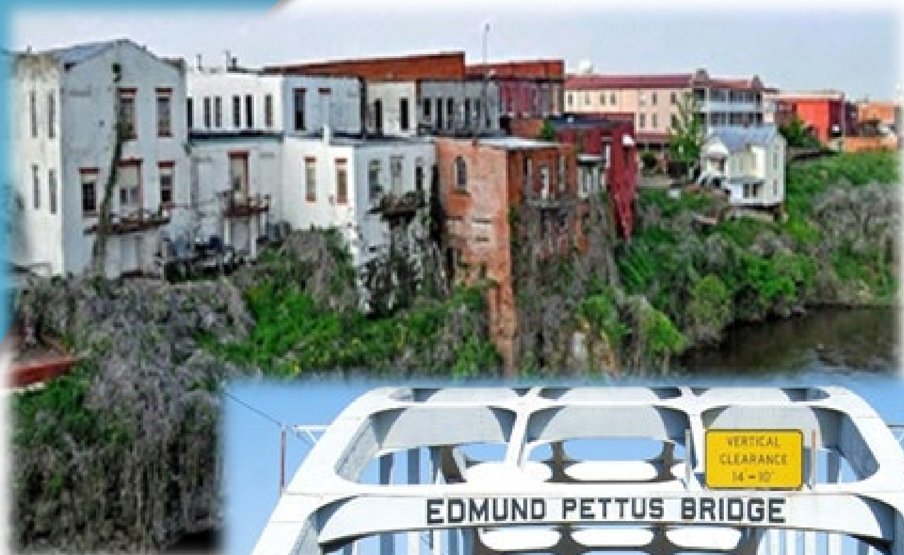
Selma, Alabama

Flood Risk Management Study

Draft Integrated Feasibility Report and Environmental Assessment



US Army Corps
of Engineers
Mobile District

September 14, 2020

FINDING OF NO SIGNIFICANT IMPACT FOR SELMA FLOOD RISK MANAGEMENT STUDY INTEGRATED FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT CITY OF SELMA, DALLAS COUNTY, ALABAMA

1. DESCRIPTION OF THE PROPOSED ACTION. The Tentatively Selected Plan (TSP) (i.e. proposed action) is Alternative 4 plus a floodplain management/emergency evacuation plan (FMEEP) to reduce the flood induced threats to cultural resources while also reducing the life-safety risk to citizens affected by flooding within the Study Area. Alternative 4 is the construction of a Soldier-Pile Wall for bank stabilization spanning approximately 750 linear feet (ft). Staging, access, and construction would occur via barge from the Alabama River. The FMEEP would identify at-risk zones and create a warning and evacuation system designed to efficiently direct citizens out of flood prone areas.

2. DESCRIPTION OF THE FINAL ARRAY OF ALTERNATIVES.

a. No Action Alternative. The future without project condition (FWOP), or No Action Alternative, is the anticipated future for a given resource if no action is taken or implemented. The FWOP for the Selma Flood Risk Management Study would not implement any structural or non-structural alternatives. Peak flows associated with flooding within the Study Area would increase approximately two percent for FWOP conditions. This increase in peak flows is driven by forecasted land use changes in Alabama River basins upstream of the Study Area.

b. Alternative 1.A: Buyouts. This alternative involves the acquisition and demolition of 25 parcels. Relocation assistance would be offered for residents in accordance with Public Law 91-646; however, Decent, Safe, and Sanitary housing conditions with which to base assistance are limited within the Study Area.

c. Alternative 3: Optimized Levee. This alternative involves the construction of an optimized levee within Ward 8 with connection to and revetment of United States (U.S.) Highway 80. This alternative would fragment the Ward 8 population and have adverse environmental impacts. The optimized levee alignment would also induce flooding beyond the scope of the study limits.

d. Alternative 4: Soldier-Pile Wall. Alternative 4 is the construction of a Soldier-Pile Wall design spanning approximately 750 linear ft at the base of the Edmund Pettus Bridge complete with riprap end caps. Real estate acquisition would be required prior to implementation. This alternative is likely to adversely affect the Federally listed Tulotoma Snail (*Tulotoma magnifica*) and would adversely affect cultural resources within the footprint of the proposed alternative. Federal coordination to minimize impacts is ongoing.

e. Alternative 5: Soldier-Pile Wall and Buyouts. Alternative 5 is a combination of Alternatives 1.A and 4.

f. Alternative 6: Levee, Soldier-Pile Wall, and Buyouts. Alternative 6 is a combination of Alternatives 3 and 5; however, the proposed buyout footprint is modified to capture parcels not within the levee alignment.

3. FINDINGS OF NO SIGNIFICANT IMPACT. Based on the Integrated Feasibility Report and Environmental Assessment prepared for this project, it was determined that this flood risk management action does not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, the action does not require the preparation of a detailed statement under Section 102(2)(C) of the National Environmental Policy Act of 1969 (42 U.S. Code 4321 et seq.). The U.S. Army Corps of Engineers (USACE), Mobile District's determination was made considering the following factors, which are further discussed in the Integrated Feasibility Report and Environmental Assessment attached to this document:

a. The proposed action "may affect and is likely to adversely affect" the Federally listed Tulotoma Snail. Additionally the proposed action may affect and is likely to adversely affect critical habitats for Alabama Sturgeon (*Scaphirhynchus suttkusi*), Orangenacre Mucket (*Lampsilis perovalis*), and Southern Clubshell (*Pleurobema decisum*), occurring in the project area.

b. No significant cumulative or secondary impacts would result from implementation of this action.

c. The USACE, Mobile District proposes to fulfill the requirements of Section 106 of the National Historic Preservation Act by conducting cultural data recovery coupled with an Unexploded Ordnance Survey to identify and document any material removed from the footprint. The resulting cultural resources reports will be coordinated with the Advisory Council of Historic Properties, Alabama State Historic Preservation Officer, National Park Service and any interested Federally Recognized Indian Tribes. A Memorandum of Agreement is being developed to mitigate adverse effects to historic properties.

d. The proposed action would result in no significant impacts to air or water quality. Coordination with the Alabama Department of Environmental Management to obtain is ongoing to obtain Water Quality Certification.

e. The proposed action would result in no significant adverse impact to fish and wildlife resources.

f. The proposed action would not cause any environmental health risks or safety risks that may disproportionately affect children and complies with Executive Order (EO) 13045, "Protection of Children from Environmental Health Risks and Safety Risks."

g. The proposed action would not cause any disproportionately high and adverse human health or environmental effects to minority populations and low-income populations and complies with EO 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations."

4. CONCLUSIONS. The environmental analysis supports the conclusion that the TSP will not significantly impact health and the human environment; consequently, an Environmental Impact Statement is not required. The requirements of the National Environmental Policy Act and the Council on Environmental Quality regulation have been satisfied.

DATE:______________________________ ______________________________

Sebastien P. Joly
Colonel, U.S. Army
District Commander

City of Selma Flood Risk Management Integrated Feasibility Report and Environmental Assessment

Table of Contents

List of Figures

List of Tables

Appendices

List of Acronyms

ACT.........Alabama Coosa Tallapoosa River Basin
ADEM......Alabama Department of Environmental Management
ADOT......Alabama Department of Tourism
AEP........Annual Exceedance Probability
AFB.........Air Force Base
ALDCNR..Alabama Department of Conservation and Natural Resources
ALDOT....Alabama Department of Transportation
AMM.......Alternative Milestone Meeting
AMM-IPR.Alternative Milestone Meeting-In Progress Review
ASA(CW).Assistant Secretary of the Army for Civil Works
BCR........Benefit-to-Cost Ratio
BGEPA....Bald and Golden Eagle Protection Act
BMPs......Best Management Practices
BO..........Biological Opinion
CAA........Clean Air Act
CAP........Continuing Authorities Program
CFR.........Code of Federal Regulations
CWA........Clean Water Act
DSS........Decent, Safe, and Sanitary
eDNA.......Environmental DNA
EOP........Environmental Operating Principles
EQ..........Environmental Quality
ER...........Engineering Regulation
ESA........Endangered Species Act
FCA.........Financial Capability Agreement
FCSA......Feasibility Cost Share Agreement
FEMA......Federal Emergency Management Agency
FHWA......Federal Highway Administration
FMEEP....Floodplain Management/Emergency Evacuation Plan
FR/EA.....Feasibility Report and Environmental Assessment
FRM.......Flood Risk Management
FWOP.....Future Without-Project Condition
FY...........Fiscal Year
H&H........Hydrology and Hydraulics
HEC........Hydrologic Engineering Center
HTRW......Hazardous, Toxic, and Radiological Waste
HQ..........Headquarters
ICLUS.....Integrated Climate and Land-Use Scenarios
IDC..........Interest During Construction
IPR..........In Progress Review
LERRDs..Lands, Easements, Rights-of-way, and Relocations, and Disposal sites
MBTA......Migratory Bird Treaty Act
MFR........Memorandum for Record
MOA.......Memorandum of Agreement
NAA........No Action Alternative
NAAQS...National Ambient Air Quality Standards
NAVD88.. North American Vertical Datum of 1988
NED........National Economic Development
NEPA......National Environmental Policy Act
NFIP.......National Flood Insurance Program
NFS........Non-Federal Sponsor
NHPA......National Historic Preservation Act
NPDES....National Pollutant Discharge Elimination System
NPS........National Park Service
NRCS......Natural Resources Conservation Service
O&M.......Operation and Maintenance
OMRR&R.Operations, maintenance, repair, rehabilitation and replacement
OSE........Other Social Effects
OSHA......Occupational Safety and Health Administration
P&G........Principles and Guidelines
P.L..........Public Law
PCE(s)....Primary Constituent Element(s)
PDT........Project Delivery Team
PED........Preconstruction Engineering and Design
POA........Period of Analysis
PPA........Project Partnership Agreement
REC........Recognized Environmental Conditions
RED........Regional Economic Development
RECONS.Regional Economic Systems Model
ROM.......Rough Order of Magnitude
RM..........River Mile
RPM(s)....Reasonable and Prudent Measure(s)
SAD........South Atlantic Division
SHU........Strategic Habitat Unit
SRRU......Strategic River Reach Unit
T&E........Threatened and Endangered Species
TMDL(s)..Total Maximum Daily Load(s)
TSP........Tentatively Selected Plan
U.S.........United States
USACE....U.S. Army Corps of Engineers
USDA......U.S. Department of Agriculture
USEPA....U.S. Environmental Protection Agency
USFWS...U.S. Fish and Wildlife Service
USGS......U.S. Geological Survey
UXO(s)....Unexploded Ordnance(s)
WQC.......Water Quality Certification
WRDA.....Water Resources Development Act
WRRDA...Water Resources Reform and Development Act

Units of Measurement

Cubic feet Per Second....cfs
Cubic yards....................cy
Degrees........................... °
Fahrenheit...................... F
Feet................................ft
Inch................................ “
Miles ....mi
Percent.......................... %
River Mile .... RM
Square feet..................sq ft

1.0 INTRODUCTION*

This Draft Integrated Feasibility Report and Environmental Assessment (FR/EA) presents the results of the City of Selma Feasibility Study. The Draft Integrated FR/EA integrates plan formulation with documentation of environmental effects, potential alternatives for flood risk reduction, and outlines the process used for identifying the Tentatively Selected Plan (TSP) It also documents compliance with the National Environmental Policy Act (NEPA) of 1969, and includes input from the non-federal study sponsor and the public. Sections required for NEPA compliance are denoted with an asterisk(*) in the heading.

1.1. Study Authority*

This feasibility study is authorized by House Resolution No. 66, June 7, 1961:

> *"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report on Alabama-Coosa Branch of Mobile River, Georgia and Alabama, published as House Document No. 66, Seventy-fourth Congress, first, session, with a view to determining the advisability of providing improvements for flood control on Alabama River in Dallas County, Alabama."*

The Bipartisan Budget Act of 2018 (Public Law (P.L.) 115-123), Division B, Subdivision 1, Title IV, appropriates funding for the study at full Federal expense. As identified under this "Supplemental Appropriation" bill, the study is subject to additional reporting requirements and is expected to be completed within three years and for $3 million dollars.

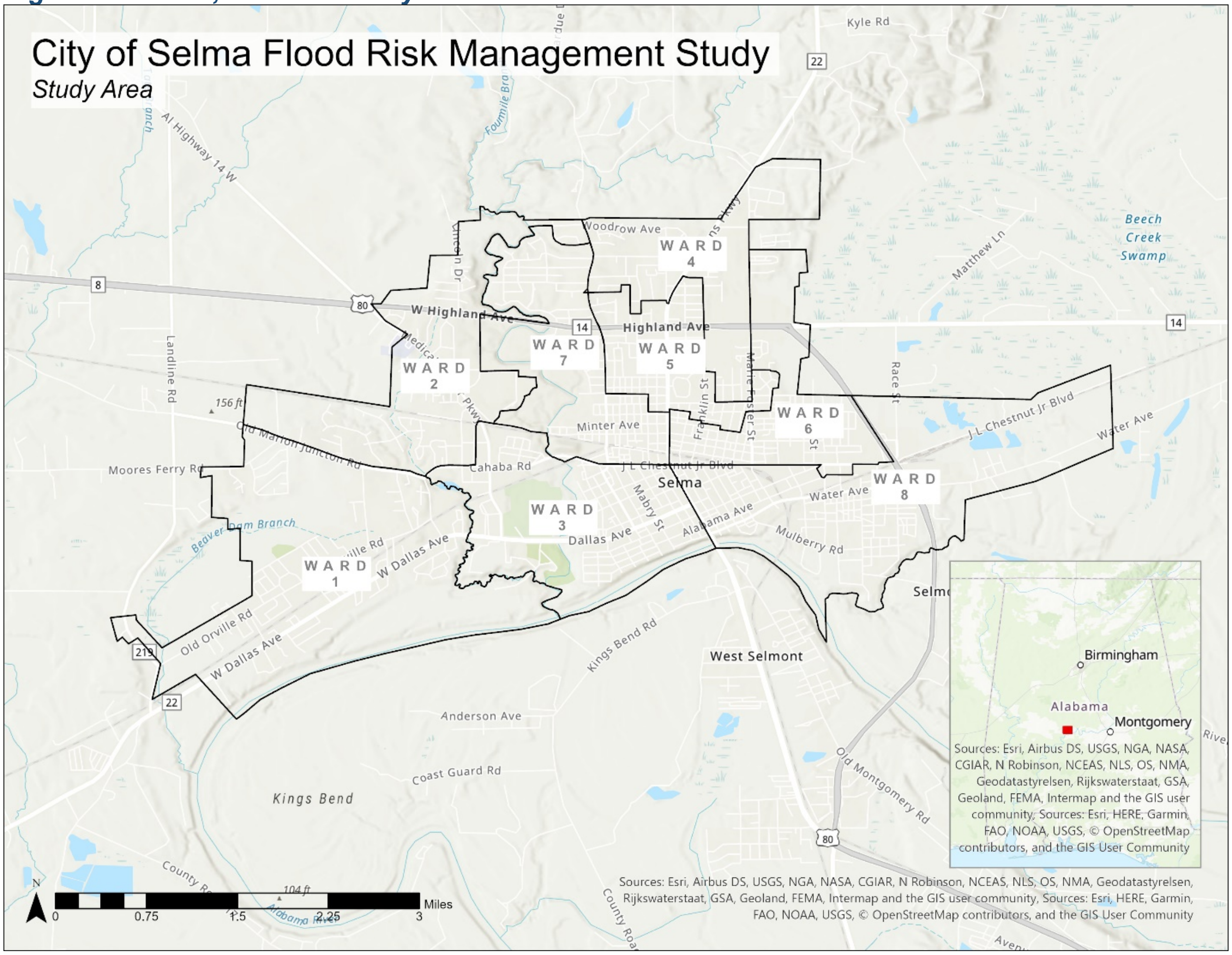
In accordance with the memorandum for the Commander dated July 16, 2020 from Headquarters (HQ) United States Army Corps of Engineers (USACE) to the South Atlantic Division (SAD), the investigation of streambank (bankline) erosion measures is being performed in accordance with Section 1203 of Water Resources Development Act of 2018:

> *"(a) Feasibility Reports.--The Secretary shall expedite the completion of a feasibility study for each of the following projects, and if the Secretary determines that the project is justified in a completed report, may proceed directly to preconstruction planning, engineering, and design of the project: (1) Project for riverbank stabilization, Selma, Alabama."*

1.2. Location and Study Area*

The Study Area is located along the Alabama River in the City of Selma, Alabama. Selma is home to the largest historic district in Alabama. It is located approximately 50 miles (mi) west of Montgomery, Alabama. The city itself is divided into wards with each having a representative in the city government. The wards receiving frequent flooding are identified and are the focused project area for this study. They include Wards 1, 3, 6 and 8. Alabama River Mile(s) (RM) 256 through 261 have been assessed for this study.

Figure 1: Selma, Alabama Study Area



1.2.1. *Congressional District*

United States (U.S.) Senators of Alabama Mr. Richard Shelby and Mr. Doug Jones and U.S. Representative Ms. Terri Sewell (District 7) serve the project area.

1.3. Non-Federal Sponsor

The City of Selma is the Non-Federal Sponsor (NFS) for the Selma, Alabama Flood Risk Management (FRM) Study. The Feasibility Cost Share Agreement (FCSA) was signed on October 9, 2018 which marked the beginning of the Feasibility Study process.

1.4. Federal Interest

The USACE FRM Program works across the agency to focus its policies, programs and expertise toward reducing overall flood risk. This includes the appropriate use and resiliency of structural measures (e.g. levees and floodwalls), as well as the use of non-structural measures (e.g., land acquisition, flood proofing, etc.) to develop alternatives which reduce the risk of loss of life, reduce long-term economic damages to the public and private sector, and improve the natural environment.

The flooding, and subsequent structural integrity issues in Selma have been well documented over the decades, evidenced by the 1967 USACE, Mobile District FRM

Study; the USACE, Mobile District Selma, Alabama Continuing Authorities Program (CAP) Section 14 Study; and the 2016 Federal Emergency Management Agency (FEMA) armament of a historic masonry stormwater outfall. The 1967 study highlights the overbank flooding towards the east of the City, particularly in Ward 8. The FEMA armoring and the current Section 14 study both highlight the continued flooding-induced erosion that significantly threatens the structural integrity of the historic Selma riverfront.

Addressing bank stabilization as part of FRM helps to preserve many shoreline characteristics that include unique ecosystems, historic structures, and critical infrastructure along navigable waterways. The City of Selma lies on the Alabama River, a Federal navigation project operated by the USACE, which includes three locks and dams (Claiborne Lock and Dam, Millers Ferry Lock and Dam, and Robert F. Henry Lock and Dam), and associated reservoirs. Finally, this study is significant to the values and principles upon which the Nation was created and to the citizens of the State of Alabama, as the City of Selma is nationally historically significant based on the 1965 Selma to Montgomery marches. The heritage tourism spurred from these events attracts hundreds of thousands of visits annually from around the world, contributing significantly to the economy of the City and surrounding region. Based on these factors, there is clear local, State, and Federal interest in preserving and maintaining the cultural, historic, and structural integrity of Selma, Alabama.

1.5. Study Purpose, Need, and Scope

1.5.1. *Study Purpose and Need**

The purpose of this feasibility study is to identify and evaluate alternative plans that would address damages caused by flooding in the City of Selma. This study will assess solutions that are structurally sustainable, economically justified, and environmentally acceptable. There is a need for this feasibility study as the City of Selma has experienced historic flooding since its incorporation and many of the historic riverfront structures are at risk of condemnation and demolition due to flood-induced erosion and subsurface instability. There is a further social and regional economic need to maintain the historic, cultural, and community integrity of Selma as it played a pivotal role in the Civil Rights Movement, leading to landmark legislation that changed the nation. Without action, the historic context, viewshed of the Edmund Pettus Bridge, a National Historic Landmark, and crucial heritage tourism within the city could be significantly lessened or completely lost.

1.5.2. *Study Scope*

The scope of the study focused on achieving National Economic Development (NED) benefits in addition to conducting a robust analysis on Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE). The study scope consisted of identifying FRM solutions for flooding events and damages within the City of Selma (located along the Alabama River in Dallas County, Alabama) and by evaluating types of improvements as outlined in Engineering Regulation (ER) 1105-2-100, Sec 3, E-17 dated April 22, 2000. The analysis focused on the following:

- Flood Risks and Flood Damage Assessment;

- Life and Safety Risk qualitative assessment;
- Hydrology and Hydraulics (H&H) modeling;
- Geotechnical assessment;
- National Economic Benefits;
- Regional Economic Benefits;
- Environmental Impacts Analysis; and
- Social Effects (including benefits of cultural and historical significance) evaluation.

