is difficult to quantify. In addition, the widening of streams would be reduced, preventing damage to infrastructure, such as bridges and roads as well

as residential property. With construction of the NER Plan, it is estimated that approximately 282 acres of land adjacent to the final array of streams would be saved due to prevention of erosion and bank failures.

5.2.4.1 Relevant Resources Affected and Expected Impacts (Affected Environment and Environmental Consequences)

5.2.4.1.1 *Wetlands and Bottomland Hardwood Forest*

With implementation of the NER Plan, approximately 894 acres of native BLH species would be planted along the 11 study streams. The NER Plan would provide riparian corridors that would connect isolated stands of suitable habitat to larger forested blocks and wetlands.

For acreage and AAHUs of each stream, refer to Table 4-11. A total of approximately 678 AAHUs would be restored due to reforestation of 25 percent of the reforestable acreage along with the implementation of grade control (discussed further in Section 5.8.1.2. Reforestation of these acres would improve the Mississippi Flyway by increasing the acreage of BLH (a limiting habitat type), improving forage capacity, and cover and reproductive habitat. The NER Plan would increase connectivity in the form of forested corridors and provide for an increase in biodiversity.

5.2.4.1.2 *Water Quality and Aquatic Resources*

Introduction and/or rehabilitation of GCS within the study streams would prevent or reduce the further degradation of the stream bed, also reducing the uncontrolled widening of the streams. Grade control, as well as reforestation, would reduce problems within the streams including sedimentation, low dissolved oxygen and excess nutrients. Producing a total of approximately 149 AAHUs, the GCS also prevent the loss of stream bank habitat and adjacent land. Based on the acreage of land that is estimated to be retained due to the GCS, an additional 228 AAHUs are expected to be retained from BLH. Water quality and aquatic resources would improve with the construction of the low drop GCS. Erosion and bank failures along with incision and head-cutting, would also be expected to decrease.

Fish passage is highly impacted in all streams included within the NER Plan by perched culverts, scour at hardpoints, excessive sedimentation and other barriers. Design of GC structures and bank stabilization would allow for the improvement of fish passage in the streams. The NER Plan would provide connection in ~90 stream miles in DeSoto County, reconnecting impacted and degrading stream reaches to the Coldwater River, Lake Arkabutla, and the Mississippi Alluvial Plain (MAP) ecoregion (depending on the geographic of the streams and the direction of flow).

5.2.4.1.3 *Wildlife*

Construction of the NER Plan would contribute to habitat stability along the study area streams in DeSoto County. Stabilization of the stream banks would improve wildlife access to the stream and the improvement of in-stream structure would increase utilization by macroinvertebrates improving the food chain, as well as the reproductive needs of several

aquatic species. Aquatic species endemic to the area as well as Federally threatened species (NLEB and wood stork) are impacted by systemic degradation of streams and adjacent habitat. Endemic and/or species in need of conservation include the Yazoo darter and Yazoo shiner, red-bellied dace, and piebald madtom (currently petitioned for listing under the ESA) could utilize additional habitats that would become accessible through this project.

The increase of approximately 894 acres of forested habitat would improve the Mississippi Flyway and increase organic input into the streams (such as leaf pack). The NLEB as well as neo-tropical migratory birds would benefit from the reforestation within the project area. Both NLEB and wood stork would benefit from the addition of GCS which would increase habitat for aquatic insects and pooling habitat. An increase of cover also improves the ability of species to move between areas limiting species dispersal. Reforestation and the reduction of stream degradation would increase biodiversity and improve the ability of species to utilize the study area.

5.2.4.1.4 *Cultural Resources*

This alternative would be unlikely have any impact on known cultural resources. The majority of this alternative has been previously surveyed for the last 40 years and no eligible resources are located within the project area. Currently, USACE is developing a programmatic agreement with the MS SHPO and federally recognized tribes to establish protocols for additional surveys prior to construction.

5.2.4.1.5 *Aesthetics*

The proposed riparian buffer strips and grade control would typically have positive direct impacts on aesthetics as it restores natural and scenic properties intrinsic to streams. However, due to the rural setting of these small streams, access is limited, and visibility remains low. Generally, immediate roadway crossings provide the primary public views into these drainage corridors. Potential impacts on aesthetics would be short-term and coincide with the duration of construction activities.

Environmental Commitments would be implemented to avoid and/or reduce potential impacts to aesthetics during construction. For all alternatives, these environmental commitments would include:

- Work and staging areas would be kept orderly and free of trash and debris.
- A storage area for collection and storage of recyclable and green waste materials would be kept within the work area. All trash and debris would be removed from the work area at the end of each day.
- Signs would be posted prohibiting trespassing within the “construction zone.”
- Confine vehicular traffic to routes of travel to and from the project site, and prohibit cross-country vehicle and equipment use outside designated work and storage-staging areas.
- Reduce visibility of construction activities and construction related equipment. Construction activities and construction related equipment, including staging

areas, laydown areas, stockpiles, and equipment storage would be temporarily screened throughout construction when visible from roads, trails, or residences to the extent practicable. Screening would consist of temporary screening fences with colors and materials to reflect the natural surroundings.

5.2.4.1.6 *Recreation*

Riparian Buffer Strips

The proposed riparian buffer strips are to occur along land uses related to agriculture and land that is barren or unforested. The reforestation measure would maintain and improve wildlife habitat on 960 acres along 11 streams. Recreational activities such as bird watching, fishing, and hunting would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

Grade Control

The 88 proposed GCS are to occur within 11 streams. The structures would maintain and improve wildlife that benefits from pooling habitat created behind the structures. Recreational-riparian activities such as bird watching and fishing would be enhanced. The proposed work activities would cause adverse, short-term direct and indirect impacts to wildlife species within the work areas during construction, but these impacts would be minor and temporary, and should not adversely or significantly impact area wildlife over the long-term.

Environmental Commitments would be implemented to avoid and/or reduce potential impacts to recreation during construction. For all alternatives, these environmental commitments would include:

Provide notices and information on current recreation use status during the construction period through local media and signage.