1.6. Prior Reports and Current Projects

Table 1 lists previous investigations and reports as well as the most recent studies which are pertinent to, or supply supplemental information regarding, flooding and erosion problems in Selma, Alabama.

Table 1: Prior Studies and Reports

STUDY	DESCRIPTION
1967 FRM for Alabama – Coosa River System Study	The FRM feasibility study was completed in 1967. The report recommended levees be constructed along the Alabama River; however, the project was never implemented.
Selma, Alabama CAP Section 14 Study	A Section 14 Study recommended construction of approximately 150 ft of articulated concrete mat on the riverbank of the Historic Riverfront Park. Project Design is ongoing.
FEMA Armoring Work	FEMA completed armoring work at a historic masonry stormwater outfall adjacent to the Historic Riverfront Park. The project protected the outfall pipe and the surrounding area from erosion.

1.7. Planning Process

This report presents a collaboratively-developed plan prepared in accordance with established policies, principles and guidance: (1) 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Implementation Studies (P&G); (2) ER 1105-2-100 (2000) also known as Planning Guidance Notebook; and (3) Engineer Pamphlet 1105-2-58. This study was conducted under the USACE Planning Process which involves a six-step iterative and structured approach to problem solving: (1) Specify Problems and Opportunities, (2) Inventory and Forecast Conditions, (3) Formulate Alternative Plans, (4) Evaluate Effects of Alternative Plans, (5) Compare Alternative Plans, and (6) Select Recommended Plan. Step 1 is discussed in **Section 2.0**, Step 2 in **Section 3.0**, Steps 3, 5, and 6 in **Section 4.0**, and Step 4 in **Section 5.0**.

This study identified measures presented at the Alternative Milestone Meeting (AMM) on January 16, 2019. Evaluations and comparisons of the focused alternatives were presented at the post Alternative Milestone Meeting – In Progress Review (AMM-IPR) on June 26, 2019. The successful TSP Milestone Meeting was held on July 22, 2020.

2.0 PROBLEMS, OPPORTUNITIES, OBJECTIVES, AND CONSTRAINTS

The City of Selma and surrounding areas have experienced 31 moderate to major floods since 1886. Sixteen (16) of the floods are considered 0.04 Annual Exceedance Probability (AEP) (25-year) or greater flood events with crests greater than 52 feet (ft). This results in flood impacts to structures in a region that is one of the most economically deprived in the country. Overbank flooding is localized to Ward 8 of the City of Selma, with the most inundation seen closest to the bank of the Alabama River. Furthermore, the flood-induced erosion and subsequent sheer bank failures are threatening one of the last remaining historic riverfronts in the U.S. The Nationally Registered structures along this riverfront are intimately tied to the Edmund Pettus Bridge, a National Historic Landmark. Currently, eleven (11) nationally registered historic buildings risk collapse into the river under the Future Without Project (FWOP) conditions. Threats from riverine flooding and frequent high flow velocities threaten the preservation of cultural and historic values intrinsic to the City of Selma.

2.1. Study Problems and Opportunities

The problems in the Study Area stem from flooding of the Alabama River. These floods and high-water events have historically and continuously caused problems for the City of Selma and surrounding area. The problems identified include:

- Infrastructure and structural damages due to flooding in Wards 1, 3, 6, and 8;
- Riverbank erosion from drawdown of floodwaters along Alabama River from RM 256-261;
- Structural foundation impacts to historic buildings along the Alabama River due to subsurface inundation during riverine flood process;
- Impacts to community cohesiveness due to flood damages to property; and
- Lack of access to the Alabama River.

The opportunities are to:

- Stabilize riverbank to reduce erosion along the Alabama River;
- Reduce flood related damages to properties;
- Improve recreational opportunities and increase access to the Alabama River; and
- Reduce threats to historic buildings and cultural resources.

2.2. Objectives and Constraints

The National Federal objective is to contribute to NED consistent with protecting the Nation's environment, which may be considered more of a National goal. ER 1105-2-100 states:

> *"Protection of the Nation's environment is achieved when damage to the environment is eliminated or avoided and important cultural and natural aspects of our nation's heritage are preserved." (USACE, 2000, 2-1)*

The study objectives describe what the alternative plans should achieve. The following objectives were developed to apply to this area over the next 50 years:

- Reduce average annual flood damages to residential and commercial property;

- Increase community resiliency and maintain community cohesion by reducing risk to vulnerable populations (human health and safety);
- Improve Alabama River bank stability between RM 256-261, due to erosion and rapid drawdown of floodwaters; and
- Stabilize and preserve the historic integrity of structures surrounding the iconic viewshed of the Edmund Pettus Bridge.

The study specific constraints for a 50-year Period of Analysis (POA) from approximately 2025 through 2074 are:

- Avoid impacts to existing threatened and endangered species (T&E) and their critical habitats (such as Tulotoma Snail (*Tulotoma magnifica*), Heavy Pigtoe (*Pleurobema taitianum*) Alabama Sturgeon (*Scaphirhynchus suttkusi*), Orangenacre Mucket (*Lampsilis perovalis*), and Southern Clubshell (*Pleurobema decisum*));
- Avoid impacts to existing Federal projects/studies (CAP Section 14 project);
- Minimize impacts to cultural resources (such as Edmund Pettus Bridge, Historic Districts and Civil War sites);
- impacting existing Federally constructed and/or funded projects; and
- Minimize impacts to available Decent, Safe, and Sanitary (DSS) housing for tenants (socially vulnerable populations).

Legal constraints include those associated with expanding the Study Area beyond the scope of the approved authority.

3.0 ENVIRONMENTAL SETTING WITHOUT THE PROJECT AND FUTURE WITHOUT PROJECT CONDITIONS (FWOP)*

The environmental setting without the project describes the resources in the Study Area that could potentially be affected. The existing condition was established based on a desktop review, as well as site visits made by the USACE, Mobile District, and is a baseline from which the FWOP conditions were assumed and/or developed. The FWOP conditions apply assumptions from current trends to the baseline to determine a most likely future over a 50-year period. Details on both the environmental setting and FWOP conditions are detailed in the following sections.

3.1. Physical Environment*

3.1.1. *Water Resources**

3.1.1.1. *Hydrology**

The Study Area encompasses the Alabama River in Selma, Alabama. The Alabama River begins north of Montgomery, Alabama where the Coosa and Tallapoosa Rivers join. The Alabama River flows generally westward from Montgomery to Selma, and then follows a more southwesterly path to join the Tombigbee River and form the Mobile River. The river then flows south into the Mobile Bay and then into the Gulf of Mexico. This network of rivers is termed the Alabama Coosa Tallapoosa (ACT) River Basin.

Flooding along the Alabama River is generally driven by high output rainfall events in the headwater portions of the ACT River Basin. An accumulation of significant rainfall causes a slow and steady rise of river stage elevations. Typical flooding events have an advanced notice of roughly two to three days and continual flooding generally lasts for a few days. As shown in **Figure 2**, much of the flooding extent within the Study Area is concentrated within Ward 8 for a 0.002 AEP, or 500-year, flood event. Within that extent, depth of flooding varies due to topography. **Figure 3** shows the flood depths within Ward 8 during a 0.01 AEP, or 100-year, flood event.

Figure 2: Floodplain inundation during the 0.002 AEP, or 500-year, flood event

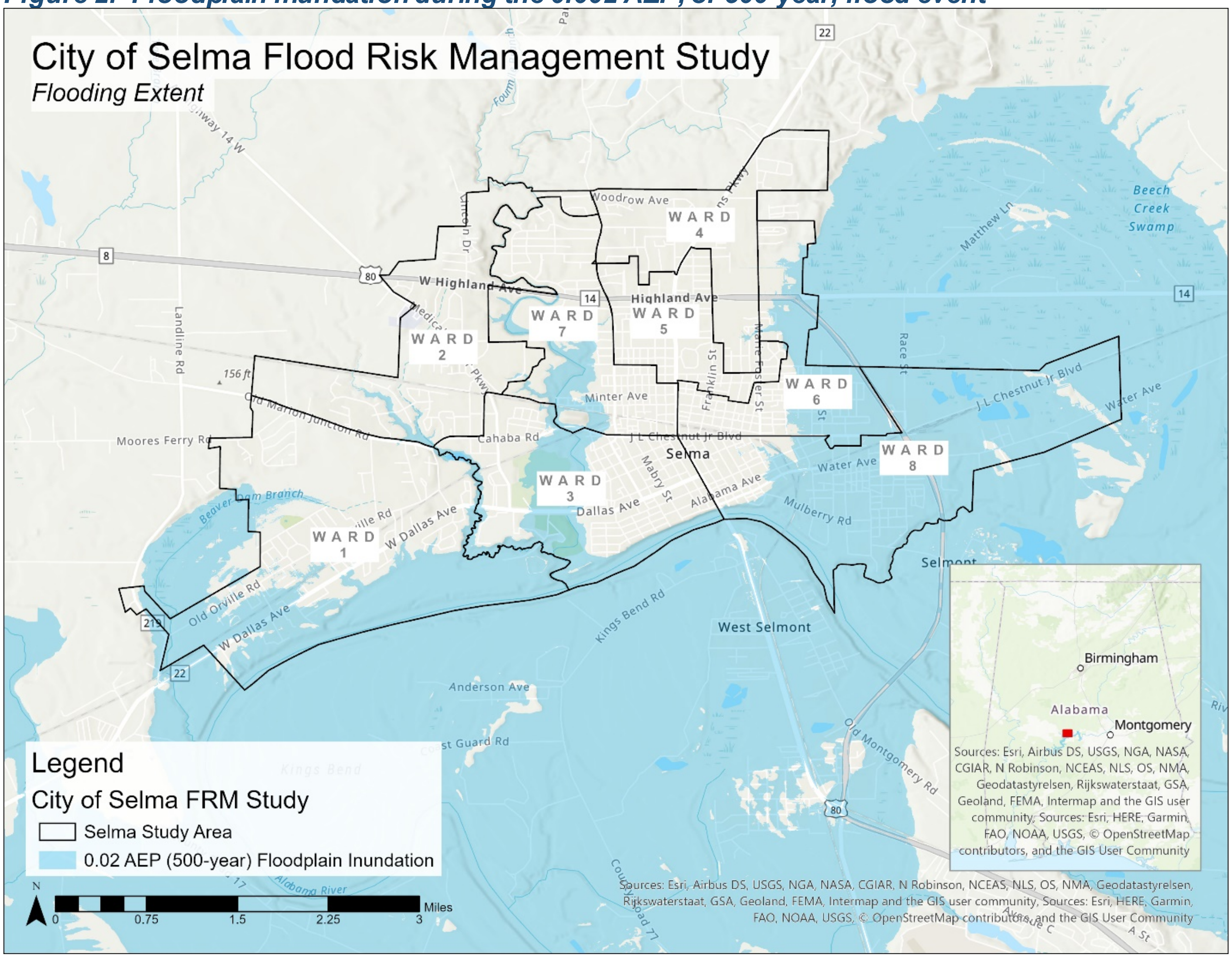


Figure 3: Flood depths of the 0.01 AEP, or 100-year, flood event within Ward 8

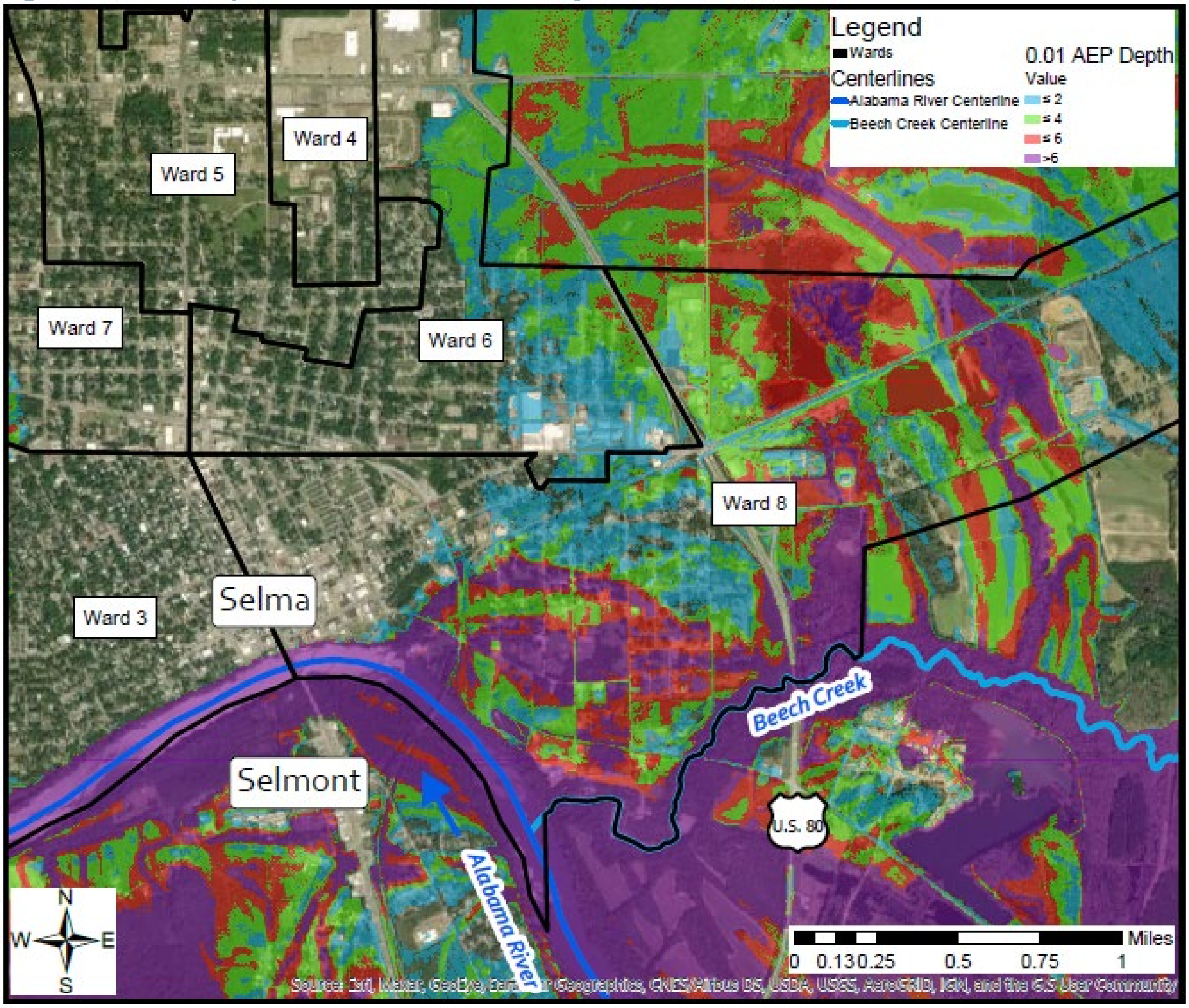


Figure 4 demonstrates the relationship of stages and flows at the U.S. Geological Survey (USGS) gage located on the Alabama River near Selma, Alabama. This relationship was developed based on peak flows measured by the USGS from 1886 through 1990 when flow measurements were stopped. Care should be given when using this data as downstream operation of Miller's Ferry Lock and Dam can affect the stage/flow relationship at this gage. Though the Study Area includes all Wards within the City of Selma, floodplain inundation shows that the Study Area receives flood waters predominantly in Ward 8.

Figure 4: Stage vs Flow Chart – Alabama River

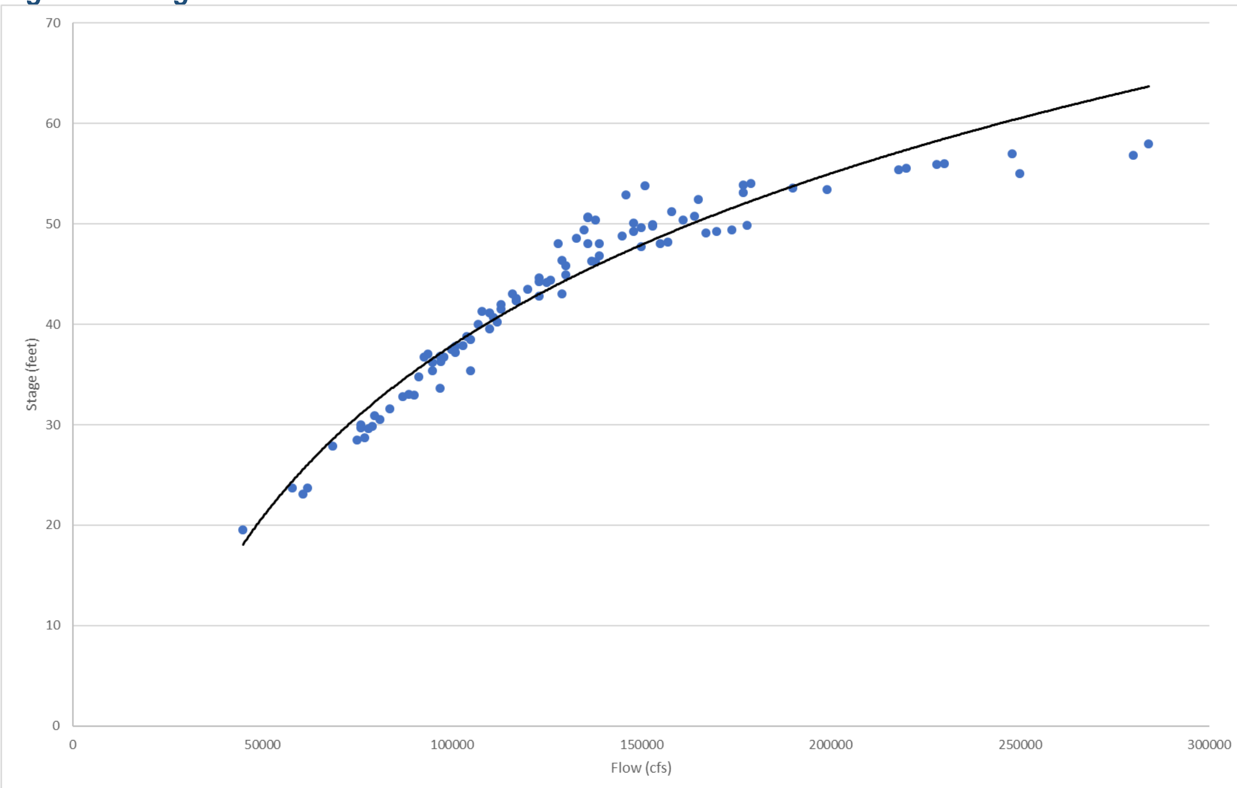


Figure 5: Alabama River Crest Stages

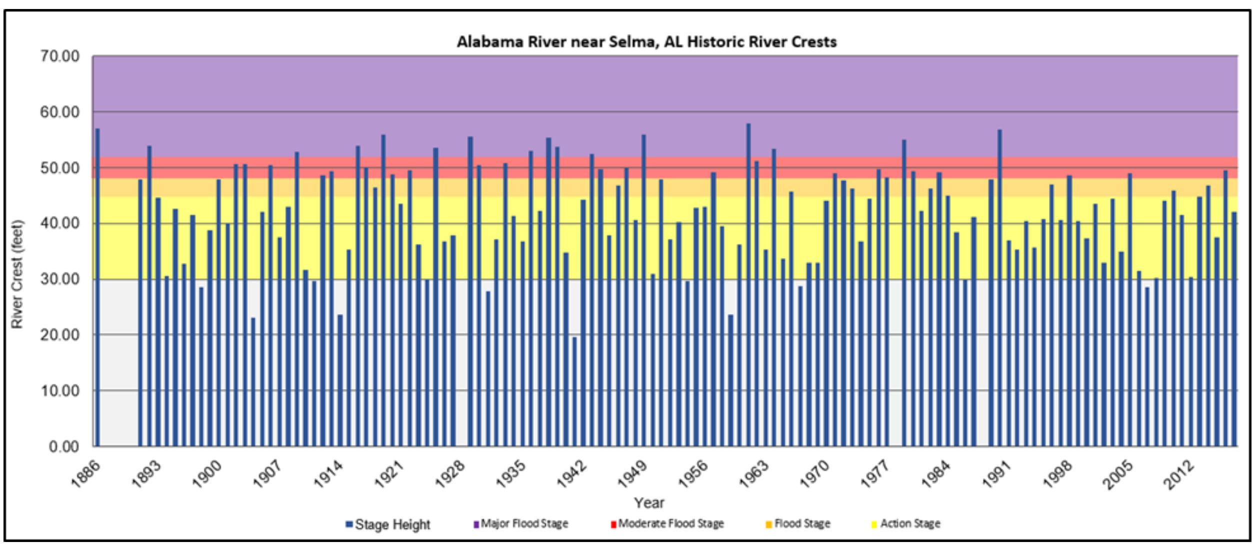


Figure 5 demonstrates the frequency of flood events declined after lock and dam structures were constructed in the 1970s; however, climatological changes such as a decrease in the number of significant precipitation events as well as increasing temperatures in the region are likely the main contributors to this decline in peak stages resulting from flood events. While direct flooding of properties along the riverbank declined, damage to the riverbank shoreline and overburden soils were never addressed

after lock and dam construction. The damaged overburden soils and unrestrained shoreline continued to actively erode along the bankline and may contribute to potential failure and further damages to historic structures.