All recreation uses would be detoured from construction areas for safety of workers and the public. USACE would coordinate with the DeSoto County, stakeholders, and lessees during the Pre-construction, Engineering, and Design (PED) phase and during the various phases of construction to notify them of closures and facilitate their provision of detours.

5.2.4.1.7 *Environmental Justice*

A system of GCS combined with 25 percent available riparian restoration would not cause direct impacts to EJ communities in the study area. Grade structures would be placed in streams in suburban/urban areas not impacting adjacent homeowners. Riparian plantings would take place along streams abutting agricultural lands or vacant lands. Indirect impacts would occur and relate to the materials and equipment used to construct this plan causing temporary minor construction-related impacts to nearby residents. Positive long-term

benefits would accrue to the area from enhanced habitat creation and stabilization of the creeks.

Section 6
Tentatively Selected Plan

The TSP as previously discussed in Section 4 includes an FRM plan, which is an LPP, and an NER plan that maximizes ecosystem benefits. The LPP is more costly than the NED plan and provides greater annual benefits. The LPP includes a channel enlargement along Horn Lake Creek, three detention basins, and a nonstructural aggregation in the Horn Lake Creek and Upper Coldwater Basin. The LPP is estimated to produce $4.5 million in average annual benefits at an average annual cost of $3.7 million for a BCR of 1.22. The NER plan maximizes ecosystem restoration benefits compared to costs. The NER plan includes grade control and riparian restoration on 11 streams and is estimated to provide 827 Average Annual Habitat Units at an average annual cost of $1.7K per AAHU. The total annual cost of the NER plan is $1.4 million. Table 6-1 provides a comparison of the NED Plan and the LPP. Table 6-2 identifies the tentatively selected NER Plan.

Table 6-1. Comparing the NED Plan to the Locally Preferred-Tentatively Selected Plan

	National Economic Development (NED) Plan-6B	**Locally Preferred & Tentatively Selected Plan (LPP/TSP)-7A**
	Horn Lake Creek Channel Enlargement, Lateral D detention, 25 year Nonstructural	Horn Lake Creek Channel Enlargement, Lateral D, Cow Pen*, Rocky Creek* detention,25 year Nonstructural
First Cost	$49,122,188	$61,839,471
Annual Cost	$2,004,000	$3,695,000
Annual Benefits	$4,363,000	$4,499,190
Net Annual Benefits	$1,727,000	$804,190
Benefit to Cost Ratio	1.66	1.22

*2 detention features are the key structural differences between these two plans

Table 6-2 National Ecosystem Restoration Plan

NER Plan- A system of GCS and riparian restoration on each of the eleven DeSoto County Creeks: Camp, Cane, Horn Lake, Hurricane, Johnson, Lick, Mussacuna, Nolehoe, Nonconnah, Red Banks, and Short Fork Creek.	
First Cost	$ 35,165,479
Annual Cost	$ 1,403,000
Average Annual Habitat Units	827
Annual Average Cost/Annual Average Habitat Unit (AAC/AAHU)	$1,713

6.1 NATIONAL SIGNIFICANCE OF THE PROJECT

The intent of comparing alternative flood risk reduction plans in terms of NED is to identify the beneficial and adverse effects that the plans may have on the national economy. Beneficial effects are increases in the economic value of the national output of goods and services attributable to a plan. Increases in NED were expressed as the plans' economic benefits, and the adverse NED effects were the investment opportunities lost by committing funds to the implementation of a plan. The NED costs and benefits for the final array are described in Table 4-13. The TSP is not the NED plan, but is instead a plan that is larger in scope, more costly, and has greater net benefits than the NED plan (Table 6-1). The TSP is estimated to produce nearly $4.5 million in average annual benefits, compared to the NED plan that would produce nearly $4.4 million average annual benefits.

The PDT would continue to evaluate both the NED plan as well as the LPP/TSP through feasibility level design. The LPP includes two additional detention basins not included in the NED plan. The PDT would optimize and evaluate ancillary benefits (including a reduction in roadway flooding, or improved water quality) that may be provided by including these two detention basins.

6.1.1 Real Estate

The Tentatively Selected Plan (TSP) includes both a Flood Risk Management (FRM) plan, a 0.04 AEP nonstructural aggregation in the Horn Lake Creek and Upper Coldwater basin, and a National Ecosystem Restoration Plan (NER) which maximizes ecosystem benefits.

The structural portion of the North DeSoto Project consists of implementing channel enlargement in Horn Lake Creek along with 3 detention sites. and nonstructural measures to reduce the risk of flood damages to residential and non-residential structures that have first floor elevations at or below the 0-25-year flood plain. An assessment of at-risk properties has currently identified a total of 37 total structures (23 residential, 8 apartments, and 6 commercial) that appear to meet the preliminary eligibility criteria for participation in the Project.

Total real estate costs, excluding mitigation, for the structural component (Horn Lake Creek Channel Enlargement + Lateral D Detention Site, Cow Pen, and Rocky) of the FRM component is $3,542,694.63. This includes the cost of acquiring channel improvement easements, road easements, detention sites in fee simple, LERRD administrative costs, utility relocations, and contingencies.

Total Real Estate Costs for the non-structural portion of the FRM component is $3,609,375.00. For the TSP this cost includes relocation assistance for tenants, administrative costs (Flood Proofing Agreement, Title verification, etc.), and contingencies for elevating 23 residential structures and flood proofing 8 apartment buildings, and 6 commercial structures.

The National Ecosystem Restoration Plan (NER) consists of implementing Grade Control Structures and establishing Riparian Zones for 11 streams in the study area.

The features have the objectives to decrease channel slopes and stabilize bank lines to improve transport of stream flows and sediment to restore and protect aquatic and riparian ecosystems over and 50 period of analysis, improve land use to support channel stabilization and ecosystem restoration, and improve water quality to support aquatic resources.

Total real estate costs, excluding mitigation, for the NER Plan is $20,093,518.75. This includes the cost of acquiring channel improvement easements, road easements, riparian zones sites in fee simple, LERRD administrative costs, and contingencies, as well as cost for potential condemnations.

A Real Estate Plan (REP) describing the real estate requirements and costs for the project can be found in Appendix K. The NFS would have the responsibility of acquiring all necessary real estate interests for the project.

Flood Risk Management

The TSP for the North DeSoto project consists of implementing channel enlargement in Horn Lake Creek along with three detention sites and nonstructural measures. This plan would reduce the risk of flood damages to residential and non-residential structures that have first floor elevations at or below the 0-25-year flood plain. An assessment of at-risk properties has identified a total of 37 total structures (23 residential, 8 apartments, and 6 commercial) that appear to meet the preliminary eligibility criteria for participation in the project.

Total real estate costs, excluding mitigation, for the structural component (Horn Lake Creek Channel Enlargement + Lateral D Detention Site, Cow Pen, and Rocky) of the FRM TSP is $3,542,694.63. This includes the cost of acquiring channel improvement easements, road easements, detention sites in fee simple, lands, easements, rights-of-way, relocations and disposal areas (LERRD), administrative costs, utility relocations, and contingencies.

Total real estate costs for the Nonstructural portion of the TSP is $3,609,375.00. For the TSP this cost includes relocation assistance for tenants, administrative costs (Flood Proofing Agreement, Title verification, etc.), and contingencies for elevating 34 residential structures and flood proofing 8 apartment buildings and 16 commercial structures. For the NED this cost includes relocation assistance for tenants, administrative costs (Flood Proofing Agreement, Title verification, etc.), and contingencies for elevating 23 residential structures and flood proofing 8 apartment buildings and 6 commercial structures.

If a structure would require elevating greater than 13 feet to meet the future year 0.01 AEP, the structure may instead be acquired and removed from the floodplain. The 13 feet height is based on guidance provided in the FEMA publication P-550.

Ecosystem Restoration

The NER consists of implementing GCS and establishing Riparian Zones for 11 streams in the study area.

The features have the objectives to decrease channel slopes and stabilize bank lines to improve transport of stream flows and sediment to restore and protect aquatic and riparian ecosystems over and 50 period of analysis, improve land use to support channel stabilization and ecosystem restoration, and improve water quality to support aquatic resources.

Total real estate costs, excluding mitigation, for the NER Plan is $20,093,518.75. This includes the cost of acquiring channel improvement easements, road easements, riparian zones sites in fee simple, LERRD administrative costs, contingencies, and cost for potential condemnations

6.1.2 Design

The FRM TSP includes these structural features:

Horn Lake Creek Extended Channel Enlargement- the Horn Lake Creek channel enlargement would increase the bottom width to 40 feet for approximately 4,300 linear feet from Mile 18.6 to Mile 19.41, downstream of Goodman Road in Horn Lake, Mississippi. This feature is described in greater detail in Appendix I, section 2.6.1 and shown in Figure I: 2-1.

Cow Pen Creek Detention South- A 12-acre inline detention basin would be located on Cow Pen Creek south of Nail Road in Horn Lake, Mississippi. This feature is described in greater detail in Appendix I, section 2.6.3, and illustrated in Figure I: 2-8.

Cow Pen Creek Detention North- An 8-acre offline detention basin would be located adjacent to Cow Pen Creek north of Nail Road in Horn Lake, Mississippi. This feature is described in greater detail in Appendix I, section 2.6.2, and illustrated in Figure I: 2-3.

Lateral D Detention-A 22-acre inline detention basin would be located on Lateral D south of Church Road in Southaven, Mississippi. This feature is described in greater detail in Appendix I, section 2.6.4, and illustrated in Figure I: 2-9.

Rocky Creek Detention-A 9-acre inline detention basin would be located on Rocky Creek east of Swinnea Road in Southaven, Mississippi. This feature is described in greater detail in Appendix I, section 2.6.5, and illustrated in Figure I: 2-10.

The Ecosystem Restoration Tentatively Selected Plan Includes These Features:

NER measures were formulated by ERDC with input from the PDT. Measures proposed include grade control, bank armoring, riser pipes, and riparian buffers (nonstructural). Improvements are proposed for 11 steams and are described in detail in Appendix A. These measures provide environmental benefits such as reduced scour and deposition. These measures were not evaluated for FRM benefits. Additional field investigation, modeling, and analysis will be completed in PED prior to detailed design, any ancillary benefits identified will be noted at that time.

Grade Control-Up to 88 GCS are proposed in the NER plan. These GCS counteract head cutting that was observed in these streambeds. Structural improvements are designed to stabilize the streambed and reduce future head cutting. The structures would typically be 3.5 feet high off the channel bottom (see Appendix I figures 11 and 12). Larger 600 pound stone would face upstream, with smaller 200 pound stone protecting the downstream side. Side slope armoring and keys would reduce the risk of flanking or undercutting the structure. This design was adapted from ERDC loose rock riffle, with additional slope armor and keys to account for the erodibility of local soils.

Riparian Buffers-Land adjacent to the waterway would be converted to forest to provide a buffer from development and agriculture. There are no structural improvements associated with this measure; however, this could be paired with other measures to mitigate anticipated impacts. For instance, a parcel prone to flooding may be converted to riparian buffer, reducing the risk of damage to private property.

6.1.3 Construction Method

Construction of the structural alternatives, including, channel enlargement, or detention basins would be expected to last 2 years and can be constructed concurrently. For the purposes of computing interest during construction (IDC), construction of the nonstructural components of the plans would be expected to begin in the year 2025 and would continue for a period of 3 months. The construction period of 3 months is designated by PB 2019-03 and is not a complete construction schedule required to fully implement the TSP.

6.1.4 Operations, Maintenance, Repair, Rehabilitation, and Replacement

The OMRR&R is currently under development. OMRR&R costs associated with each of the structural measures was estimated by the cost engineering branch. OMRR&R is assumed to be a zero-dollar value when associated with the nonstructural measures. Residential structures are recommended to be elevated to the future year (2075) 1 percent AEP stage and; therefore, it is assumed that future increases in water surface elevation would not require future elevations.