3.1.1.1.1. *Future Without Project Conditions**

The FWOP condition hydrology is driven primarily by changes in land use along the headwaters above Selma, rather than land use within and immediately surrounding the Study Area. It can be reasonably assumed that in the future, population growth in the headwater portions will lead to an increase in peak flood flows from the Alabama River in the area of Selma as impervious areas surrounding the headwater rivers increase. To estimate the increase in peak flow, the Hydrologic Engineering Center (HEC) Hydrologic Modeling System for the ACT River Basin was used. This is a rainfall-runoff model that estimates flow into and along the mainstem rivers of the ACT River Basin, including the Alabama River near Selma. This model is typically used for forecasting flows in the basin and is considered calibrated to existing conditions. Adjustments were made to the estimated impervious areas in the model to account for the changes in land use due to population growth.

In order to estimate these future land use conditions of the basin, the U.S. Environmental Protection Agency (USEPA) Integrated Climate and Land-Use Scenarios (ICLUS) percent impervious surface projections dataset (Ver 1.3.2) was used. This dataset utilizes population projections through the end of the century, reflecting different assumptions about fertility, mortality, and immigration to determine the demand for new homes, and estimates the amount of impervious surface that can be expected. Average future impervious percentages for each sub-basin were calculated for the basins above Selma using this ICLUS dataset, and areas of anticipated increased development were verified using aerial imagery to assess if these areas could in fact become more developed.

Then a series of rainfall events, ranging from the 0.5 AEP (2-year) to the 0.002 (500-year) AEP were run through the hydrology model for both the existing land use and the future land use scenarios. Comparison of each of these runs showed that peak flows increased about 2 percent (%) for entire range of rainfall events; therefore, a uniform 2% increase in flow (measured in cubic feet per second (cfs)) for all AEP events was used for the FWOP hydrology. These flows and associated peak elevations (using the North American Vertical Datum of 1988 (NAVD88) and stages at the Selma, Alabama USGS gage are shown in **Table 2**.

Table 2: Annual Exceedance Probability Events for FWOP Conditions (Selma, Alabama USGS Gage #02423000)

AEP	Flow (cfs)	Elevation (ft - NAVD88)	Stage (ft)
0.5 (2-year)	124,000	105.21	43.41
0.2 (5-year)	166,000	110.83	49.03
0.1 (10-year)	193,000	113.63	51.83
0.04 (25-year)	226,000	115.91	54.11
0.02 (50-year)	251,000	118.01	56.21
0.01 (100-year)	276,000	119.33	57.53

0.005 (200-year)	300,000	120.89	59.09
0.002 (500-year)	332,000	122.85	61.05

As **Table 2** shows, the river reaches 104.83 ft NAVD88 under FWOP conditions at an AEP of just under 0.5 AEP, or 2-year, flood event. This is approximately the same elevation that the overburden soil layer is present in the Study Area.

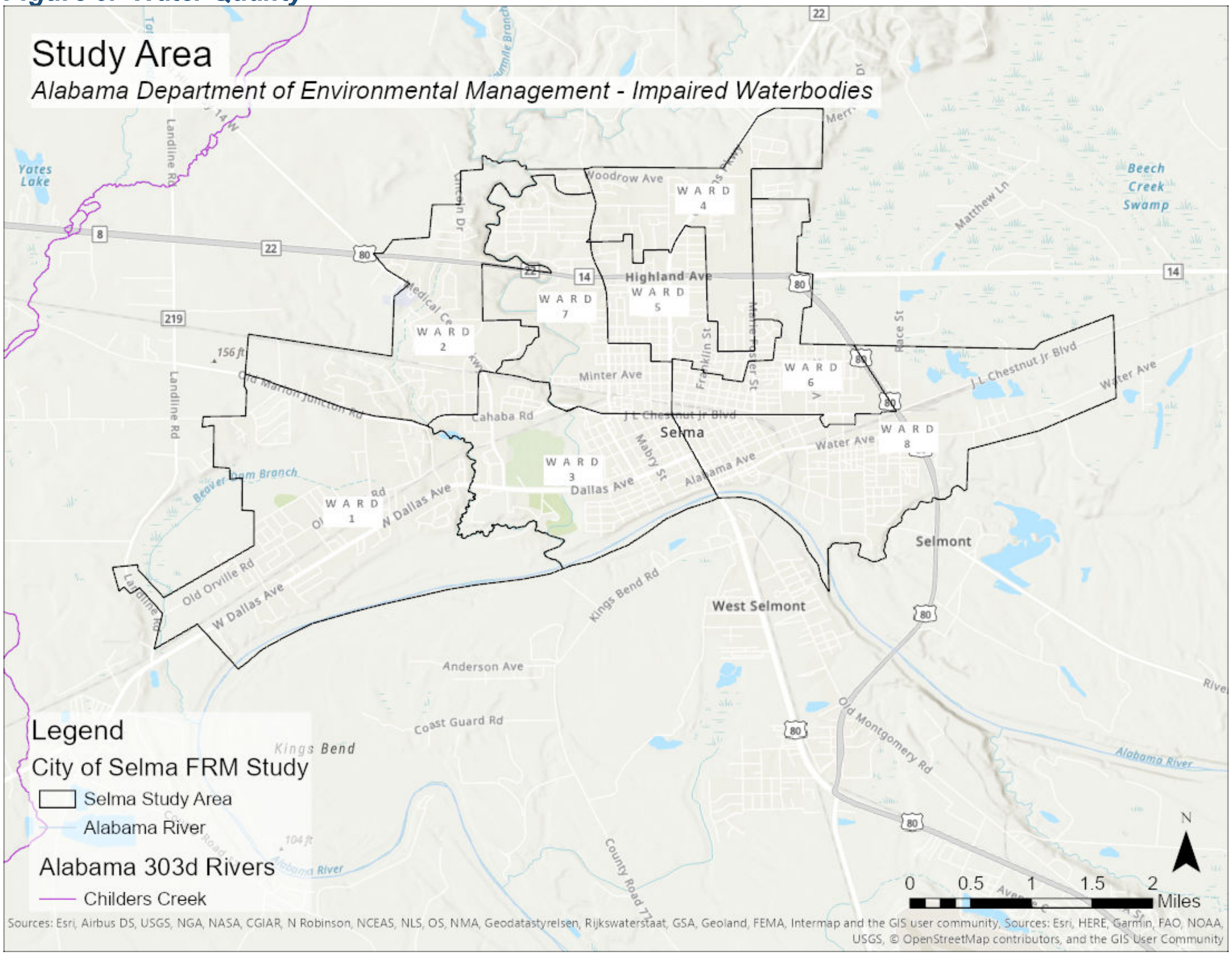
3.1.1.2. *Water Quality**

Section 401 of the Clean Water Act (CWA) requires that the State issue water quality certification for any activity which requires a Federal permit and may result in a discharge to State waters. This certification must state that applicable effluent limits and water quality standards will not be violated. The USEPA delegates authority pursuant to the CWA to the states for monitoring and maintaining clean water standards.

Section 303(d) of the CWA authorizes USEPA to assist states, territories and authorized tribes in listing impaired waters and developing Total Maximum Daily Loads (TMDLs) for these water bodies. A TMDL establishes the maximum amount of a pollutant allowed in a water body and serves as the starting point or planning tool for restoring water quality. States are required to submit their list for USEPA approval every two years. For each water body on the list, the state identifies the pollutant causing the impairment, when known. In addition, the state assigns a priority for development of TMDL based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40 Code of Federal Regulations (CFR) §130.7(b)(4)). There are no 303(d) listed bodies of water within the Study Area. The nearest impaired waterbody is Childers Creek which is a downstream tributary of the Alabama River.

Additionally, Section 402 of the CWA addresses stormwater pollution by requiring a National Pollutant Discharge Elimination System (NPDES) permit for activities that discharge into Waters of the U.S. through point (i.e. a pipe, ditch, or channel) and nonpoint source (i.e. runoff) pollution. All construction sites greater than one acre are required to obtain a NPDES permit.

Figure 6: Water Quality



3.1.1.2.1. *Future Without Project Conditions**

Impaired water quality is predominantly related to urbanized settings. No significant urbanization growth is anticipated within the surrounding area due to a depressed economy; therefore, FWOP conditions would not be significantly changed from the existing setting.

3.1.2. *Geology and Soils**

As discussed in **Section 1.1**, the feasibility study was directed to evaluate bank stabilization issues within the Study Area; therefore, this section analyzes the contributing factors to bank erosion in addition to the general environmental setting typically discussed.

The Selma area is situated near the center of the Black Prairie subdivision of the Gulf Coastal Plain physiographic province. The Black Prairie subdivision is a belt of low relief which crosses the state in and east-west direction. In the Selma area, it is about 20 mi wide and consists of flat to gently undulating prairie land. The major drainage of the area is by the entrenched and meandering Alabama River which crosses the prairie belt in a southwesterly direction. The Black Prairies correspond in length and width to the weathered outcrop of the Selma Group of late Cretaceous age which is a chalky to argillaceous limestone formation with a maximum known thickness of about 900 ft. The general dip of the strata in the Selma area is about 30 ft per mile to the south.

The geology in and around the City of Selma consists of alluvial deposits, underlain by various formations within the Selma Group, the most prevalent of these being the Mooreville Chalk. Alluvium deposits consist of a mixture of varicolored, fine to coarse sand with clay lenses and gravel. The Mooreville Chalk is generally characterized as a yellowish-gray to olive-gray clayey chalk or chalky marl. A visual survey of the banks indicate that the banks are steep (1V:1.5H and steeper), and they are comprised of sands, silts, and clays that sit atop a layer of chalk. Historical borings from past geotechnical explorations confirm this assessment, noting that the chalk layer is dense and strong. Banks in the downtown area range in height between 30 to 50 ft above the water's surface (average water surface elevation at the Edmond Pettis Bridge is 84.30 ft). The interface of the overburden and the chalk is easily spotted from the river, and this interface appears anywhere from 5 to 20 ft above the water's surface.

Many historical buildings are situated along the riverbank between Franklin and Church Streets. Their foundations appear to be set in the overburden alluvial deposits, with little to no soil coverage on the riverside of the foundation. The chalk is somewhat impervious, causing concentrated groundwater to exit the bank slopes within the overburden material as this layer becomes saturated. This continual process could potentially result in material loss beneath the building foundations which, over time, would destabilize the buildings. **Figure 7** shows a generalized cross-section of the geology of the riverbank.

The interface of the overburden soils and underlying chalk fluctuates from approximate elevation 100 to 105 ft in the Study Area. When comparing this to river elevation, it puts the boundary of the two layers approximately 15 to 20 ft above the normal pool level of 84.3 ft. According to historical hydrologic data, this layer would see loading due to the river cresting at around the 0.5 AEP (2-year) flood event. This is a fairly frequent loading and shows that minor flooding of the River could contribute to the building instability.

In addition to flooding, there were other possible contributors of building instability that are not linked to flooding. Historical and current photos show that there is a history of allowing vegetation to grow in the slopes where the building foundations are set. At times, this vegetation appears to have been removed, allowing for root systems to rot, and thus, allowing voids within the foundation soils to form. **Image 1**, **Image 2**, and **Image 3** show photos of the slopes.

Figure 7: Cross section of the downtown Selma bluffs

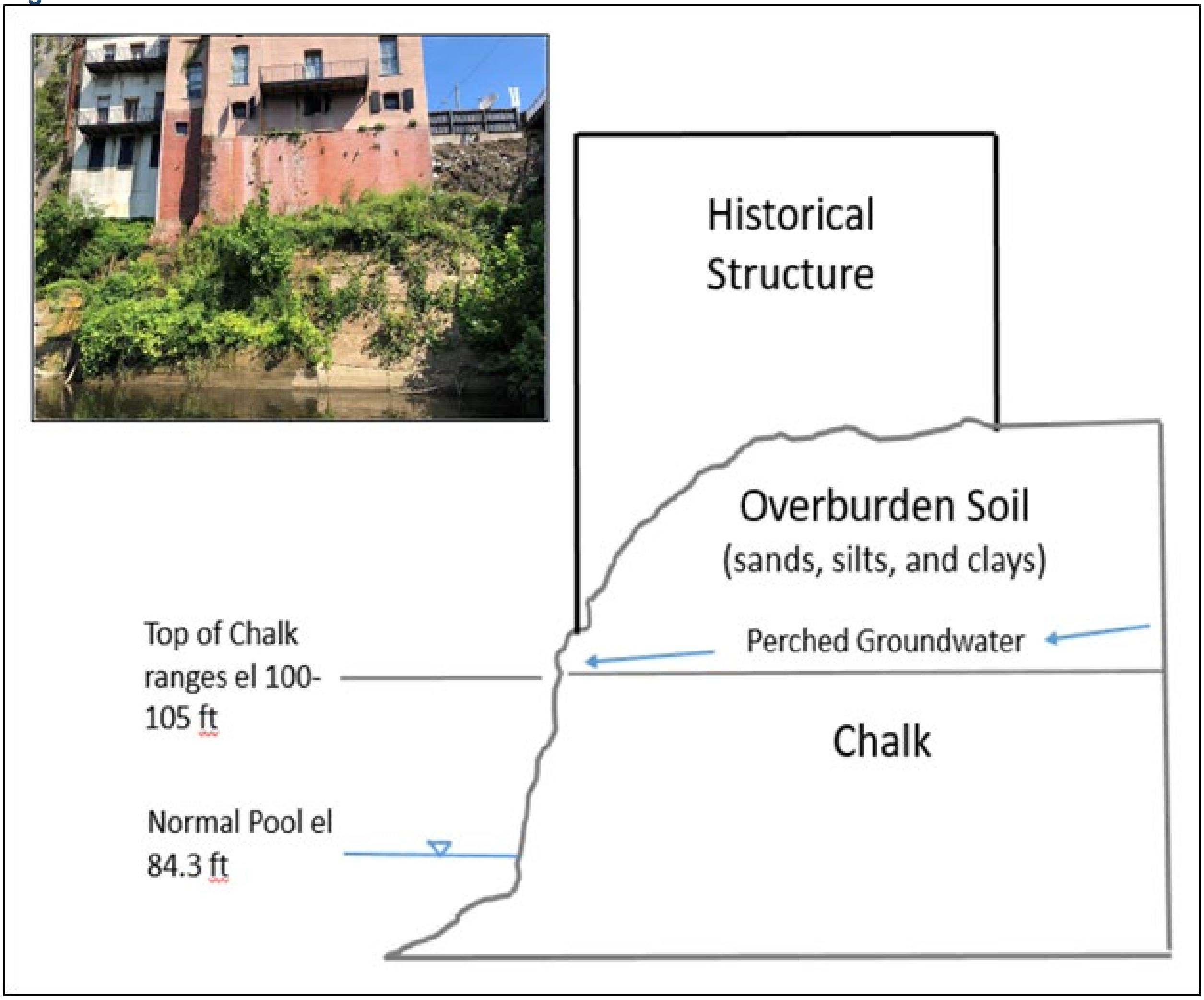


Image 1: Vegetation on the riverbank slopes in downtown Selma (c. 1940s-1950s)

Image 2: Vegetation has been sprayed or cut on either side of the Edmund Pettus Bridge (1965)

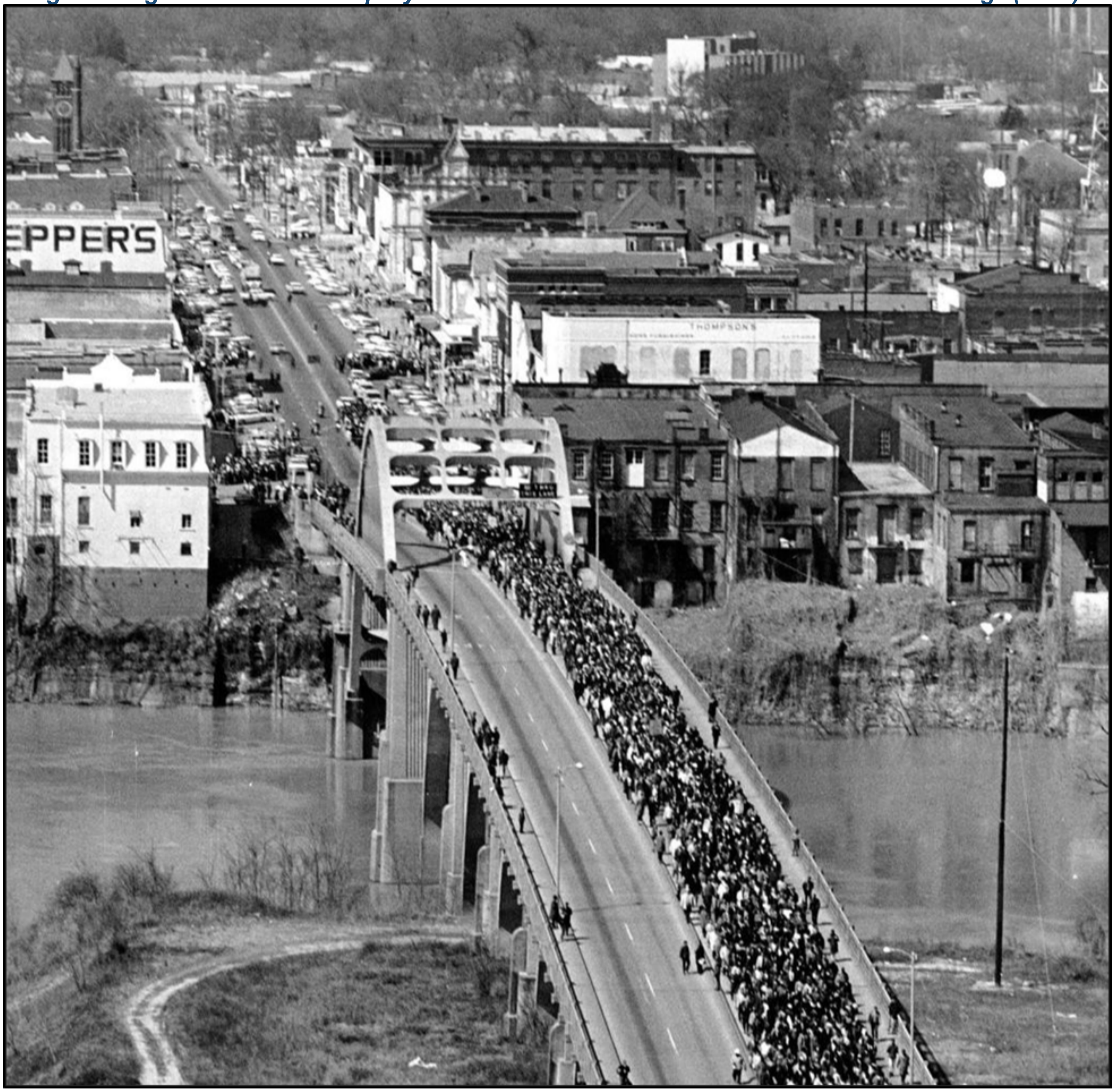
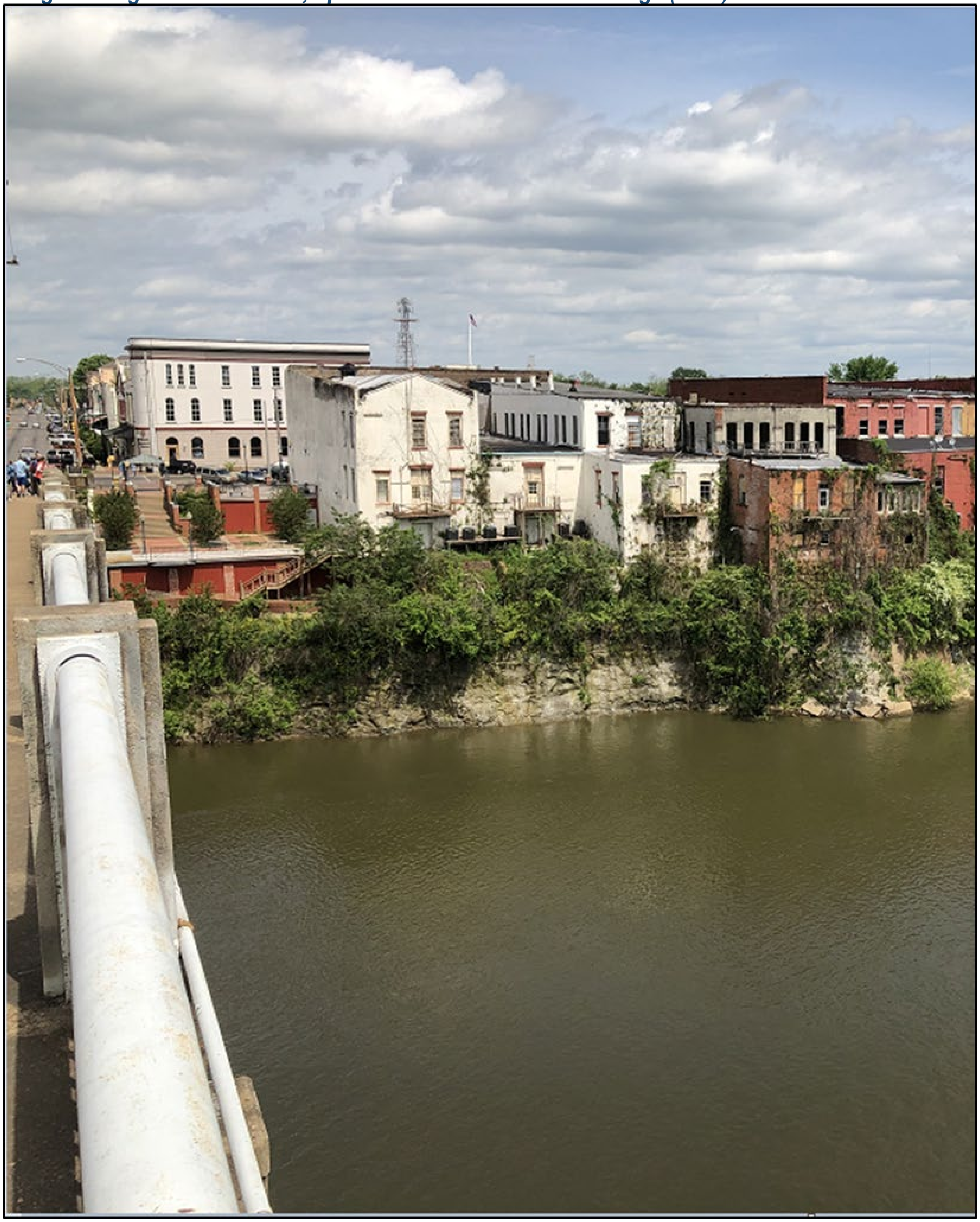
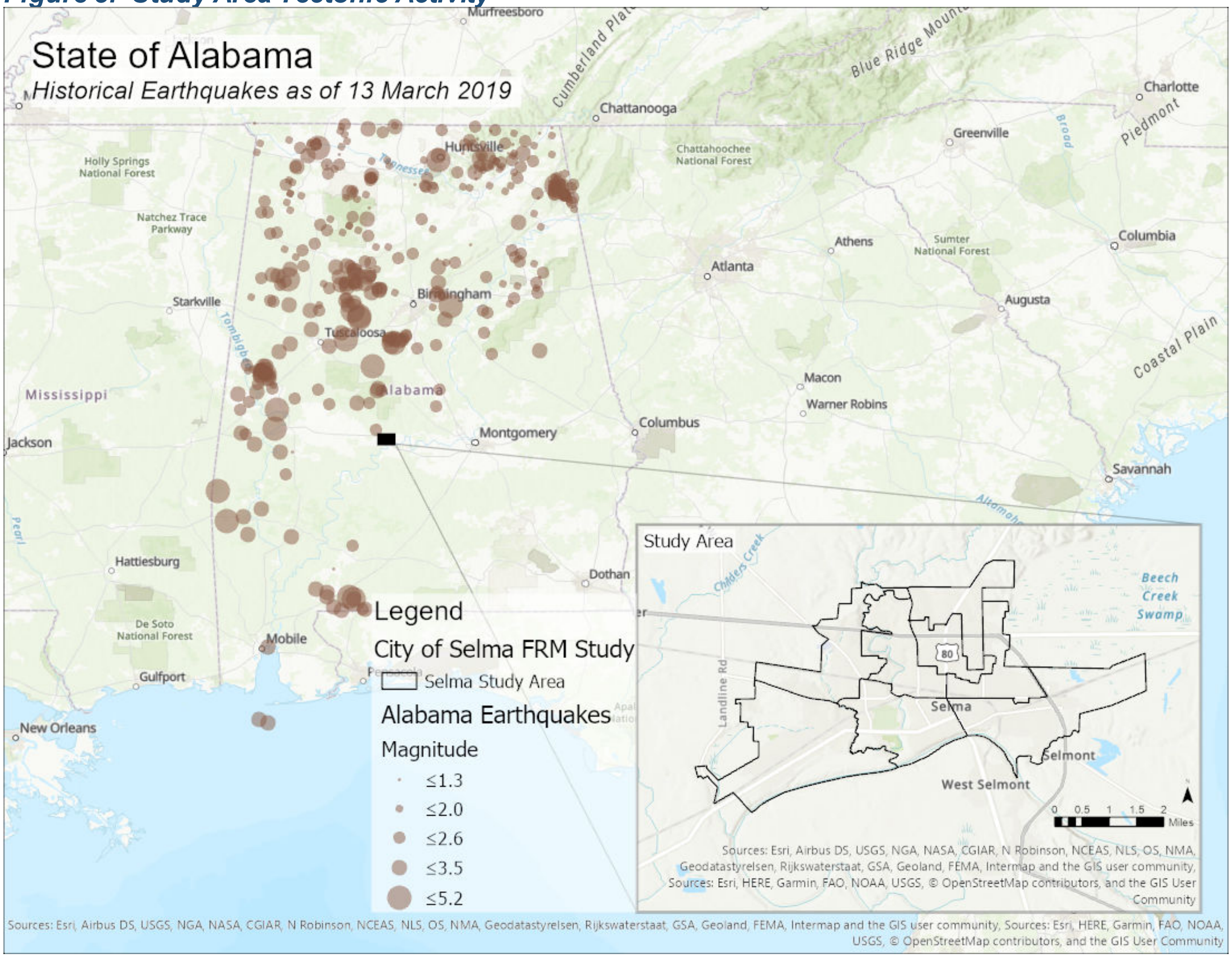


Image 3: Vegetated riverbank, upstream of Edmund Pettus Bridge (2019)



The State of Alabama typically experiences mild to moderate tectonic activity resulting in earthquakes that are rarely felt as shown in **Figure 8**. Even so, most of these earthquakes have occurred to the north and west of the Study Area. No earthquakes have occurred within or near the Study Area in the period of historical record since 1886. No active volcanoes are located in the Southeastern U.S.

Figure 8: Study Area Tectonic Activity



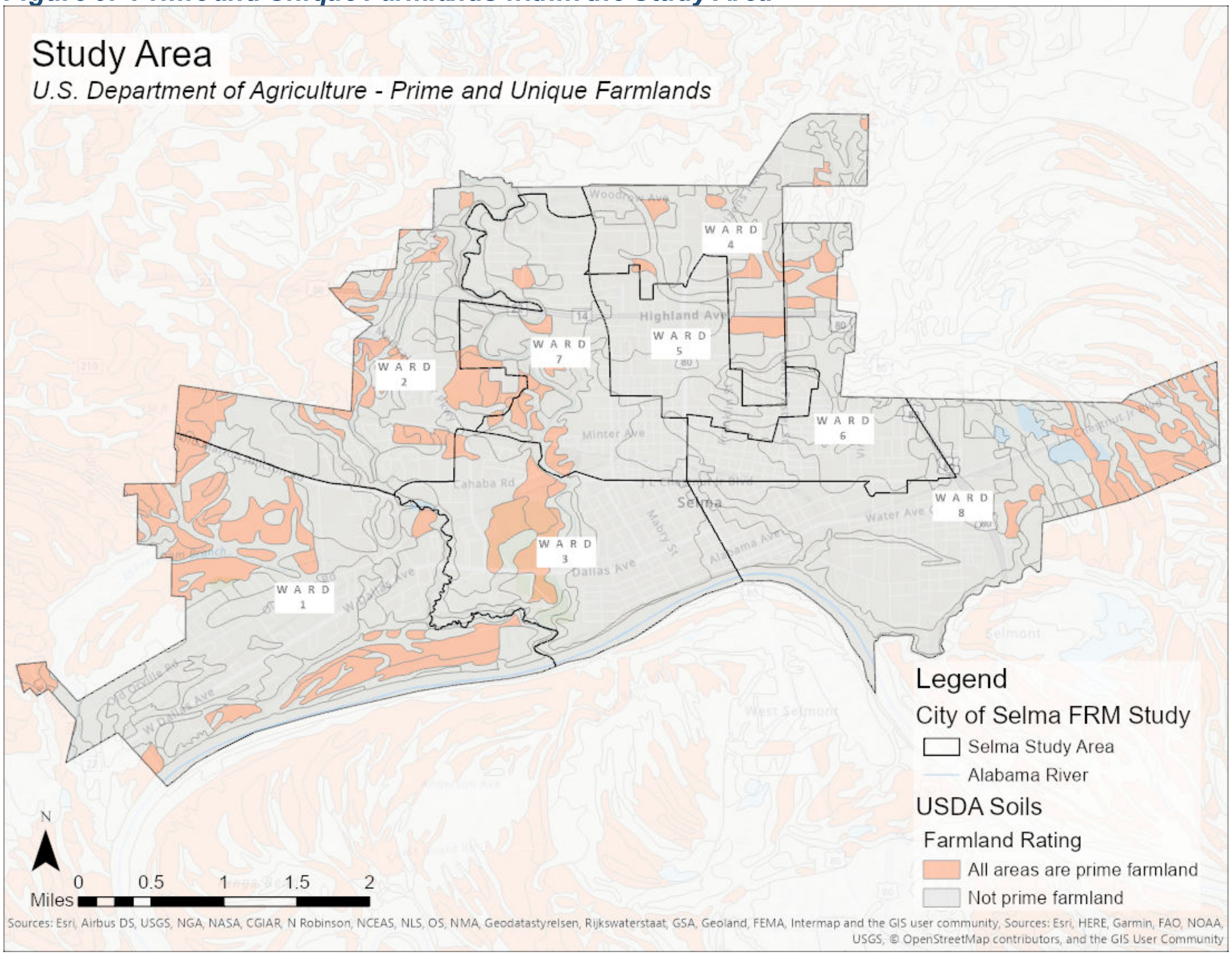
3.1.2.1. *Future Without Project Conditions**

As highlighted in **Section 3.1.1**, erosion is occurring beneath the building foundations along the riverbank between Church Street and Franklin Street. The cause of the material loss is unknown; however, if left unaddressed soil could continue to migrate from beneath the building foundations. If this were to continue in a FWOP scenario, it could potentially result in a loss of the historically significant buildings and viewshed to the Edmund Pettus Bridge and the Selma riverfront.

3.1.3. *Prime and Unique Farmlands**

Due to the urbanized setting, much of the prime farmland soils within the Study Area have been degraded. The surrounding terrain contains a significant portion of prime and unique farmland soils as shown in **Figure 9**.

Figure 9: Prime and Unique Farmlands within the Study Area



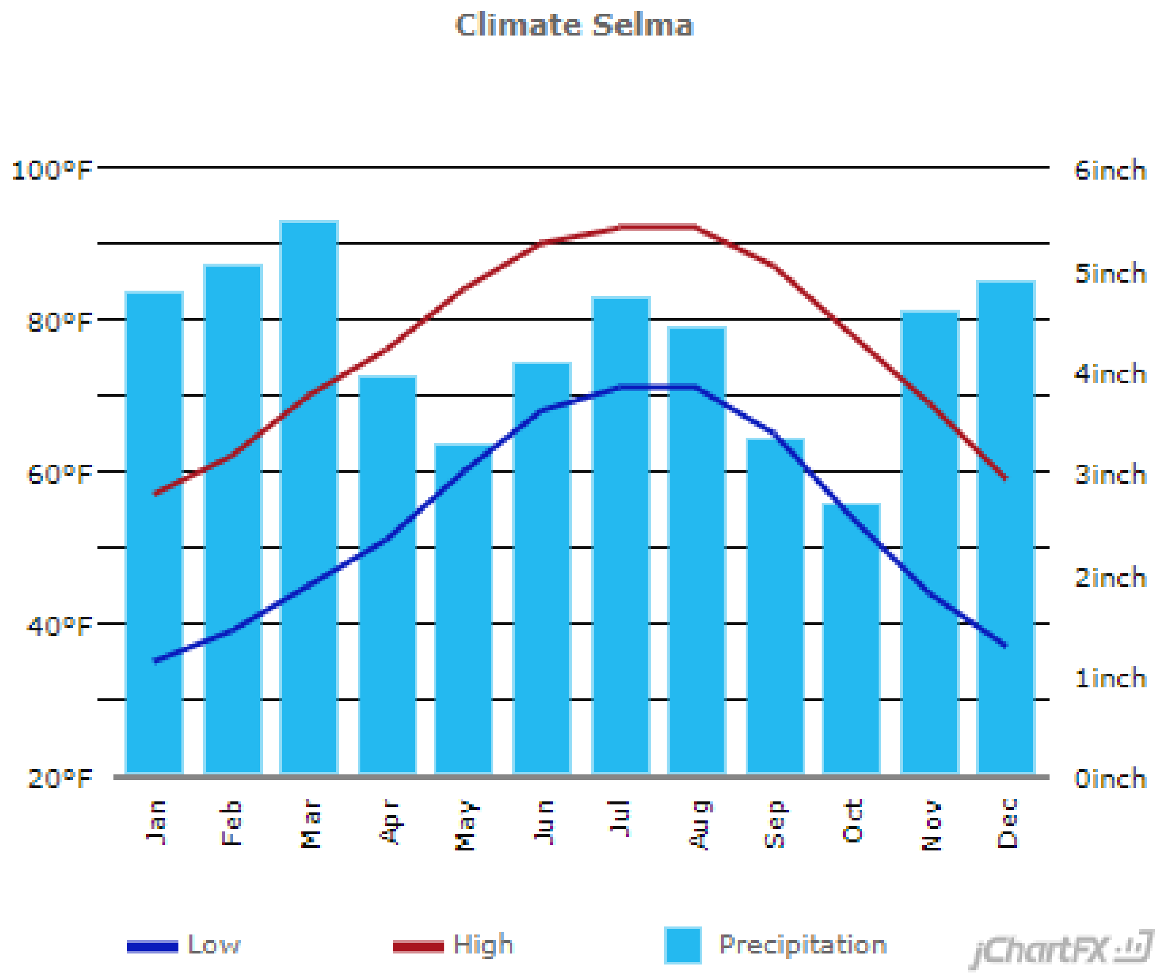
3.1.3.1. *Future Without Project Conditions**

FWOP conditions would not be significantly changed from existing conditions. No significant urbanization is anticipated due to the depressed economy.

3.1.4. *Climate**

The climate in Selma is generally warm with some seasonal variations. According to the U.S. climate data, represented in **Figure 10**, the hottest month of the year tends to be August with an average high temperature of 92°Fahrenheit (F) and average low of 71°F. The coolest month of the year is January with an average high of 57°F and low of 35°F. Precipitation is heaviest in the project area during the month of March with an average rainfall rate of 5.47 inches ("). Conversely, October is the driest month of the year with an average of 2.68" of rainfall. The average annual precipitation is 51.11".

Figure 10: U.S. Climate Data average monthly temperatures and precipitation



source: U.S. Climate Data - Climate Selma

3.1.4.1. *Future Without Project Conditions**

The FWOP conditions for the climate is analyzed using a Climate Change Assessment. Based on the literature review of relevant climate data for the southeast region, there is some consensus that there will be mild increases in the severity and frequency of storms in the region. However, there is no consensus on future changes in hydrology. Observed data from near the Study Area shows temperatures have been gradually rising since the 1970s, after a cooling period in the middle part of the century. Based on a few of the gages in the watershed, it is difficult to conclude whether temperature is increasing or if this is a reoccurring pattern. Annual precipitation seems to be variable for the region. It appears there may be more extremes occurring in recent years, such as extreme low annual precipitation values; however, the overall trends appear to be constant or increasing slightly. There is some consensus on peak streamflow for the region decreasing since the middle of the century; however, the literature lacks a clear consensus. For the Alabama Basin, this decreasing streamflow could be related to the increase in FRM projects within the region since the late 1940s.

A climate change analysis was performed using the non-stationarity detection tool and the USACE Climate Hydrology Assessment Tool. A detailed description of the climate change analysis can be found in **Appendix A**. Based on the results of this assessment, including considerations of observed precipitation, temperature, and streamflow in the basin, there is not strong evidence suggesting increasing peak annual streamflow will occur in the future within the region as a result of climate change. Furthermore, there is only some consensus the region might see a mild increase in the frequency and severity of precipitation events. This evidence, by itself does not indicate high confidence in an increase in peak flows in the Alabama basin resulting from climate change. There is also substantial uncertainty tied to the models used to forecast future streamflow in the basin; therefore, the effects of climate change can be considered within the standard uncertainty bounds associated with the hydrologic/hydraulic analysis being conducted as part of this study. The changes to hydrology were primarily driven through forecasted changes in land use in the Alabama River Basin above the City of Selma as discussed in **Section 3.1.1.1.1**. The peak flows are predicted to increase by 2% under FWOP conditions.

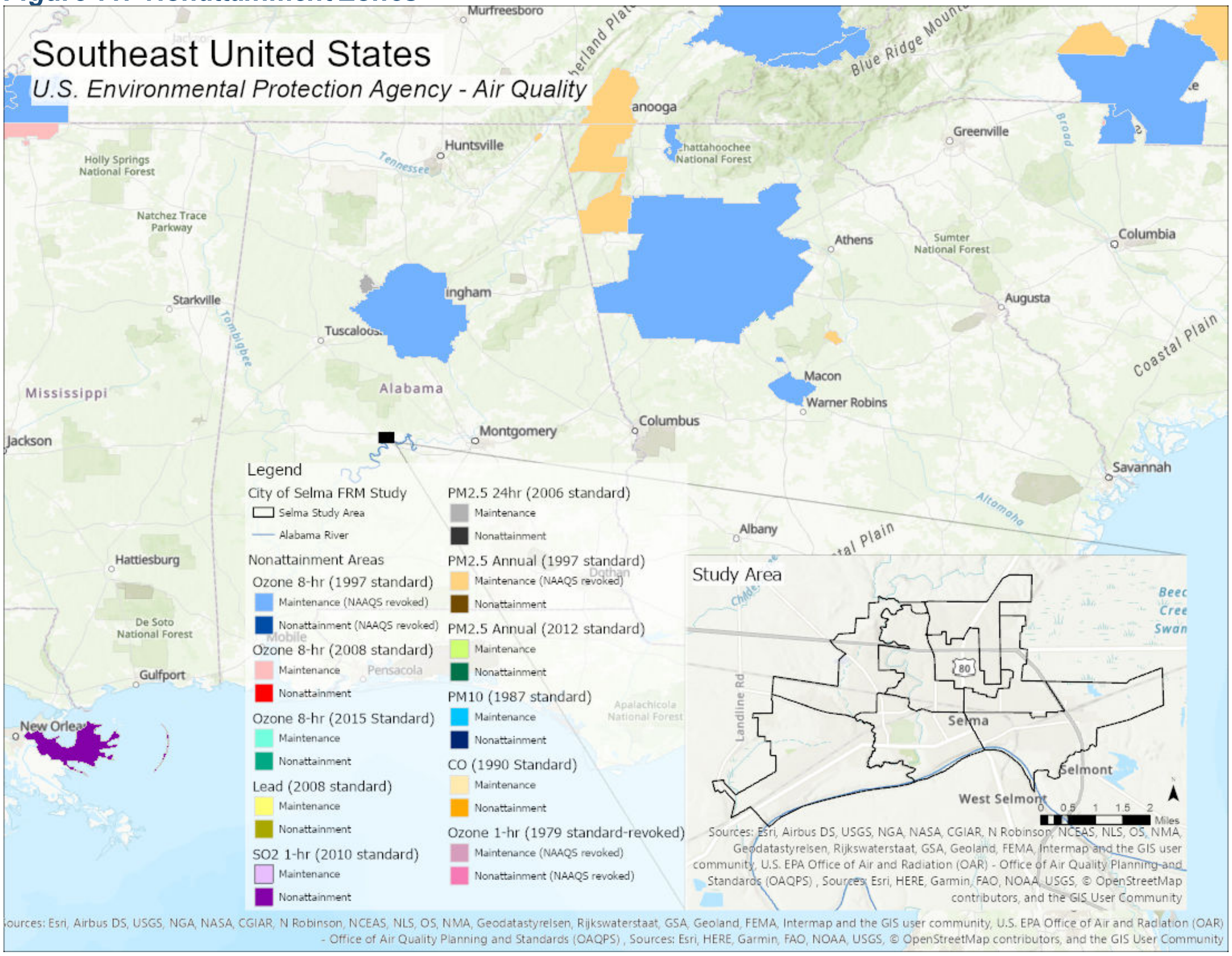
3.1.5. *Air Quality and Greenhouse Gasses**

The USEPA sets National Ambient Air Quality Standards (NAAQS) in accordance with the Clean Air Act (CAA) "for pollutants considered harmful to public health and the environment." The CAA identifies two types of NAAQS: primary and secondary. Primary standards provide public health protection and secondary standards provide public welfare protection. The USEPA has set NAAQS for six principal pollutants, which are called criteria air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulfur dioxide, lead, and particulate matter (PM_{10} and $PM_{2.5}$).