6.1.5 Compensatory Mitigation

A draft conceptual mitigation plan has been developed by the USACE for the Memphis Metropolitan Stormwater-North DeSoto County Feasibility Study, DeSoto County, Mississippi, and is included in Appendix D of this document. Compensatory mitigation planning has been developed to meet the requirements stated in ER 1105-2-100, Appendix D, and is organized around the 8 components detailed, therein. The document also addresses the Implementation Guidance for Section 2036(a) of the Water Resources Development Act of 2007 – Mitigation for Fish and Wildlife and Wetlands Losses, as well as the joint U.S. Army Corps of Engineers (USACE)/EPA Compensatory Mitigation for Losses of Aquatic Resources Rule (33 CFR 332.4(c) [40 CFR 230.94(c)])(2008 Mitigation Rule). As noted above, the Study is composed of an FRM component, as well as an ER component.

The objective of ecosystem restoration is to restore degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition. Restored ecosystems should mimic, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology. Indicators of success would include the presence of a large variety of native plants and animals, the ability of the area to sustain larger numbers of certain indicator species or more biologically desirable species, and the ability of the restored area to continue to function and produce the desired outputs with a minimum of continuing human intervention (ER 1105-2-100). Therefore, compensatory mitigation is not required for the ER component of the project.

With implementation of the proposed tentatively selected FRM plan, the USACE has determined that approximately 8.5 AAHUs for the Horn Lake Creek channel enlargement would be lost due to tree clearing. In addition, losses of 18.7 AAHUs within the Lateral D detention basin, 3.3 AAHUs within the Rocky Creek detention basin, and 3.4 AAHUs within the Cow Pen detention basin would be incurred. A total of approximately 33.9 AAHUs or approximately 1,695 habitat units over a period of 50 years would be required to be replaced with compensatory mitigation actions to prevent the loss of ecosystem functions. All impacts are associated with BLH clearing, and are summarized in Appendix D. Currently, no environmental features have been incorporated into the design of the detention basins with the exception of the approximately 5.1 acres of replanting along the channels post-construction; however, as the project progresses, additional wetland features, microtopography work, and/or tree planting may be incorporated, reducing, or possibly eliminating, the amount of off-site compensatory mitigation required for the detention basins. All excavated material is expected to be disposed of off-site, and is assumed to be placed in an upland area where no impacts would occur. The channel enlargement and detention basin designs would be optimized during feasibility-level design.

Active Restoration is the recommended compensatory mitigation plan to replace the estimated 33.9 AAHUs that would be impacted with implementation of the LPP, and a total of approximately 42.5 acres of agricultural land would be reforested by planting native trees, other activities as described below may also be included, as determined necessary by the IAT. A planting plan would be created in coordination with the IAT and included in the release of the final Environmental Impact Statement and Conceptual Mitigation Plan. A site-

specific mitigation plan would be developed during PED, further detailing a planting plan. Grade control structures or low-water weirs, strategic placement of coarse woody debris, construction of in-stream habitat, and bench cuts may also be considered for compensatory mitigation; however, no sites have been identified and detailed analyses have not been conducted.

6.1.6 Monitoring and Adaptive Management

Project plans and alternatives were developed in accordance with USACE planning guidance at ER 1105-2-100, which directs that ecosystem restoration projects be designed to avoid the need for compensatory fish and wildlife mitigation. Formulation of project alternatives was conducted in compliance with this guidance. Also, in accordance with USACE planning guidance, net ecosystem benefits expected to accrue if the proposed project is implemented may not be used as wetland banks or mitigation credit by the non-Federal sponsor.

Monitoring and Adaptive Management (AM) Plans are drafted and included in the draft Conceptual Mitigation Plan discussed in section 6.1.5, and included in Appendix D of this document. Adaptive management planning would be continued throughout the Study and through the PED phase of the Study. AM planning elements would include: 1) development of a Conceptual Ecological Model (CEM), 2) identification of key project uncertainties and associated risks, 3) evaluation of the mitigation projects as a candidate for adaptive management and 4) the identification of potential adaptive management actions (contingency plan) to better ensure the mitigation project meets identified success criteria. The adaptive management plan is a living document and would be refined as necessary as new mitigation project information becomes available.

6.1.7 Cost Sharing Requirements

A NFS must support all phases of the project. Feasibility Study costs are shared 50 percent Federal and 50 percent non-Federal for up to $3,000,000. Design and implementation phases are cost-shared, with the NFS providing a minimum of 35 percent of the total. Additionally, the NFS must provide all the LERRDs. While the sponsor may receive credit toward this cost-share for work-in-kind and LERRDs, a minimum cash contribution of 5 percent is required. Once a project has been implemented, OMRR&R of the project is a 100 percent non-Federal responsibility. In the event the LPP is recommended for construction, the Federal share of the cost of the project would be limited to the Federal share of the NED plan in accordance with the cost sharing provisions of Water Resource Development Act (WRDA) 1986, as amended.

6.1.8 Federal Responsibilities for the Tentatively Selected Plan

The Federal government would be responsible for Pre-Engineering Design (PED) and construction of the project in accordance with the applicable provisions of Public Law 99-662 (WRDA of 1986), as amended. The Government, subject to Congressional authorization, the availability of funds, and the execution of a binding agreement with the NFS in accordance with Section 221 of the Flood Control Act of 1970, as amended, and using those funds

provided by the NFS, shall expeditiously construct the project, applying those procedures usually applied to Federal projects, pursuant to Federal laws, regulations, and policies.