The General Conformity Rule published by the USEPA on November 30, 1993 designates and implements Section 176(c) of the CAA for geographic areas in CAA non-attainment areas for criteria pollutants and in those attainment areas subject to maintenance plans required by CAA Section 175(a). The CAA General conformity Rule applies to Federal actions.

The Study Area is not located within or near any designated non-attainment areas for any criteria air pollutants as shown in **Figure 11**.

Figure 11: Nonattainment Zones



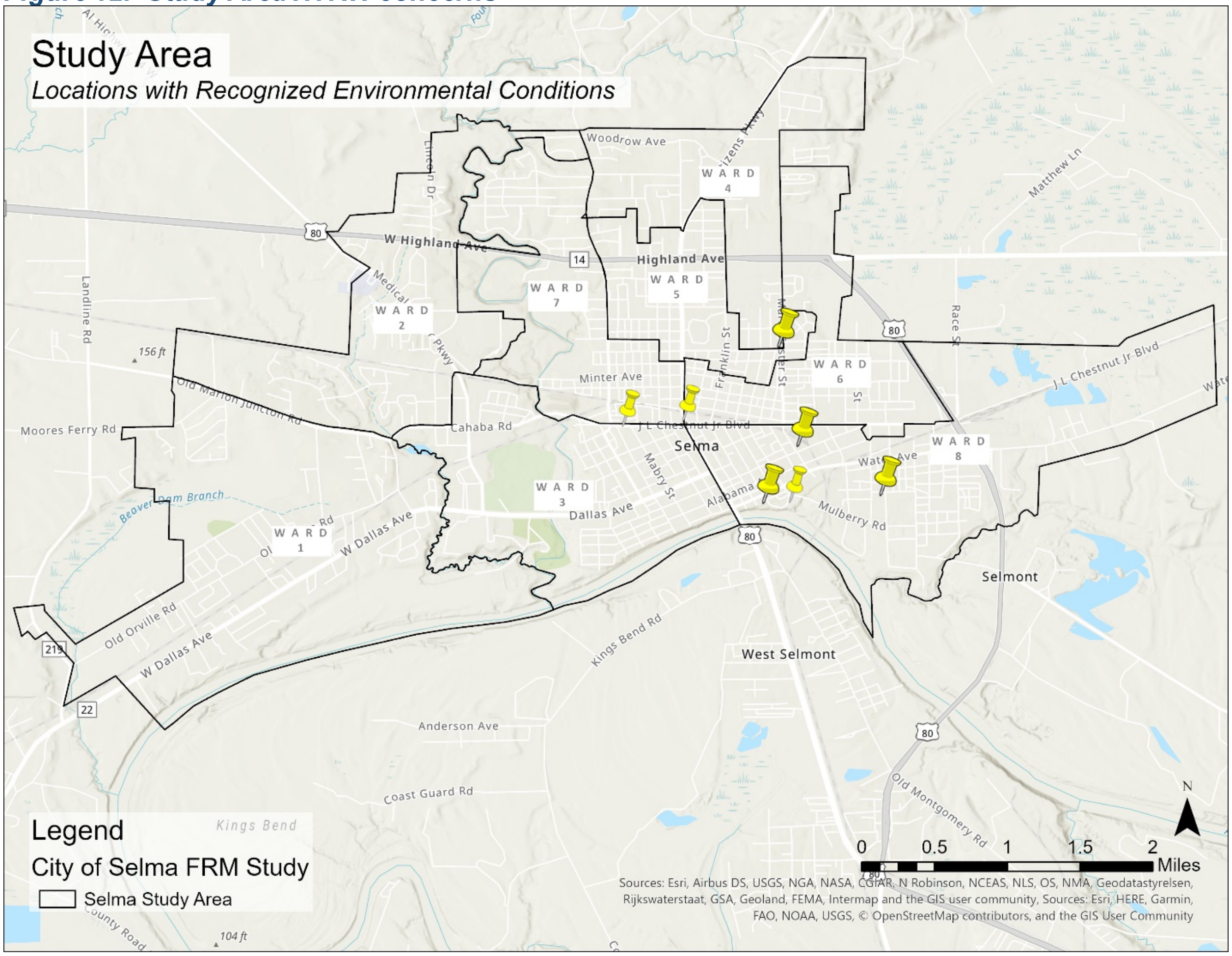
3.1.5.1. *Future Without Project Conditions**

Air quality and greenhouse gasses are predominantly driven by urbanized settings. No significant urbanization growth is anticipated within the surrounding area due to a depressed economy; therefore, FWOP conditions would not be significantly changed from the existing setting.

3.1.6. *Hazardous, Toxic, and Radiological Waste (HTRW)**

The City of Selma has conducted several Environmental Site Assessments since 2017 to identify Recognized Environmental Conditions (RECs) within the Study Area which may present HTRW concerns. RECs such as petroleum, gasoline, fertilizer, chemical cleaners and degreasers, paint products, solvents, and herbicides/pesticides were identified throughout seven properties. Those locations are shown in **Figure 12**. Historical placement of Unexploded Ordnances (UXOs) within the Alabama River is cause for concern regarding the possibility of toxic chemical leeching into the riverbed. Several excavations have occurred; however, no sediment testing has been conducted to show the level of contamination, if any.

Figure 12: Study Area HTRW concerns



3.1.6.1. *Future Without Project Conditions**

The FWOP conditions would not be significantly changed from existing conditions with respect to UXO placement. Because the likelihood that UXO material was made using lead is high, the possibility of chemical leeching into the riverbed sediment is a concern; therefore, chemical leeching would continue under FWOP conditions.

3.2. Biological Resources*

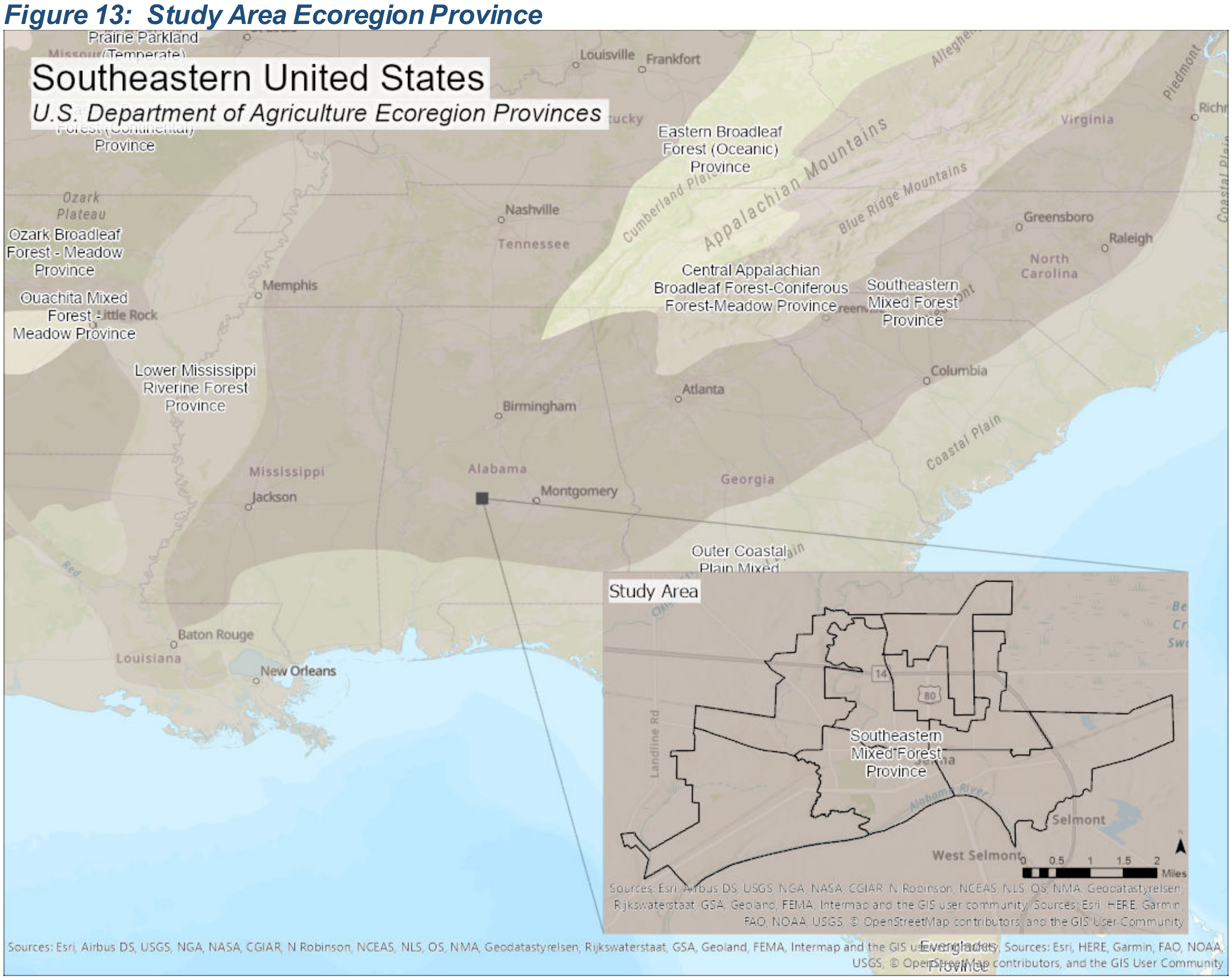
3.2.1. *Vegetation**

The U.S. Department of Agriculture (USDA) has defined ecological regions of the U.S. through a hierarchal assessment of domains, divisions, and provinces. Based on the USDA Ecoregion Map provided in **Figure 13**, the Study Area lies within the southeastern mixed forest province of the Continental U.S. (Bailey 1995).

Since extensive cultivation practices during the 19th century, much of the Piedmont Ecoregion has reverted to pine and hardwood woodlands. Vegetation within the Southern Mixed Forest Province ranges from medium to tall forests of broadleaf deciduous trees and evergreen pine trees (Bailey 1995). Existing habitat within the Study Area ranges from heavily to moderately disturbed areas. The surrounding habitat includes forested riparian settings. Dominant native plant species throughout the Study Area include Tulip Poplar (*Liriodendron tulipifera*), White Oak (*Quercus alba*), Northern Red Oak (*Q. rubra*), Black Oak (*Q. velutina*), Post Oak (*Q. stellata*), Hickories (*Carya glabra*, *C. tomentosa*, and *C. cordiformis*), American Beech (*Fagus grandifolia*), Loblolly Pine (*Pinus taeda*), Virginia Pine (*Pinus virginiana*), Sweetgum (*Liquidambar styraciflua*), Black Cherry (*Prunus serotina*), Flowering Dogwood (*Cornus florida*), Box Elder (*Acer negundo*), and Eastern Red Cedar (*Juniperus virginiana*).

Invasive plant species throughout the surrounding area include Japanese Arrowroot (*Pueraria montana var. lobata*), Cogongrass (*Imperata cylindrical*), Yellow Iris (*Iris pseudacorus*), Japanese Honeysuckle (*Lonicera japonica*), Star-Of-Bethlehem (*Ornithogalum umbellatum*), Garlic Mustard (*Alliaria petiolate*), and Chinese Wisteria (*Wisteria sinensis*). No formalized invasive species control plans exist within the Study Area.

Figure 13: Study Area Ecoregion Province



3.2.1.1. *Future Without Project Conditions**

FWOP conditions would not be significantly changed from existing conditions.

3.2.2. *Fish and Wildlife Resources**

The Alabama Department of Conservation and Natural Resources (ALDCNR) updates a State Wildlife Action Plan (SWAP) on a 10-year basis, which identifies outstanding wildlife diversity on a comprehensive statewide scale. According to the 2015 SWAP, "Alabama surpasses all eastern states in plant and animal diversity, ranking fifth in the nation after California, Texas, Arizona, and New Mexico" despite only contributing 1.6% of area compared to the total area within the entire contiguous Continental U.S.

3.2.2.1. *Aquatic Species**

Alabama ranks one of the highest among the Continental U.S. for aquatic diversity in both total and endemic populations as shown in **Figure 14** and **Figure 15**. Alabama is home to 93 native reptiles (*Reptiles* 2020) and 450 fish species, which is "the most found in any other state or province in North America" (Mettee, 2016). Additionally, Encyclopedia of Alabama states "Alabama is home to the most diverse fauna of freshwater mussels in all of North America, with 180 species." (Garner, 2013). Boshung and Mayden (2004), documented 185 fish species historically occurring within the Alabama River drainage (161 native species, 2 euryhaline species, 4 marine species and 18 introduced species). Williams et al. (2008), document 51 mussel species historically occurring within the Alabama River drainage. Table 3 lists some common species found throughout the Study Area, but is not a comprehensive list of all species known to occur.

Table 3: Aquatic Species within the Study Area

Fish	Mussels	Amphibians and Reptiles
Alabama Darter (*Etheostoma ramseyi*)	Threehorn Wartyback (*Obliquaria reflexa*)	Eastern Cottonmouth (*Agkistrodon piscivorus piscivorus*)
Alligator Gar (*Atractosteus spatula*)	Washboard (*Megalonaias nervosa*)	snapping turtles (*Chelydra serpentina*)
Black Crappie (*Pomoxis nigromaculatus*)	Bankclimber (*Plectomerus dombeyanus*)	Eastern Spiny Softshell (*Apalone spinifera spinifera*)
Blue Catfish (*Ictalurus furcatus*)	Southern Mapleleaf (*Quadrula apiculata*)	River Cooter (*Pseudemys Concinna*)
Bluegill (*Lepomis macrochirus*)	Fragile Papershell (*Leptodea fragilis*)	pond slider (*Trachemys scripta*)
Channel Catfish (*Ictalurus punctatus*)	Alabama Orb (*Quadrula asperata*)	Gulf Coast Smooth Softshell Turtle (*Apalone calvata*)
Flathead Catfish (*Pylodictis olivaris*)	Ebonyshell (*Fusconaia ebena*)	Alabama Map Turtle (*Graptemys pulchra*)
Redbreast Sunfish (*Lepomis auritus*)	Yellow Sandshell (*Lampsilis teres*)	Gulf Coast Spiny Softshell (*Apalone spinifera aspera*)
Redear Sunfish (*Lepomis microlophus*)	Gulf Pigtoe (*Fusconaia cerina*)	American Alligator (*Alligator mississippiensis*)
Spotted Bass (*Micropterus punctulatus*)	Monkeyface Mussel (*Quadrula metanevra*)	Florida Banded Water Snake (*Nerodia fasciata pictiventris*)
Striped Bass (*Morone saxatilis*)	Butterfly Mussel (*Ellipsaria lineolata*)	
Walleye Perch (*Sander vitreus*)	Elephant ear (*Elliptio crassidens*)	
White Bass (*Morone chrysops*)	Fawnsfoot (*Truncilla donaciformis*)	
White Crappie (*Pomoxis annularis*)		

One population of Asian Clams (*Corbicula spp.*) is known to inhabit the upstream portion of the Alabama River outside the Study Area at the U.S. Highway 80 bridge. No other aquatic invasive species are known to occur within the Study Area.

Figure 14: Total Biodiversity for Multiple Taxa

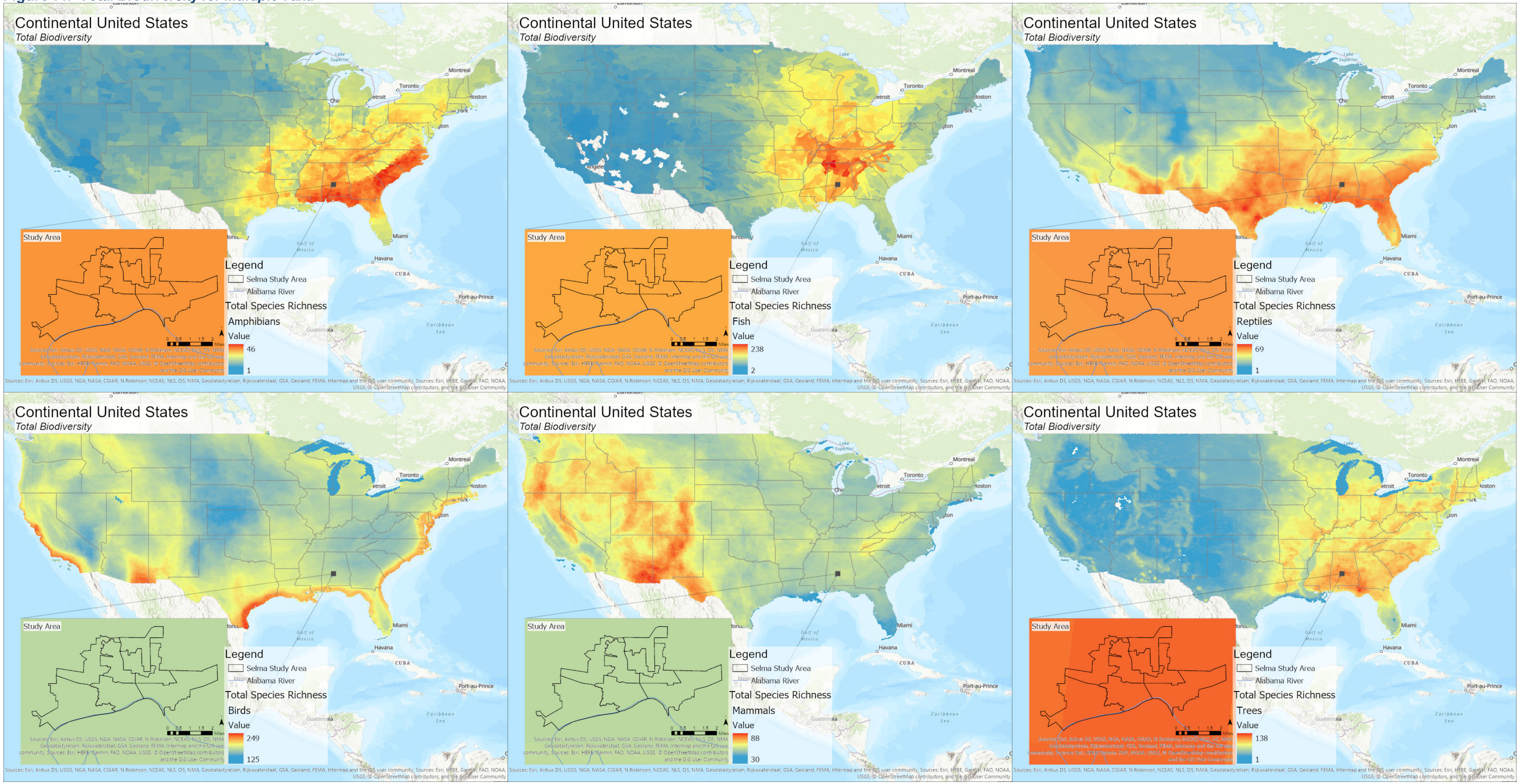


Figure 15: Endemic Biodiversity for Multiple Taxa

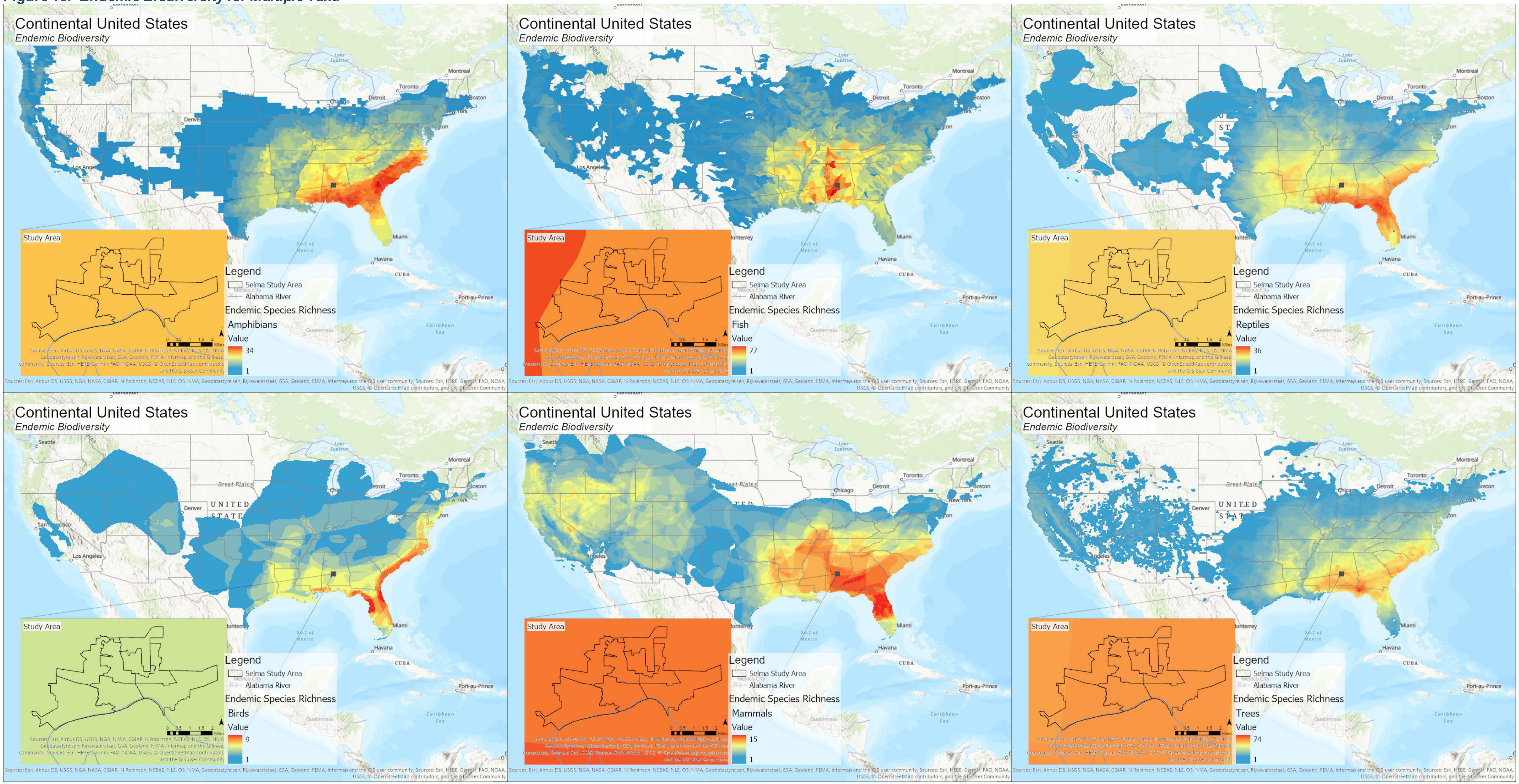
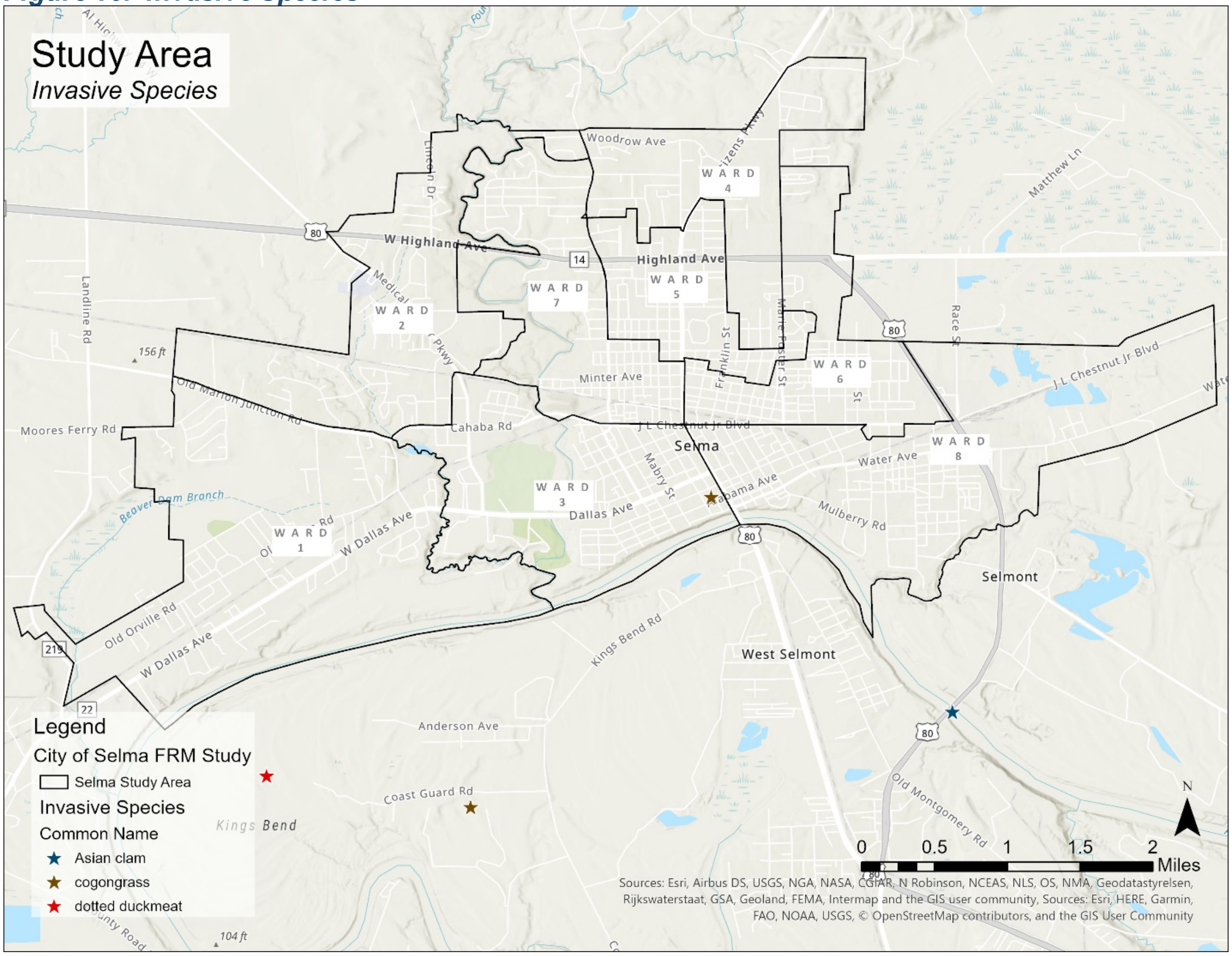


Figure 16: Invasive Species



3.2.2.1.1. *Future Without Project Conditions**
The FWOP conditions would not be significantly changed from existing conditions.

3.2.2.2. *Terrestrial Species**
Wildlife species vary throughout the Southern Mixed Forest Province. Their presence depends on age and thickness of timber stands, percent of deciduous trees, proximity to clearings, and bottom-land forest types (Bailey, 1995). Though Alabama is more diverse in aquatic species, a variety of terrestrial species exist within the State including 62 native mammal species. (Manno and Paemelaere, 2016). According to the 2019 Article h-1284 written by Dr. Thomas Haggerty:

> *"Few states can match Alabama's rich diversity of birds...Currently, the Alabama Ornithological Society recognizes 433 species that have been seen in the state. From this list, about 158 are considered regular breeders within Alabama's borders…"*

Some common species throughout Alabama and the Study Area are included in **Table 4**.

Table 4: Terrestrial Species within the Study Area

Mammals	Birds	Reptiles
Eastern Cottontail Rabbit (*Sylvilagus floridanus*)	Blue Jay (*Cyanocitta cristata*)	Gopher Tortoise (*Gopherus Polyphemus*)
Raccoon (*Procyon lotor*)	Northern Mockingbird (*Mimus polyglottos*)	Green Anole (*Anolis carolinensis carolinensis*)
Norway Rats (*Rattus norvegicus*)	American Crow (*Corvus brachyrhynchos*)	Eastern Fence Lizard (*Sceloporus undulates*)
Grey mouse (*Pseudomys albocinereus*)	American Goldfinch (*Spinus tristis*)	Mole Skink (*Plestiodon egregious*)
White-tailed Deer (*Odocoileus virginianus*)	American Robin (*Turdus migratorius*)	Five-Lined Skink (Plestiodon fasciatus)
Greater Mouse-Eared Bat (*Myotis myotis*)	Barn Swallow (*Hirundo rustica*)	Southern Copperhead (*Agkistrodon contortrix contortrix*)
Little Brown Bat (*Myotis lucifugus*)	Barred Owl (*Strix varia*)	Eastern Worm Snake (*Carphophis amoenus amoenus*)
Groundhog (*Marmota monax*)	Blue-gray Gnatcatcher (*Polioptila caerulea*)	Northern Black Racer (*Coluber constrictor constrictor*)
American Red Fox (*Vulpes vulpes fulvus*)	Carolina Chickadee (*Poecile carolinensis*)	Timber Rattlesnake (*Crotalus horridus*)
Striped Skunk (*Mephitis mephitis*)	Carolina Wren (*Thryothorus ludovicianus*)	Eastern Ribbon Snake (*Thamnophis sauritus sauritus*)
Coyotes (*Canis latrans*)	Red-tailed Hawk (*Buteo jamaicensis*)	Eastern Glass Lizard (*Ophisaurus ventralis*)

3.2.2.2.1. *Future Without Project Conditions**
The FWOP conditions would not be significantly changed from existing conditions.

3.2.3. *Protected Species**

The Alabama SWAP categorizes species throughout the State with the Greatest Conservation Need Priorities 1-5, 5 being the highest conservation concern. These species are protected through Alabama State regulations and can be found in the periodically updated SWAP. All Federally protected species receive a State priority ranking.

3.2.3.1. *Threatened and Endangered Species**

The Endangered Species Act (ESA) "provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend." The ESA makes it illegal to "take" a Federally listed species, such as T&E, without a permit. "Take" is defined by the ESA as "to harass, harm, pursue, hunt, shoot, would, kill, trap, capture, or collect or attempt to engage in any such conduct." The U.S. Fish and Wildlife Service (USFWS) has statutory authority for the assessment of Federally listed or petitioned species on the land or in freshwater.

Because of the unique and complex ecosystem, the Alabama Rivers and Streams Network was formed to aid in conservation efforts. The Alabama Rivers and Streams Network is a conglomeration between non-profit organizations, private companies, State and Federal agencies, and concerned citizens that have classified watersheds and river reaches within the state of Alabama into Strategic Habitat Units (SHUs) and Strategic River Reach Units (SRRUs) which have the capacity to support viable and healthy aquatic habitats, populations of imperiled species, and provide good opportunities for restoration and recovery. As shown in **Figure 17** the Study Area encompasses SRRU number 24 (Lower Alabama River) and lies adjacent to SHU number 27 (Upper Cahaba River). Priority species within the Lower Alabama River SRRU and Upper Cahaba River SHU includes numerous Federally listed T&E and other at-risk species. (*Alabama Rivers and Streams Network*, 2020). Those Federally listed species occurring within Dallas County, Alabama are referenced in **Table 5**.

Additionally, results of recent collections of environmental DNA (eDNA) from water samples have detected the species in the Alabama River from below Robert F. Henry. Although most eDNA detections were from areas below the first passage barrier on the Alabama River (Claiborne lock and dam), there were eDNA detections past two passage barriers (Pfleger et al. 2016). Gulf Sturgeon at Claiborne Lock and Dam were detected both by eDNA and by sonic tag (Rider et al. 2016) and by eDNA below Robert F. Henry (Pfleger et al. 2016). Since 2010, the USACE in cooperation with ALDCNR has been conducting voluntary conservation locking measures to provide potential fish passage during the spring spawning season at Claiborne and Millers Ferry lock and dam. The detection of Alabama and Gulf Sturgeon eDNA above these hydro projects could indicate the potential for fish to pass through these navigation locks. However, further study is needed to determine the correct path of passage and to what extent.

Figure 17: Strategic Habitat and River Reach Units surrounding the Study Area

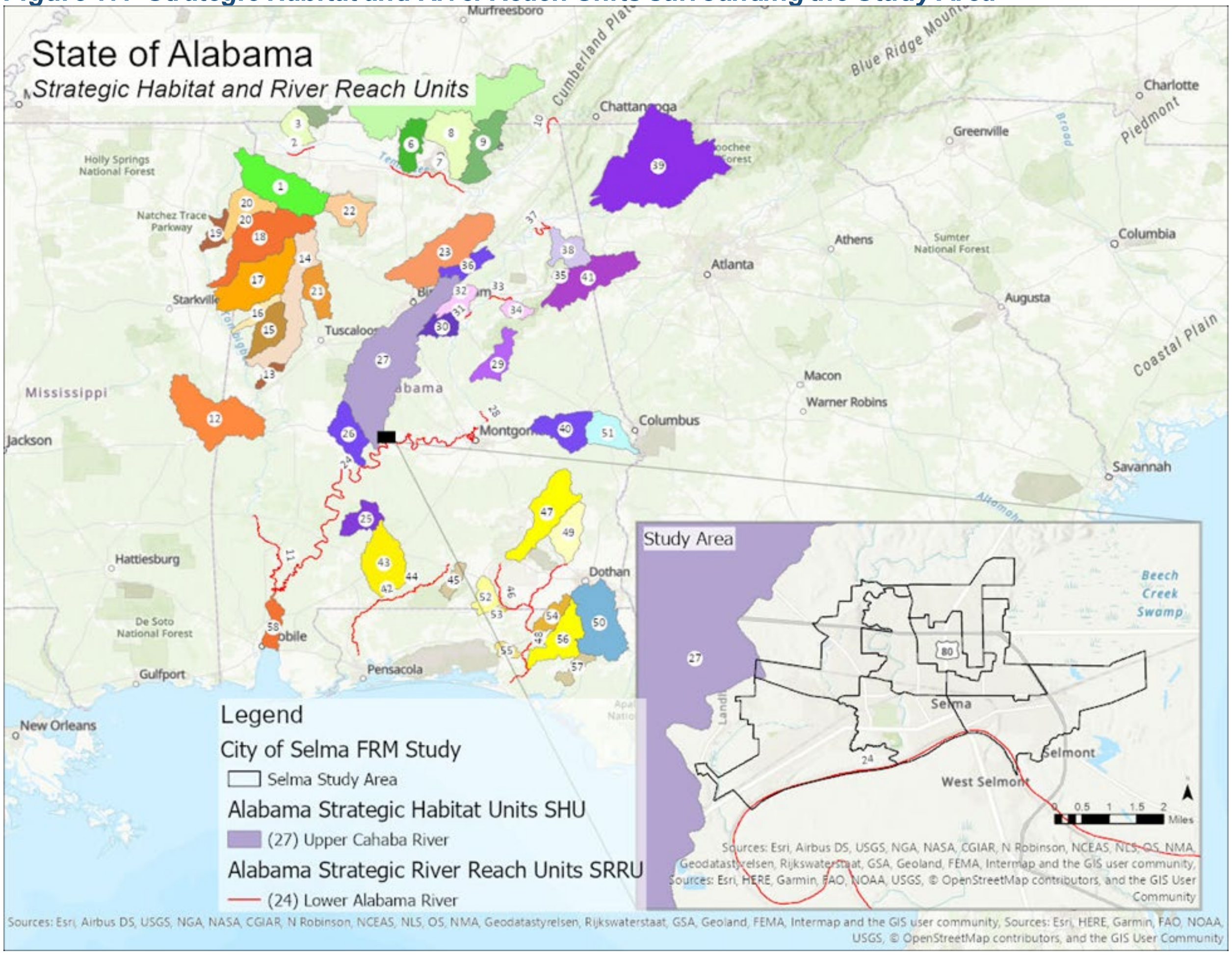


Table 5: Official Species List for Federally Listed Threatened and Endangered Species within Dallas County dated August 1, 2020

Common Name	Scientific Name	Federal Status	State Rank	Habitat
Red-cockaded Woodpecker	*Picoides borealis*	Endangered	S2	Open, mature pine woodlands
Wood Stork	*Mycteria americana*	Threatened	S2N	Forested/herbaceous wetland
Alabama Sturgeon	*Scaphirhynchus suttkusi*	Endangered	S1	Main channels of major rivers in areas below the Fall Line
Alabama Moccasinshell	*Medionidus acutissimus*	Threatened	S1	Sand and gravel substrate in clear water of moderate flow in small to large rivers
Heavy Pigtoe	*Pleurobema taitianum*	Endangered	S1	Gravel with large component of coarse sand in water exceeding 6 m with variable current
Orangenacre Mucket	*Lampsilis perovalis*	Threatened	S2	High quality stream and small river habitat on stable sand/gravel/cobble

Common Name	Scientific Name	Federal Status	State Rank	Habitat
				substrate in moderate to swift currents
Ovate Clubshell	*Pleurobema perovatum*	Endangered	S1	Sand/gravel shoals and runs of small rivers and large streams
Southern Clubshell	*Pleurobema decisum*	Endangered	S2	Highly oxygenated streams with sand and gravel substrate in shoals of large rivers to small streams
Tulotoma Snail	*Tulotoma magnifica*	Threatened	S2	Riffles and shoals on the undersides of large rocks
Alabama Canebrake Pitcher-plant	*Sarracenia rubra ssp. alabamensis*	Endangered	S1S2	Sandhill seeps, swamps, and sloping bogs along the Fall Line Hills that divide the upper Coastal Plain and Piedmont physiographic regions
Georgia Rockcress	*Arabis georgiana*	Threatened	S1	Shallow soil accumulations on rocky bluffs, ecotones of gently sloping rock outcrops, outcrops along rivers, and sandy loam along eroding riverbanks
Price's Potato-bean	*Apios priceana*	Threatened	S2	Open, mixed-oak forests, forest edges and clearings on river bottoms and ravines, being unable to tolerate deep shade

Key: State Rank = S1: Critically Imperiled; S2: Imperiled; S3: Vulnerable; S4: Apparently Secure; S5: Secure; SX: Presumed Extirpated; SH: Historical (Possibly Extirpated); SNR: Unranked

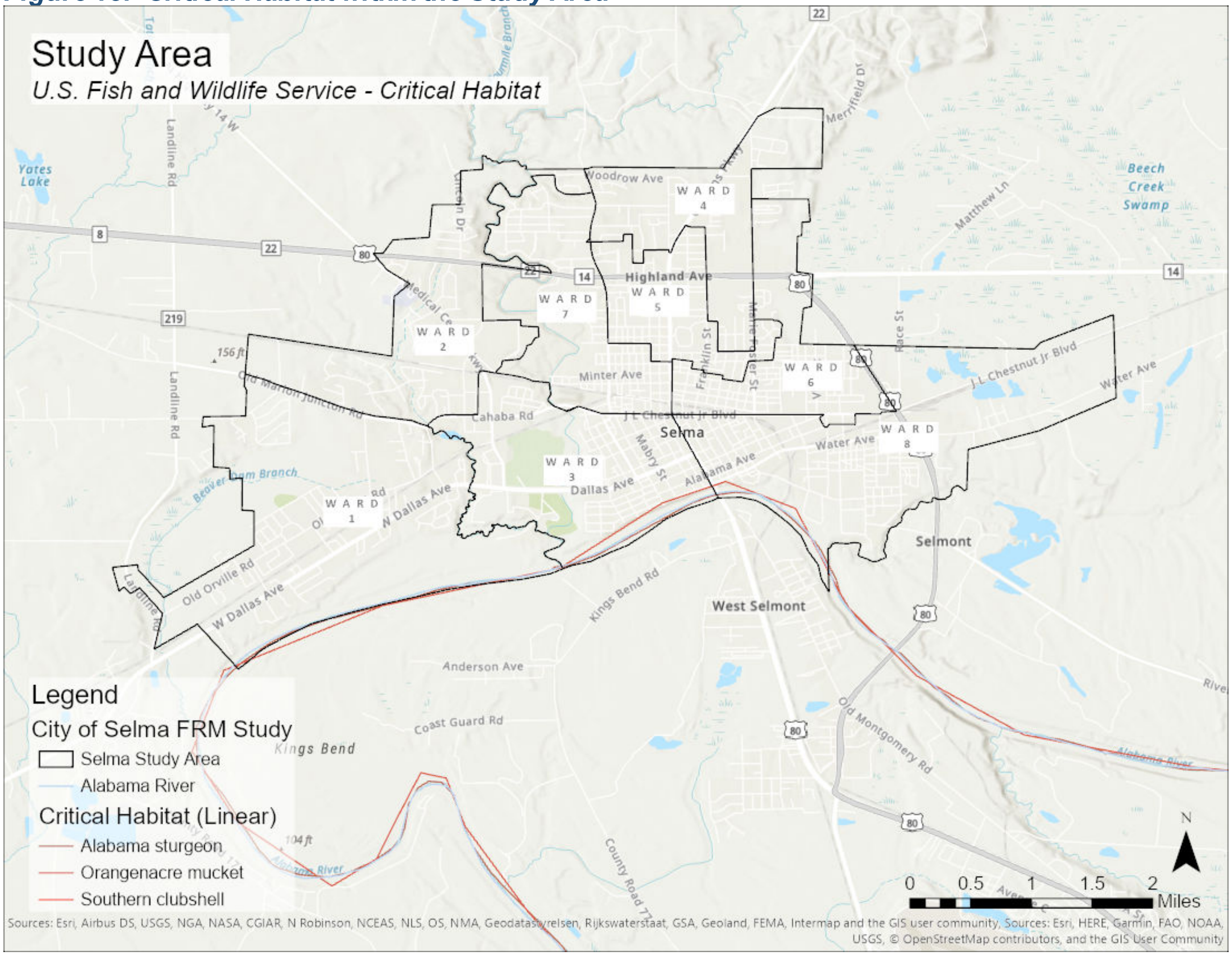
In addition to the Official Species List shown in Table 5, eDNA of Gulf Sturgeon shows the presence of the species within the Alabama River. Four Federally listed mollusk species that are currently considered extirpated from the Alabama River but were historically documented throughout the area include Flat Pigtoe (*Pleurobema marshalli*), Inflated Heelsplitter (*Potamilus inflatus*) and Southern Combshell (*Epioblasma penita*).