6.1.9 Non-Federal Responsibilities for the Tentatively Selected Plan

Federal implementation of the project would be subject to the NFS agreeing in a binding written agreement to comply with applicable Federal laws and policies, and to perform the following non-Federal obligations, including, but not limited, to:

a. Provide 35 percent of total project costs as further specified below:
    1. Provide the required non-Federal share of design costs in accordance with the terms of a design agreement entered into prior to commencement of design work for the project;
    2. Provide, during the first year of construction, any additional funds necessary to pay the full non-Federal share of design costs;
    3. 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, all as determined by the Government to be required or to be necessary for the construction, operation, maintenance, repair, rehabilitation and replacement of the project;
    4. Provide, during construction, any additional funds necessary to make its total contribution equal to 35 percent of total project costs;
b. Shall 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 funds verifies in writing that such funds are authorized to be used to carry out the project;
c. Not less than once each year, inform affected interests of the extent of protection afforded by the project;
d. Agree to participate in and comply with applicable Federal floodplain management and flood insurance programs;
e. 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;
f. 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;
g. 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;

h. 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;

i. For so long as the project remains authorized, OMRR&R the project or functional portions of the project, including any mitigation features, 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; provided, however, that the NFS shall have no obligation to address loss of risk reduction due to relative sea level rise through the repair, rehabilitation or replacement of localized storm surge risk reduction components associated with the construction of large ring berms around groups of residential structures, nor shall the NFS be obligated to OMRR&R those flood proofing measures that constitute elevation of individual residential structures or construction of small ring berms around individual non-residential or light industry/warehouse structures.

j. Give the Federal government a right to enter, at reasonable times and in a reasonable manner, upon property that the NFS owns or controls for access to the project for the purpose of completing, inspecting, operating, maintaining, repairing, rehabilitating, or replacing the project;

k. 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;

l. 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 would 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;

m. 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 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.);

n. 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 Comprehensive Environmental Response, Compensation, and Liability Act (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, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report. 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;
o. 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, easements, or rights-of-way that the Federal government determines to be required for construction, operation, and maintenance of the project, including those lands, structures and interests necessary for the implementation of all of the localized storm surge risk reduction components of the Project as described in this Report;
p. 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 would not cause liability to arise under CERCLA; and
q. 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.
r. Shall 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;
s. Pay all costs due to 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.

Table 6-3 and Table 6-4 share the FRM TSP Cost Allocation and the Ecosystem Restoration TSP Cost Allocation.

Table 6-3 Flood Risk Management Plan TSP Cost Allocation

Civil Works Work Breakdown Structure (CWWBS)	Federal	Non-Fed	Total
Lands, easements, rights-of-way, relocations, and disposal areas (LERRD)		100%	
Lands and Damages		$1,115,000	$1,115,000
Relocation		$1,384,853	$1,384,853
LERRDs Subtotal		$2,499,853	$2,499,853
Construction First Cost LPP	65%	35%	
Mitigation	$1,009,140	$519,860	$1,529,000
25 Year Nonstructural	$15,624,266	$6,076,104	$21,700,370
Channels and Canals	$2,197,600	$1,082,400	$3,280,000
Floodway Control and Diversion	$13,177,450	$7,095,550	$20,273,000
Construction First Cost LPP Subtotal	$32,008,456	$17,273,767	$49,282,223
Administrative Costs	65%	35%	
Planning Engineering and Design	$2,312,700	$1,245,300.00	$3,558,000
Construction Management	$2,312,700	$1,245,300.00	$3,558,000
Administrative Subtotal	$4,625,400	$2,490,600	$7,116,000
TOTAL	**$36,633,856**	**$19,764,367**	**$56,398,223**

Table 6-4 Ecosystem Restoration Cost Allocation

CWWBS	Feature of Work	Fed	Non-Fed	Total
LERRDs	Real Estate		$7,004,247	$7,004,247
	Relocations	$0	$0	$0
Fish and Wildlife Facilities	Riparian Buffers	$653,925	$0	$653,925
Bank Stabilization	Riprap	$14,843,997	$1,628,003	$16,472,000
Cultural Resources	Surveys	$533,400	$0	$533,400
First Cost		65%	35%	
Subtotal		$16,031,322	$8,632,250	$24,663,572
Planning Engineering and Design		$1,721,784.15	$927,114.54	$2,648,899
Construction Management		$1,721,784.15	$927,114.54	$2,648,899
Administrative Cost		65%	35%	
Subtotal				$5,297,797
Total		$19,474,890.07	$10,486,479.26	$29,961,369

6.1.10 Risk and Uncertainty

Risk and uncertainty are intrinsic in water resources planning and design. This section describes various categories of risk and uncertainty pertinent to the study. Risk and uncertainty would be further considered during feasibility-level design and analysis.

6.1.10.1 Residual Damages and Residual Risks

Incorporating nonstructural alternatives in addition to the TSP is a plan formulation strategy being used to further reduce residual damages in areas where the channel enlargement and detention basins are not effective at reducing flood stages. By incorporating the nonstructural plan in conjunction with the structural features, we are limiting the potential for high residual damages. Appendix L section 5.4 describes the residual risks. The residual damages for the NED plan (Plan 6B) would be concentrated in the Rocky Creek and Cow Pen Creek reaches, and moving to the LPP (Plan 7A) would reduce these damages so that there are no concentrations left within the study area where residual damages of over 16 percent exist.

6.1.10.2 Potential Induced Flooding

The NED and LPP plans are currently modeled in a 1D environment and found to cause minor inducements downstream in the Horn Lake Creek area. These inducements would be further investigated and would therefore impact the cost and benefits of the TSP going forward.

6.1.10.3 Ecosystem Restoration study and data uncertainties

Uncertainties exist in any method when developing stabilization plans in fluvial systems for a number of reasons. Below is a list of potential uncertainties based on the data available for this study.

- Fluvial systems are not static but dynamic in nature so existing conditions can change in a short period of time. For example, the PDT could decide to gather detailed channel survey data in June and within a few days after data collection, flow events may change the channel conditions and local morphology, possibly making the channel survey data obsolete.
- Existing LiDAR data used for the analysis is approximately 10 years old and may not accurately reflect existing conditions. The data was used to identity channel stability issues and locations within the watershed where those issues are occurring. The channel stability issues were qualitatively field identified on the 3 watersheds with no new channel survey data collected. However, the specific locations of these trends have likely changed since the LiDAR data was collected and will continue to change until construction of stabilization measures are complete.
- Grade control structures were located based on channel slopes (determined from LiDAR data) and the locations will need to be adjusted in the field prior to final designs.