Within the Study Area, suitable habitat is present for the Alabama Sturgeon, Gulf Sturgeon, Tulotoma Snail, Heavy Pigtoe, Orangenacre Mucket, and Southern Clubshell. The Alabama Sturgeon is critically imperiled and is believed to extant within the Alabama River. The Heavy Pigtoe is also critically imperiled; however, the last surviving population of Heavy Pigtoe in the entire Continental U.S. is located approximately 1 RM upstream of the U.S. Highway 80 Bridge. (Garner and Buntin, 2011). During the 2011 Heavy Pigtoe survey, Orangenacre Mucket and Southern Clubshell individuals were observed as well. Of the entire species range for Tulotoma Snail, only five surviving populations exist within the Alabama River. Notably, the largest and healthiest population of Tulotoma Snail is located immediately downstream of the Edmund Pettus Bridge within the Study Area. (Garner at. al, 2011).

As shown in **Figure 18** designated critical habitats for the Alabama Sturgeon, Orangenacre Mucket, and Southern Clubshell are present within the Alabama River throughout the Study Area. The USFWS has identified five Primary Constituent Elements (PCE(s)) necessary for the conservation for the Alabama Sturgeon: (1) a range of flows with a minimum 7-day flow of 4,640 cfs during normal hydrologic conditions, measured in the Alabama River at Montgomery; (2) river channel with stable sand and gravel river bottoms, and bedrock walls, including associated mussel beds; (3) limestone outcrops and cut limestone banks, large gravel or cobble such as that found around channel training devices, and bedrock channel walls that provide riverine spawning sites with substrates suitable for egg deposition and development; (4) long sections of free-flowing water to allow spawning migrations and development of eggs and larvae; and (5) water temperature not exceeding 90 °Fahrenheit (32 °Celsius), dissolved oxygen content over 4 milligrams per liter, and potential of hydrogen (pH) within the range of 6.0 to 8.5.

The USFWS has identified six PCE(s) essential for the conservation of the Orangenacre Mucket and Southern Clubshell. The SRRU Unit 24, which includes the section of the Alabama River within the Study Area, has been identified as containing the PCEs to a degree that allows the survival of these species. These elements are: (1) geomorphically stable stream and river channels and banks; (2) a flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of mussels and their fish hosts in the river environment; (3) Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages; (4) sand, gravel, and/or cobble substrates with low to moderate amounts of attached filamentous algae, and other physical and chemical characteristics necessary for normal behavior, growth, and viability of all life stages; (5) fish hosts with adequate living, foraging, and spawning areas for them; and (6) few or no competitive or predaceous nonnative species present. All efforts will be made to avoid affecting the critical habitat during this project.

Figure 18: Critical Habitat within the Study Area



3.2.3.1.1. *Future Without Project Conditions**

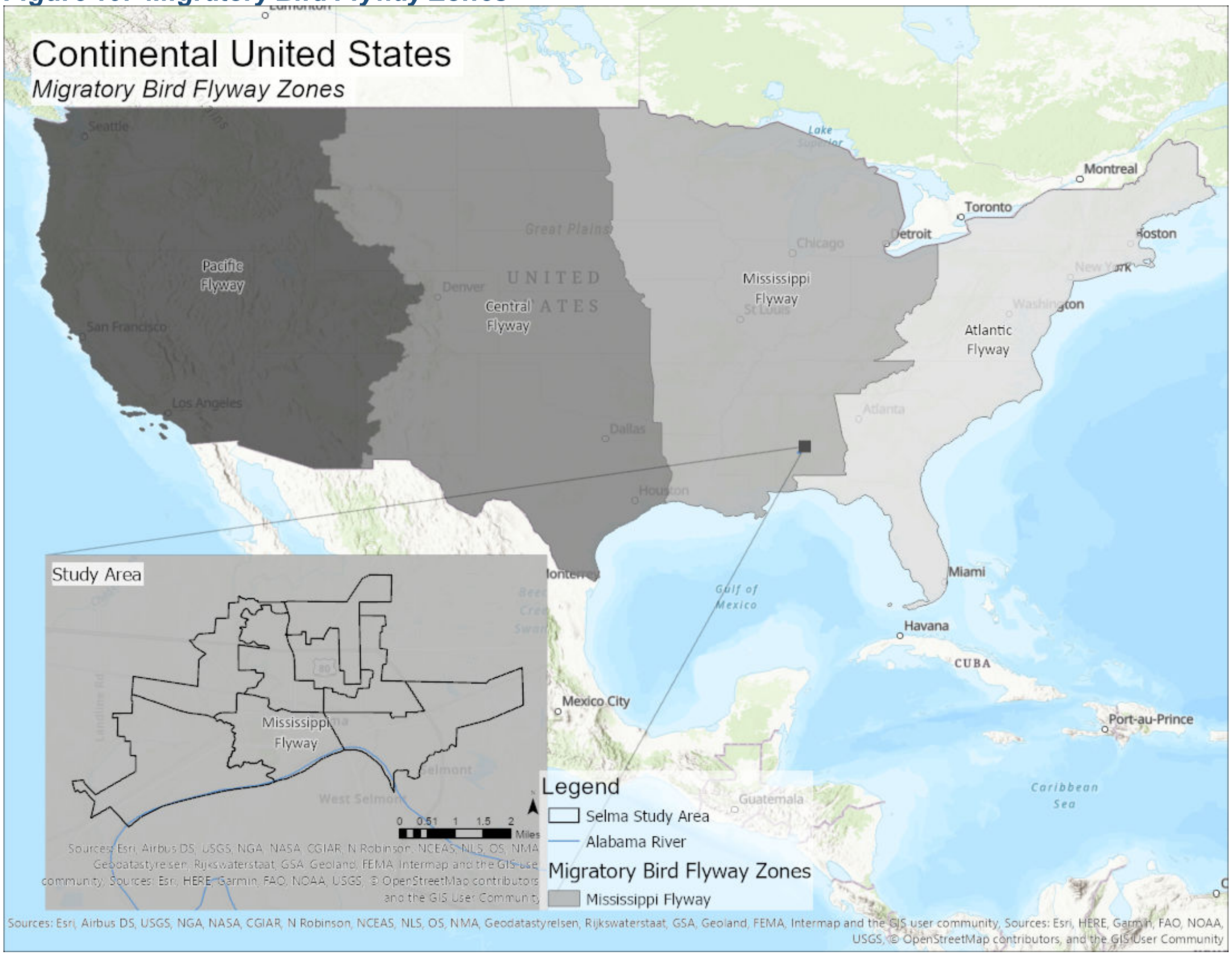
Additional Federally listed species as well as critical habitat could be proposed under FWOP conditions.

3.2.3.2. *Migratory Birds**

The Migratory Bird Treaty Act (MBTA) makes it illegal to "take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter" a species identified in 50 CFR 10.13. The USFWS has statutory authority and responsibility for enforcing the MBTA under 16 U.S.C. 703-712. The USFWS recently proposed in the Federal Register (Vol. 83, No. 229, November 28, 2018) both adding and removing species. Migratory species protected by the MBTA are internationally protected through conventions between the U.S. and Canada, Mexico, Japan, and Russia. Any species protected through one or more of the four international conventions is qualified for protection under the MBTA.

The Study Area is located in the Mississippi Flyway zone. No stopover sites are known to occur within the Study Area; however, migratory birds, such as the Common Ground-Dove (*Columbina passerine exigua*) occasionally utilize the Study Area as a resource.

Figure 19: Migratory Bird Flyway Zones



3.2.3.2.1. *Future Without Project Conditions**

The FWOP conditions would not be significantly changed from existing conditions.

3.2.3.3. *Bald and Golden Eagles**

The Bald and Golden Eagle Protection Act (BGEPA) prohibits the "taking" of Bald Eagles (*Haliaeetus leucocephalus*) or Golden Eagles (*Aquila chrysaetos*) as defined in 16 U.S.C. 668-668c. "Take" is defined by the BGEPA as to "pursue, shoot, shoot at, poison, wound, kill capture, trap, collect, molest or disturb." "Disturb" is further defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." The BGEPA extends to activities occurring near nests when eagles are not present.

According to the National Bald Eagle Management Guidelines dated May 2007, Bald Eagles primarily nest near aquatic habitat in mature or dead trees. Man-made structures such as power-poles and communication towers also serve as nesting sites for some Bald Eagles. Bald Eagle nests are distinctly large at four to six ft in diameter and three ft deep weighing more than 1,000 pounds. Nests are generally constructed with large sticks and lined with soft and pliable greenery such as moss, grass, or lichens.

There are no known Bald or Golden Eagle nests within the Study Area; however, according to the ALDCNR, there are confirmed nests within Dallas County, Alabama. Bald Eagles primarily inhabit forested habitat adjacent to large river systems. As one of the largest riverine systems in Alabama, the probability of active and inactive nests surrounding the Alabama River are high.

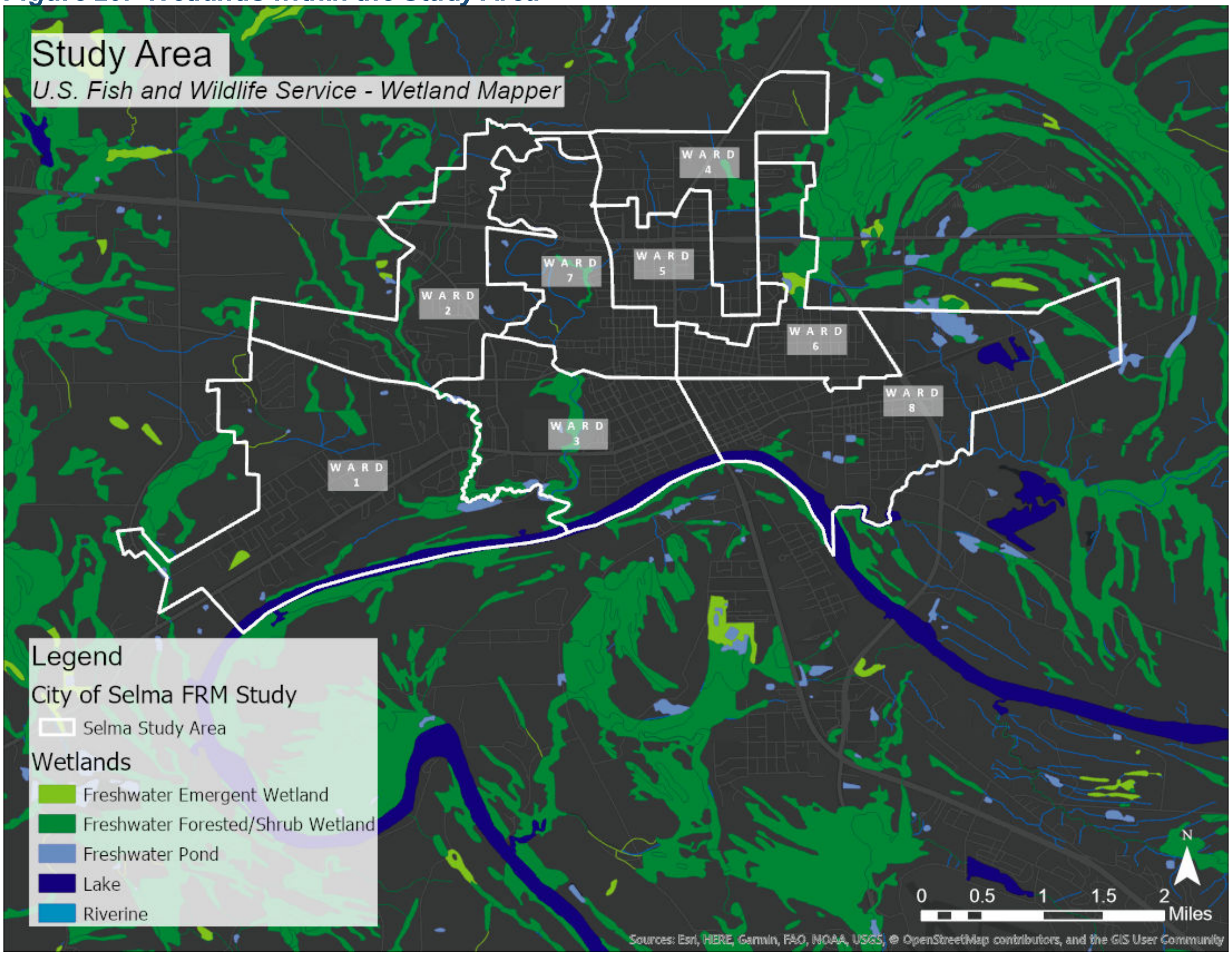
3.2.3.3.1. *Future Without Project Conditions**

Under FWOP conditions the possibility for Bald Eagle population increase is plausible.

3.2.4. *Wetlands**

Section 404 of the CWA establishes a program to regulate the discharge of dredged or fill material into Waters of the U.S., including wetlands. Wetlands are defined as jurisdictional when three criteria are met: hydrologic connectivity, hydric soils, and hydrophyte vegetation (USACE, Wetlands Delineation Manual, 1987). No delineations have been conducted as part of this feasibility study. However as shown in **Figure 20** the Study Area contains a low potential for having jurisdictional wetlands. This is primarily due to the highly urbanized environment. The surrounding area does have a high potential for having jurisdictional wetlands; however, no formal efforts to delineate wetland boundaries have occurred.

Figure 20: Wetlands within the Study Area



Activities in Waters of the U.S. regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. Section 404 requires a permit before dredged or fill material may be discharged into waters of the U.S. The basic premise of the program is that no discharge of dredged or fill material may be permitted if: (1) a practicable alternative exists that is less damaging to the aquatic environment (i.e. avoid) or (2) the nation's waters would be significantly degraded.

3.2.4.1. *Future Without Project Conditions**

FWOP conditions would not be significantly changed from existing conditions. No significant land use development within the Study Area is anticipated to occur that would decrease potential wetland habitats.

3.3. Cultural and Historic Resources*

3.3.1. *Architectural**

The Study Area contains the most Nationally Registered Historic Properties in a city or town in the State of Alabama. These structures contribute to five National Register Historic Districts: Water Avenue District, Old Towne District, Riverview District, Ice House

District, and Civil Rights Historic District. Some of structures also contribute to the viewshed of the National Historic Landmark, the Edmund Pettus Bridge. Viewshed of a historic property can be crucial to the historic context and integrity of the property and changes to the visual landscape of a property can impact the historic significance of the property. These same structures also contribute to one of the last remaining intact historic riverfronts in the Southeastern United States. Some of the structures along the riverfront are pre-Civil War and have contributed to the cultural makeup of the city since early in its incorporation. Construction dates of these structures range from the 1830s to the 1960s, and include locally, regionally, and nationally significant structures such as the St. James Hotel, the Brown Chapel A.M.E. church, the former National Voting Rights Museum, and the Edmund Pettus Bridge, a National Historic Landmark.

3.3.1.1. *Future Without Project Conditions**

FWOP conditions would be significantly changed in regards to the integrity and viewshed of the Water Avenue and Civil Rights Historic Districts. Geologic models demonstrate a projected loss of bank stability overtime, directly impacting the structural integrity. These projections have been recently realized with one of the contributing historic properties of the Water Avenue and Civil Rights Historic Districts undergoing demolition and another being condemned from public use due to the structural instability. Overtime, a complete loss of the historic riverfront of Selma could be expected.

3.3.2. *Cultural and Archaeological Resources**

The Study Area contains a number of nationally significant cultural and archeological sites, including the 1865 Civil War Battle of Selma and the 1965 Selma to Montgomery Voting Rights Marches. A portion of the Nationally Registered Selma to Montgomery Trail runs through the Study Area. Few areas of the nation encompass such a comprehensive cultural snapshot of America.

3.3.2.1. *Future Without Project Conditions**

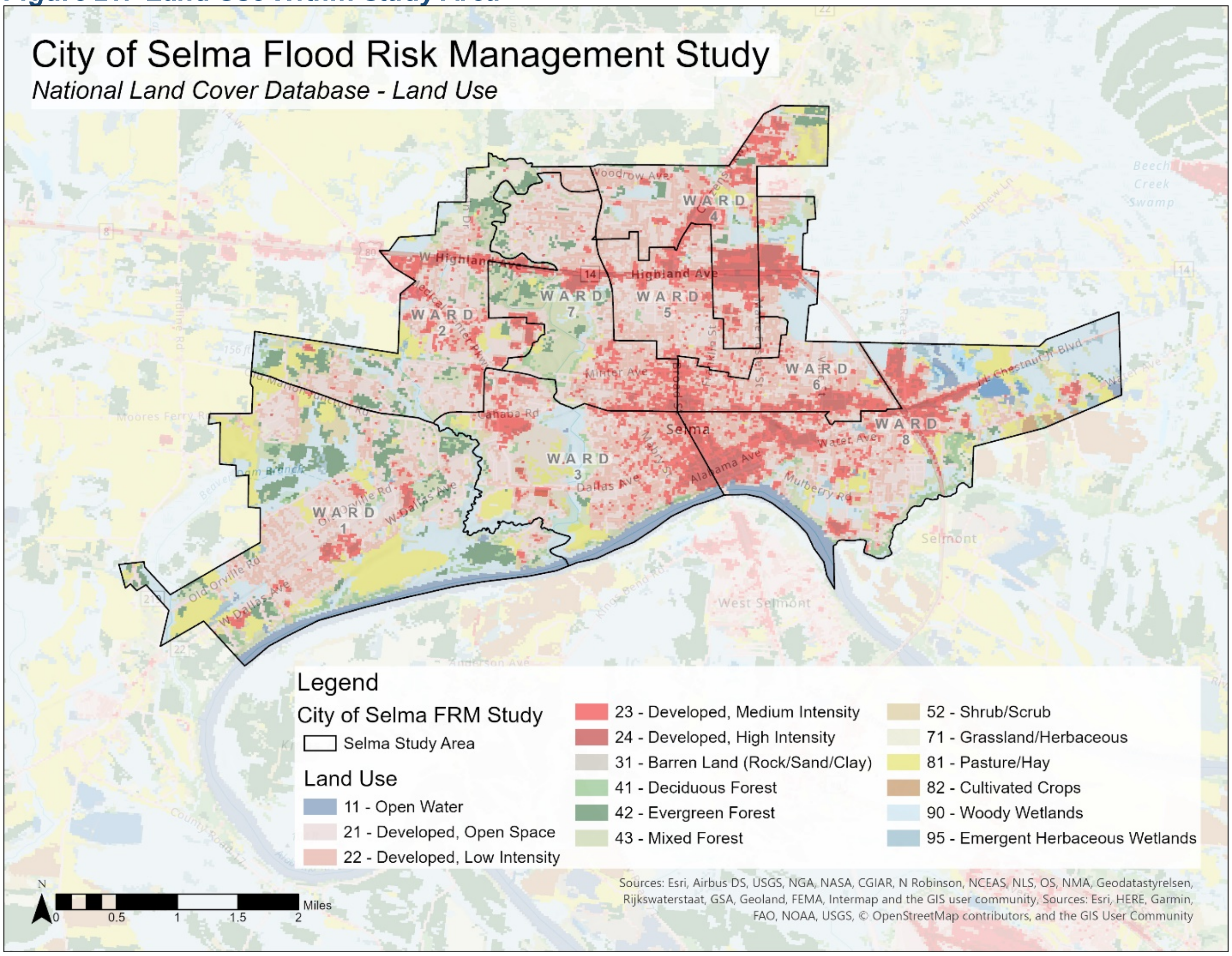
FWOP conditions would be significantly changed in regards to the integrity and viewshed of a number of cultural and archaeological sites. The severe erosion and sloughing along the bankline has diminished the integrity of archeological sites along the riverbank. The potential loss of bankline and structures along the riverfront due to erosion and potential bank failure will significantly impact the viewshed of the Edmund Pettus Bridge and historic Downtown Selma.