6.1.11 Public Involvement

Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input during alternative development. NEPA provides people, organizations, and governments an opportunity to review and comment on proposed major Federal actions. Engaging and receiving input from the public, interested parties, stakeholders, government agencies, and nongovernmental organizations regarding the content of the draft IFR-EIS in all stages is critical to achieving the USACE objective of enhancing trust and understanding with customers, stakeholders, teammates, and the public through strategic engagement and communication. Public participation efforts began with the NEPA scoping process and would continue through to the conclusion of the formal comment period on the final IFR-EIS.

A public notice will be published in appropriate local paper(s) for the 45-day comment period starting with the public release of the for the draft IFR-EIS in May 2021. Preparation of this draft IFR-EIS has been coordinated with appropriate Congressional, Federal, Tribal, state, and local interests, as well as environmental groups and other interested parties.

6.2 VIEWS OF THE NON-FEDERAL SPONSOR

The NFS has been actively involved in all of the planning milestone meetings with the vertical team and critical stakeholder meetings held since the beginning of the study. The NFS supports both the FRM and ER TSP.

Section 7
Environmental Laws and Regulations

7.1 EXECUTIVE ORDER 11988 FLOODPLAIN MANAGEMENT

Executive Order 11988 directs Federal agencies to reduce flood loss risk; minimize flood impacts on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by flood plains. Agencies must consider alternatives to avoid adverse and incompatible development in the flood plain. If the only practical alternative requires action in the flood plain, agencies must design or modify their action to minimize adverse impacts. The TSP represents the least environmentally damaging alternative to accomplish the needed flood risk reduction.

7.2 CLEAN AIR ACT OF 1970

The Clean Air Act (CAA) sets goals and standards for the quality and purity of air. It requires the EPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The study area is in DeSoto County, Mississippi, which is currently in attainment for NAAQS. The transportation conformity rule (40 CFR part 93) establishes policy, criteria, and procedures for demonstration and assuring conformity of transportation activities. Based on the scope of the project, transportation conformity is not warranted.

7.3 CLEAN WATER ACT OF 1971 SECTION 401 AND 402

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 401 of the CWA requires a Water Quality Certification from the Mississippi Department of Environmental Quality (MDEQ) ensuring the proposed project does not violate established effluent limitations and water quality standards. On June 1, 2020, the EPA finalized the “Clean Water Act Section 401 Certification Rule” to implement the water quality certification process consistent with the text and structure of the CWA. The final rule was published in the *Federal Register* on July 13, 2020 and became effective on September 11, 2020. Coordination with MDEQ is on-going, and State Water Quality Certification would be requested at a later date as plans progress and detailed designs are completed.

A Section 404(b)(1) evaluation to assess the short- and long-term impacts associated with the placement of fill materials into waters of the United States resulting from the proposed project is included in Appendix E.

7.4 ENDANGERED SPECIES ACT OF 1973

The purpose of the Endangered Species Act of 1973 (ESA) is to protect and recover imperiled species of fish, wildlife, and plants and the ecosystems upon which they depend. It

is administered by the USFWS. The USFWS has primary responsibility for terrestrial and freshwater organisms.

Under the ESA, species may be listed as either endangered or threatened. A listing of *endangered* means a species is in danger of extinction throughout all or a significant portion of its range. A listing of *threatened* means a species is likely to become endangered within the foreseeable future. All species of plants and animals, except pest insects, are eligible for listing as endangered or threatened. For the purposes of the ESA, Congress defined species to include subspecies, varieties, and, for vertebrates, distinct population segments.

An official (updated) species list was requested on 2 September 2020 from the USFWS Information Planning and Consultation website, per request to do so from the USFWS Mississippi Ecological Services Field Office. In response, the threatened NLEB (*Myotis septentrionalis*) and the wood stork (*Mycteria Americana*) were listed as potentially occurring within the proposed project area.

Pursuant to Section 7 of the Endangered Species Act, as amended, the USACE has determined that implementation of the TSP may affect, but is not likely to adversely affect the NLEB, as tree clearing would be conducted outside of June and July. The project is expected to have no effect on the wood stork, as the project would not directly impact suitable wood stork foraging habitat (i.e., wetland communities and/or impoundments with shallow-open water areas that are relatively calm and have a water depth between 2 and 15 inches deep). On 22 September 2020, the USFWS concurred with USACE's determination that the proposed action may affect but is not likely to adversely affect both species. Habitat for both species is expected to improve with the implementation of the NER Plan. No plants were identified as being threatened or endangered in the project area.

7.5 FISH AND WILDLIFE COORDINATION ACT OF 1943

The Fish and Wildlife Coordination Act (FWCA) provides the basic authority for 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 consult with the USFWS (and the National Marine Fisheries Service in some instances) and state fish and wildlife agencies regarding anticipated impacts on fish and wildlife resources and measures to mitigate these impacts.

Subsection 2(b) of the FWCA requires the USFWS to produce a Coordination Act Report (CAR) that details existing fish and wildlife resources in a project area, potential impacts due to a proposed project and recommendations for a project. The CAR is anticipated to be received within 60 days of the release of this draft IFR-EIS. Recommendations offered by the USFWS, as well as USACE responses, would be included in the FEIS and implemented as practicable.

7.6 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

ER 1165-2-132 and Division Regulation 1165-2-9 established policies for conducting Hazardous, Toxic, and Radioactive Waste (HTRW) review for USACE Civil Works Projects. USACE is obligated under ER 1165-2-132 to assume responsibility for the reasonable identification and evaluation of all HTRW contamination within the vicinity of proposed actions. ER 1165-2-132 states that HTRW policy is to avoid the use of project funds for HTRW removal and remediation activities.

A Phase I Environmental Site Assessment (ESA) 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 CERCLA. Other regulated contaminants include those substances that are not included under CERCLA but pose a potential health or safety hazard. Examples include, but are not limited to, many industrial wastes, naturally occurring radioactive materials, many products and wastes associated with the oil and gas industry, herbicides, and pesticides.

A preliminary HTRW Phase 1 ESA was conducted for the draft IFR-EIS This preliminary ESA was conducted to facilitate early identification and consideration of HTRW issues.

Several potential HTRW issues were identified in this ESA; however, a full Phase I ESA would be conducted on the TSP and would be included in the final IFR-EIS. The preliminary ESA also identified the presence of several active, inactive, and plugged and abandoned oil/gas wells, several injection wells, and several oil and gas pipelines within the study area. Several industrial facilities such as chemical plants and refineries were also noted in the study area. There is a low probability of encountering HTRW from the wells, pipelines, and industrial facilities during construction of the project.

7.7 MIGRATORY BIRD TREATY ACT

The study area is known to support colonial nesting wading/water birds (e.g., herons, egrets). Based on review of existing data, site visits, and with the use of USFWS guidelines, the USACE finds that implementation of the TSP would have no effect on colonial nesting water/wading birds or shorebirds. USFWS and USACE biologists would survey the proposed project areas prior to construction because suitable habitat and the potential for nesting may exist within the proposed project areas. If active nesting exists within 1,000 feet (water birds) or 1,300 feet (shorebirds) of construction activities then USACE, in coordination with USFWS, would develop specific measures to avoid adverse impacts to those species. A detailed nesting prevention plan may be necessary in order to deter birds from nesting within the aforementioned buffer zones of the project footprint in order to avoid adverse impacts to these species. If a nesting prevention plan is necessary, it would be prepared in coordination with USFWS.

7.8 THE BALD AND GOLDEN EAGLE PROTECTION ACT

The Bald and Golden Eagle Protection Act (BGEPA) was enacted in 1940 and prohibits anyone without a permit issued by the Secretary of the Interior, from "taking" bald or golden

eagles, including their parts, nests, or eggs. The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment.

The American bald eagle was removed from the T&E Species List in August 2007 by the USFWS, but continues to be protected under the BGEPA, as amended. No known bald eagle nests occur within the proposed project locations. A USACE biologist and/or USFWS biologist would survey project areas for nesting birds prior to the start of construction. If nests are observed, further coordination would occur with the USFWS to avoid impacts during the nesting season, and construction would take place outside of USFWS buffer zones.

7.9 EXECUTIVE ORDER 12898 ENVIRONMENTAL JUSTICE

EJ is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Executive Order 12898 of 1994 directs Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of federal actions to minority and/or low-income populations. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, some other race, or a combination of two or more races. A minority population exists where the percentage of minorities in an affected area either exceeds 50 percent or is meaningfully greater than in the general population. Low-income populations as of 2017 are those whose income are $24,600 for a family of four and are identified using the Census Bureau's statistical poverty threshold. The Census Bureau defines a "poverty area" as a census tract or block group with 20 percent or more of its residents below the poverty threshold and an "extreme poverty area" as one with 40 percent or more below the poverty level.

The Environmental Consequences section (5.1) assess the study area to identify EJ communities that could be directly, indirectly, and cumulatively impacted by the federal action. Mitigation measures should be developed specifically to address potential disproportionately high and adverse effects to minority and/or low-income communities. When identifying and developing potential mitigation measures to address environmental justice concerns, members of the affected communities would be consulted. Enhanced public participation efforts would also be conducted to ensure that effective mitigation measures are identified and that the effects of any potential mitigation measures are fully analyzed and compared. Mitigation measures may include a variety of approaches for addressing potential effects and balancing the needs and concerns of the affected community with the requirements of the action or activity. If there are no high, adverse impacts or if there are high, adverse impacts that are not disproportionate, mitigation is not required.

The Regional Planning and Environmental Division South conducted an EJ analysis focusing on the potential for disproportionately high and adverse impacts from the construction and normal operation of the proposed flood risk reduction system and the ecosystem restoration plan. A disproportionately high and adverse effect means the impact is appreciably more severe or greater in magnitude on minority or low-income populations than the adverse effect suffered by the non-minority or non-low-income populations after considering offsetting benefits. The EJ assessment found that no disproportionately high and adverse effects to environmental or human resources with any of the alternatives.

7.10 NATIONAL HISTORIC PRESERVATION ACT OF 1966

The consideration of impacts to historic and cultural resources is mandated under Section 101(b)4 of NEPA as implemented by 40 CFR, Parts 1501-1508. Section 106 of the NHPA requires Federal agencies to consider their effects on historic properties (i.e., historic and cultural resources) and allow the Advisory Council on Historic Preservation (ACHP) an opportunity to comment. Historic properties are identified by qualified agency representatives in consultation with interested parties. The CEMVN has chosen to address potential impacts to historic properties through the "Section 106 consultation process" of the NHPA as implemented through 36 CFR, Part 800.

The Memphis District of USACE (CEMVM) is engaged in developing a Programmatic Agreement (PA) that would establish procedures to satisfy the MVM's Section 106 responsibilities pursuant to 36 Code of Federal Regulations (CFR) Part 800.14(b) with regard to the programmatic review of this study. The PA allows the CEMVM to coordinate Section 106 reviews with its evaluation of the proposed action's potential for significant impacts to the human and natural environment required by NEPA, as amended (42 U.S.C. § 4321 et seq.). The PA would address the potential to affect historic properties that are eligible for or listed in the National Register of Historic Places (NRHP), including archaeological sites, districts, buildings, structures, and objects that are significant in American history, architecture, archaeology, engineering, and/or sites of religious and cultural significance on or off Tribal Lands (as defined in 36 CFR § 800.16(x)) that may be affected by this undertaking. USACE would continue to develop a process-specific PA in furtherance of the CEMVM's Section 106 responsibilities for this undertaking. The PA would then govern the CEMVM's subsequent NHPA compliance efforts. Following the execution of the PA, the CEMVM may proceed with issuing a Record of Decision (ROD) in compliance with Section 106 of the NHPA and in coordination with NEPA.

7.10.1 Executive Order (EO) 13175 Consultation and Coordination with Indian Tribal Governments

It is the policy of the federal government to consult with Federally recognized Tribal Governments on a Government-to-Government basis as required in EO 13175 ("Consultation and Coordination with Indian Tribal Governments;" U.S. President 2000). The requirement to conduct coordination and consultation with Federally-recognized Tribes on and off of Tribal lands for "any activity that has the potential to significantly affect protected tribal resources, tribal rights (including treaty rights), and Indian lands" finds its basis in the constitution,

Supreme Court cases, and is clarified in later planning laws. The USACE Tribal Consultation Policy, 1 Nov 2012, specifically implemented this E.O. and later Presidential guidance. The 2012 USACE Tribal Consultation Policy and Related Documents provide definitions for key terms, such as tribal resources, tribal rights, Indian lands, consultation, as well as guidance on the specific trigger for consultation (Table 7-1).

While DeSoto County has a long history of occupation by Native American communities, prior to its establishment and throughout its history, there are currently no protected tribal resources, trial rights, or Indian lands that have the potential to be significantly affected by the proposed actions within in the study area. In partial fulfillment of Executive Order (EO) 13175, NEPA, Section 106 of the National Historic Preservation Act, and 36 CFR Part 800, consultation was initiated in July 2019 with these Federally-recognized Tribes: Alabama-Coushatta Tribe of Texas, Jena Band of Choctaw Indians, Mississippi Band of Choctaw Indians, The Chickasaw Nation, The Choctaw Nation, The Muscogee Nation, The Quapaw Nation, and the Tunica-Biloxi Indian Tribe. At this time, USACE intends to address any potential issues through the Section 106 process.

Table 7-1. 2012 USACE Consultation Policy Definitions

Category	Definition
Tribal rights:	Those rights legally accruing to a Federally recognized Tribe or tribes by virtue of inherent sovereign authority, unextinguished aboriginal title, treaties, statutes, judicial decisions, executive orders or agreement and that give rise to legally enforceable remedies.
Tribal lands:	Any lands title to which is: either held in trust by the United States for the benefit of any Federally-recognized Indian tribe or individual or held by any Federally-recognized Indian tribe or individual subject to restrictions by the United States against alienation.
Protected tribal resources	Those natural resources and properties of traditional or customary religious or cultural importance, either on or off Tribal lands, retained by, or reserved by or for, Federally recognized Tribes through treaties, statutes, judicial decisions or executive orders.

Section 8
Conclusion

Information in this document was developed for feasibility analysis, with input from agencies and comments from the public, to help refine potential solutions to flood risk in North DeSoto County and channel instability countywide. Public involvement is an important part of planning and decision-making. Agencies, non-governmental organizations, and citizens provided valuable input for the tentatively selected plan.

A Notice of Availability for this draft report would be published in the Federal Register and circulated for a 45-day public review period to Federal, state, and local agencies and organizations and individuals who have an interest in the project. All comments received during the public review period would be considered and incorporated into the final report, as appropriate.

A Notice of Availability of the final report for a 30-day state, agency, and public review period would be published in the Federal Register. All comments received during this period would be considered prior to USACE making a final decision on the TSP and in preparing the Record of Decision (ROD).

Section 9
List of Preparers

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Section 11
List of Acronyms and Abbreviations

A	
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACE	Annual Chance Exceedance
ADCIRC	Advanced Circulation
AEP	Annual Exceedance Probability
AQCR	Air Quality Control Region
B	
BCR	Benefit to Cost Ratio
BGEPA	Bald and Golden Eagle Protection Act
BMP	Best Management Practices
C	
CAR	Coordination Act Report
CDP	Census of Designated Places
CEMVN	USACE New Orleans District
CEMVM	USACE Memphis District
CEQ	Council on Environmental Quality
CNO	Choctaw Nation of Oklahoma
CWA	Clean Water Act
E	
EC	Engineer Circular
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	Environmental Justice

EM	Engineering Manual
EO	Executive Order
EPA	Environmental Protection Agency
EQ	Environmental Quality
ER	Engineer Regulation
ESA	Endangered Species Act
F	
FCSA	Feasibility Cost Sharing Agreement
FDR	Federal Discount Rate
FEMA	Federal Emergency Management Agency
FMC	Fish Management Counsel
FWCA	Fish and Wildlife Coordination Act
FWCAR	Coordination Act Report
FWOP	Future with Out Project
G	
GCS	Grade Control Structure
H	
H&H	Hydraulics and Hydrology
HTRW	Hazardous, Toxic, and Radioactive Waste
I	
IFR	Integrated Feasibility Report
L	
LERRD	Lands, Easements, Rights-of-Way, Relocations, and Disposal
LORR	Level of Risk Reduction
LWCF	Land and Water Conservation Fund

M

MBCI	Mississippi Band of Choctaw Indians
MBTA	Migratory Bird Treaty Act
MCN	Muscogee (Creek) Nation
MDEQ	Mississippi Department of Environmental Quality
MEMA	Mississippi Emergency Management Agency
MSC	Major Subordinate Command
MVLP	Mississippi Valley Loess Plain

N

NAAQS	National Ambient Air Quality Standards
NED	National Economic Development
NER	National Ecosystem Restoration
NEPA	National Environmental Policy Act
NFS	Non- Federal Sponsor
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRHP	National Register of Historic Places
NRCS	Natural Resources Conservation Service
NS	Nonstructural
NSI	National Structure Inventory

O

O&M	Operation and Maintenance
OMRR&R	Operations, Maintenance, Repair, Rehabilitation, and Replacement
OSE	Other Social Effects

P

P&G	Policy and Guidance
PA	Programmatic Agreement
PDT	Project Delivery Team

PED	Pre-construction Engineering and Design
PPA	Project Partnership Agreement
R	
RED	Regional Economic Development
ROD	Record of Decision
ROE	Right of Entry
RPEDS	Regional Planning and Environmental Division South
S	
SHPO	State Historic Preservation Officer
SNO	Seminole Nation of Oklahoma
STF	Seminole Tribe of Florida
T	
TBTL	Tunica-Biloxi Tribe of Louisiana
T&E	Threatened and Endangered
TSP	Tentatively Selected Plan
U	
USACE	United States Army Corps of Engineers
USDA	US Department of Agriculture
USFWS	US Fish and Wildlife Service
USGS	United States Geological Survey
W	
WMA	Wildlife Management Area
WVA	Wetland Value Assessment