3.4. Socioeconomics*

3.4.1. *Land Use**

Land use within the Study Area is highly developed as shown in **Figure 21**. Historically, the Study Area incorporated agriculture and farmland with commercial export, establishing itself as one of the most important river towns in the South during the 1830s – 1860s. After the Civil War, the economic focus of the region shifted from agricultural goods such as cotton to capitalizing on transportation systems such as railroads. This lead to an increased urbanization in the Study Area.

Figure 21: Land Use Within Study Area



3.4.1.1. *Future Without Project Conditions**

Within the extent of the Study Area, FWOP conditions would not be significantly changed from existing conditions; however, metropolitan cities in the headwater portions would experience additional development which would result in an increase of 2% in flow over a 50-year POA.

3.4.2. *Noise**

Ambient noise of the Study Area is consistent with urban and suburban zones. The project location is within the Historical Waterfront Park and the downtown area of Selma is less than a mile away. Traffic, construction, and community events contribute to occasional higher levels of steady noise.

3.4.2.1. *Future Without Project Conditions**

The FWOP conditions would not be significantly changed from existing conditions.

3.4.3. *Aesthetics**

Aesthetics is an approach to assign appreciation of natural environments. The general aesthetics of the Study Area is moderately to heavily urbanized.

According to the Planning P&G dated 1983, "Aesthetic attributes are perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation. Included in this category are sights, sounds, scents, tastes, and tactile impressions and the interactions of these sensations, of natural and cultural resources."

The Study Area is comprised of a unique aesthetic directly attributed to the historic riverfront. The Selma riverfront is one of the last remaining intact riverfronts in the U.S., particularly the southeast U.S. This aesthetics provides a rarely seen snapshot in time with many of the structures lining the riverfront that were constructed in the 1800s. As stated in **Section 3.3.1**, the historic viewsheds of the Edmund Pettus Bridge, the riverfront of the Alabama River, and the Water Avenue and the Civil Rights Historic Districts contribute greatly to the aesthetics of the Study Area.

3.4.3.1. *Future Without Project Conditions**

If the bank is left unaddressed, the migration of soil out from under the building foundations could continue. This FWOP scenario could ultimately threaten the historically significant structures and historical viewsheds.

3.4.4. *Recreation**

According to the City of Selma Recreation and Communities homepage, which was last updated February 9, 2017, there are six community parks with two additional parks proposed for construction. Activities available to the public includes sports such as tennis, soccer, basketball, baseball, volleyball and recreation such as playgrounds, water parks, walking trails, etc. Pockets of community greenspace occurs throughout the city as well. The Selma Senior Center provides educational, recreational, socialization, fitness, etc. to citizens aged 55 years or older. A popular park within the Study Area is the Historic Riverfront Park. Work was done in 2012 to renovate the historic train depot into an amphitheater and construct an adjacent river walk. Significant erosion along the bank at this park has prompted a Section 14 investigation and has resulted in an emergency bank stabilization project. The Selma City Marina at RM 207.3 is a small boat access channel within the Study Area that the USACE maintains on an as-needed basis. This location serves as an access point for many recreational, hunting, and fishing spots for both local and visiting persons.

Additionally, an annual Riverfront Market Festival occurs yearly to showcase artists and other vendors which draws local crowds.

3.4.4.1. *Future Without Project Conditions**

The FWOP conditions would not be significantly changed from existing conditions. Because land use within the Study Area is not anticipated to change significantly, recreation would not vary greatly.

3.4.5. *Industry**

An assessment of regional industry benefits including tourism, recreation, and income shared between Selma and local towns illuminates interdependencies and supports Federal interests in the region (i.e. Maxwell/Gunter Air Force Base (AFB), National Historic Landmarks and Civil Rights Trails). Several large employers in Selma and the surrounding area include: International Paper Company, Honda Lock-America, and Bush Hog. International Paper's Dallas County, Alabama location employs more than 500 people.

Because of the lack of "brick and mortar" industry due to a shift in focus from transportation and agriculture, the City of Selma has transformed a lot of its economic efforts into Heritage Tourism. The Alabama Department of Tourism (ADOT) reported 1,028 jobs in Dallas County to be supported by tourism in 2018. The ADOT reported Dallas County generated $75,781,018 in tourism revenue in 2018, notching a 7.1 percent increase over 2017. Although these numbers encompass all of Dallas County, it can be inferred that the majority of these tourism dollars stem from the heritage tourism concentrated in downtown Selma.

An example of lost businesses along the riverfront include condemnation of the National Voting Rights Museum resulting in its relocation, and the demolition of the Safelight building.

3.4.5.1. *Future Without Project Conditions**

FWOP conditions would result in continued bankline instability which would result in continued degradation of infrastructure and weaken Selma's appeal for heritage tourism thus reducing tourism and its benefits to Selma.

3.4.6. *Demographics**

The population of Selma according to the 2017 census was 18,370 (U.S. Census, 2017). Since the 2010 census there has been an 11.5% decrease to the city's population (shown in **Table 6**). Of the 18,370 Selma residents, 81.5% percent are reported to be minorities. The mean income for households in Selma is $37,272, and 33.4% of families and 41.4% of individuals are below the Federal poverty line. Of those below the poverty line, 63% of those are under 18, and 15.3% are 65 years or older. (Selma, Alabama Population 2020).

Figure 22 on **Page 42** shows a visual representation of the distribution for total population, percent minority, low income, and poverty.

Table 6: Selma Population Estimate

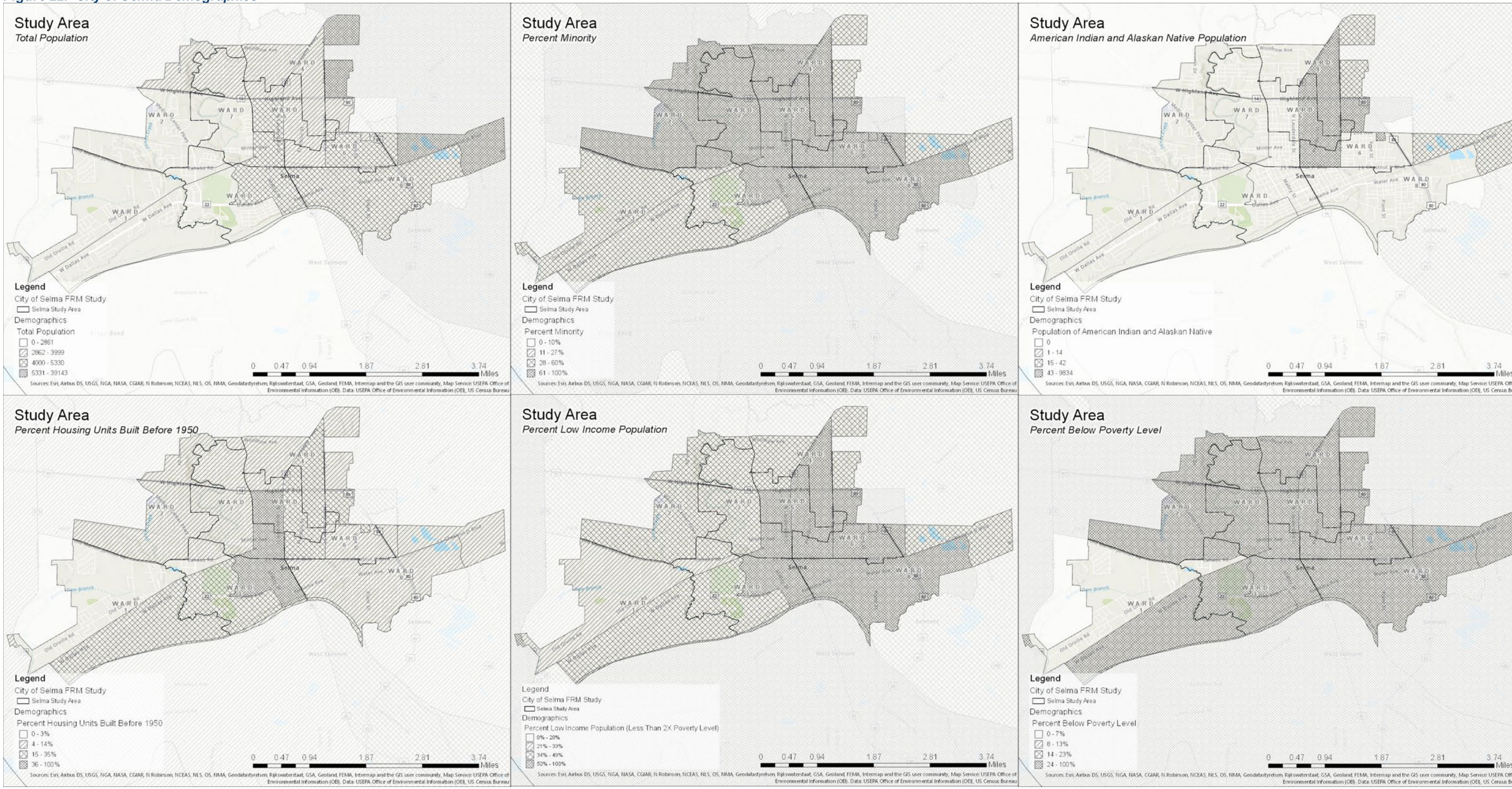
Geography	Census	Estimates Base	2010	2011	2012	2013	2014	2015	2016	2017
City of Selma, Dallas County, Alabama	20,756	20,756	20,785	20,505	20,199	19,786	19,612	19,270	18,833	18,370

Note: Estimates based on April 2010 Census for July 1st of shown year

3.4.6.1. *Future Without Project Conditions**

No significant increase in population is anticipated under FWOP conditions. Continued erosion of the riverbank could decrease Heritage Tourism within the Study Area which could decrease the City of Selma's economy and lead to diminished capacity to assist citizens.

Figure 22: City of Selma Demographics



3.4.7. *Public Safety**

Current threats to public safety arise from flooding events and the consequences of riverbank erosion. Due to the slow rising floodwaters, minimal threats to public evacuation and first responder access exist. Additionally, spontaneous sink holes occasionally occur along Water Avenue that pose a threat to pedestrian public safety.

3.4.7.1. *Future Without Project Conditions**

Continued riverbank erosion would lead to a failure of the historical riverbank foundations and thus increased condemnation of infrastructure. Additionally, increased sink hole patterns would continue.

3.4.8. *Traffic and Navigation**

The Selma area is served by two railroad systems, a municipal airport, several motor freight lines, West Alabama Public Transportation, and Trailway Bus service. Major arteries of Interstates 65 and 85 intersect in Montgomery, which is a short 40-minute drive from the City of Selma. U.S. Highway 80, a four-lane thoroughfare, and Alabama Highways 14, 22 and 41 also serve the city. Water Avenue currently serves as the main road for the annual Selma Bridge Crossing Jubilee which draws in a significant volume of tourism traffic. Sink holes along Water Avenue can and have spontaneously occurred due to a number of factors and pose a threat to local traffic patterns.

The Alabama River is considered a low-use navigable waterway. The USACE, Mobile District provides maintenance activities and maintenance dredging of the entire Alabama River navigation channel; however, the only section within the Study Area that USACE, Mobile District maintains is the Selma City Marina small boat access channel at RM 203.7 of 1,000 cubic yards (cy) of material with open water disposal on an as-needed basis. Therefore, navigation within the Alabama River is predominantly utilized by local and visiting boaters and anglers.

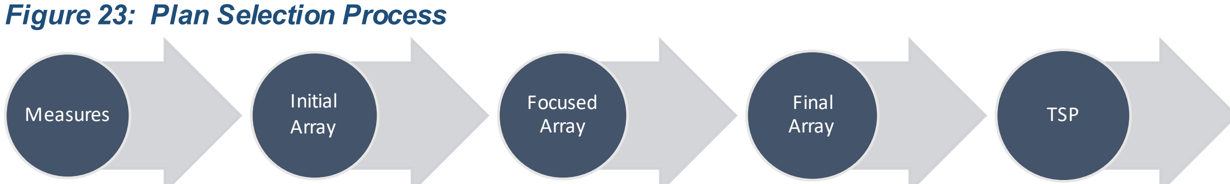
3.4.8.1. *Future Without Project Conditions**

FWOP conditions would not be significantly changed from existing conditions. It is not anticipated that any substantial increase in budget would occur that would allow this section of the Alabama River to be dredged on a more frequent basis.

4.0 PLAN SELECTION

Based on the six-step planning process, risk-informed decision making was used to select the best alternative for the study. **Figure 23** outlines the steps taken during the planning process, which are described in further detail in **Sections 4.1**, **4.2**, and **4.3**.

Figure 23: Plan Selection Process



4.1. Measures

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. With the problems, opportunities, objectives, and constraints in mind, measures were developed in accordance to ER 1105-2-100. Measures were derived based on feedback gathered from the Planning Charette on October 23, 2018. These measures were then evaluated and screened on their ability to meet study objectives and avoid constraints. The criteria for screening the initial measures by using professional judgment included: 1) was it implementable, 2) would it significantly induce flooding, 3) would it be part of a solution that consistently meets the planning objectives and, 4) what are the relative effectiveness to other measures. These measures along with the initial array of alternatives were presented at the AMM held on January 16, 2019.

Identified measures are separated into two categories: Structural and Non-Structural. Each measure considered for this study is referenced in **Table 7**. Measures which were screened out are highlighted in blue. The Structural Measures carried forward were combined into varying alternatives. The Flood Warning System, later renamed as Floodplain Management/Emergency Evacuation Plan (FMEEP), was determined to be applicable to any alternative that may be chosen and therefore was not explicitly stated within each alternative description.

Table 7: Study Measures

Structural Measures	Non-Structural Measures
Levee(s)/Floodwall(s)	Elevating Structures
Riverbank Stabilization	Acquisition/Buyouts
Pump Stations	Relocation of Structures
Culverts/Weirs/Sluice Gates	Flood Warning System (FMEEP)
Bridge Modification (screened out)	Land Use Regulation Changes (screened)
In-Line/Off-Line Detention (screened out)	Green Infrastructure (screened)
Channel Diversion (screened out)	Floodproofing of Structures (screened)
Channel Modification (screened out)	

4.1.1. *Definition of Each Measure*

Structural:

- Levee(s) Floodwall(s): Levees are a man-made embankment used to prevent flooding and are often built to keep high river levels from overflowing into the banks where flooding would be undesirable or cause damage.
- Riverbank Stabilization: Riverbank stabilization is used to protect banklines and inland properties from deterioration caused by erosion due to flooding or increases in overland flow. Methods for riverbank stabilization typically include placing earthen material and riprap to armor the bank or other methods that reduce erosive pressure.
- Pump Stations: Pump stations are used in conjunction with levees to drain flood water from the interior section of the levee. Alone they do not provide flood

protection, but when used as part of a levee system they prevent flooding by pumping floodwaters out of flood prone areas.

- Culverts/Weirs/Sluice Gates: Sluice gates are hydraulic structures that can be opened and closed to control the flow of water through an opening. These structures could be used to prevent flood waters from backing up tributaries that feed main stem rivers. During high flow events, as the river rises water may begin to flow up local tributaries causing flooding from the backwater effect of the main river.
- Bridge Modification: Bridges over rivers and streams can create flow constrictions which reduce hydraulic conveyance of water and may cause water to back up on the upstream side of the bridge. Replacement of the bridge or modifications to the size and/or location of structures such as bridge piers and abutments can relieve the constriction of flow and may reduce flood elevations upstream of the bridge. It is important to note that such modifications can also exacerbate flooding downstream of the bridge due to the increased hydraulic conveyance through the bridge.
- In-Line/Off-Line Detention: In-line/off-line detention is the temporary storage of flood waters used to reduce the peak flood elevation downstream. These structures act to reregulate an incoming flood by storing floodwater and slowly releasing them back into the river. In-line detention would be a dam or weir structure completely crossing the river and creating a flood pool on the main stem of the river. Off-line detention would involve diverting flood waters to a detention pond for temporary storage located adjacent to the river.
- Channel Diversion: Channel diversion involves redirecting flood waters from an upstream point to a downstream along the same river, bypassing a portion of the river and reducing flood risks along the portion of the river that was bypassed. This typically involves the creation of a channel capable of bypassing a specified amount of flow.

Non-Structural Measures:

The following definitions are provided based on the 2019 USACE Field Guide for Conducting Nonstructural Assessments:

- Elevating Structures: Should be considered for lifting an existing structure to an elevation which is at least equal to or greater than the design water surface elevation, which could be the 1% annual chance flood elevation. The final elevation should place the first floor and associated ductwork, plumbing, mechanical and electrical systems above the projected water surface elevation.
- Acquisition/Buyouts: Consists of acquiring the at-risk structure and land that the structure sits upon. The structure is then demolished. The land where the structure had been originally located is purchased, becoming deed restricted in order to prevent development from occurring in the future, and becomes available for open land management as stipulated by the National Flood Insurance Program (NFIP).

- Relocation of Structures: Consists of acquiring the at-risk structure and land that the structure sits upon. Requires physically moving the existing at-risk structure away from the flood hazard area to a location which is completely outside of the floodplain. The land where the structure had been originally located is purchased, becoming deed restricted in order to prevent development from occurring in the future, and becomes available for open land management as stipulated by the NFIP.
- Flood Warning System: Relies upon stream gages and rain gages for collecting hydrologic information, and computer modeling to determine the impacts of flooding for areas of potential flood risk. A flood warning system, when properly installed and calibrated, is able to identify the time available for people occupying the floodplain to safely implement temporary measures or to evacuate the area. For this study this measure was later renamed as the FMEEP.
- Land Use Regulation Changes: Based on the NFIP which requires minimum standards of floodplain regulation. For communities where future growth and expansion has been identified, restrictive land use regulations may be a deterrent to life loss and property damage.
- Green Infrastructure: An environmental solution such as wetland creation or the use of tree rootballs to provide an alternate natural approach to flood damage reduction or erosion.
- Floodproofing of Structures: Can be achieved through either dry or wet methods. Dry methods consist of waterproofing the structure to prevent flood waters from entering. Wet methods require all construction and finishing materials to be water resistant and all utilities elevated above the design flood elevation.

4.1.2. *Evaluation and Screening of Measures*

Measures were screened based on their ability to meet the study objectives and avoid constraints in addition to the discussion below:

Structural

- <u>Levee(s)/Floodwall(s)</u> – Carried Forward: Due to flood inundation seen in Ward 6 and Ward 8, this measure could potentially meet study objectives.
- <u>Riverbank Stabilization</u> – Carried Forward: Due to the severe erosion along the Alabama River this measure would meet the study objectives to reduce the threats to historic structures.
- <u>Pump Stations</u> – Carried Forward: All levees and floodwalls would require pump stations; therefore, this measure was carried forward.
- <u>Culverts/Weirs/Sluice Gates</u> – Carried Forward: Similar to pump stations, levees and floodwalls generally require culverts/weirs/sluice gates; therefore, this measure was carried forward.
- <u>Bridge Modification</u> – Screened Out: Modification was considered for several bridges along tributaries in Selma as well as the main stem Alabama River. It was discovered that only one bridge analyzed created a minor constriction that may cause any flooding to the Study Area and would only have a minor affect to less than ten (10) structures in extremely infrequent flood events. It was determined

that bridge modification would not be a cost-effective measure and was screened out.

- In-Line / Off-Line Detention – Screened Out: Detention was determined to be impractical based on the volume of flood water storage that would be needed to effectively reduce flooding from the 17,000 square mile basin upstream of Selma. The amount of land necessary to create enough storage would require approximately 100 square miles to be acquired and this was not a practical alternative.
- Channel Diversion – Screened Out: Considerations were given to several sites to utilize channel diversion and there was no practical location to construct a channel capable of effectively diverting enough flood waters to reduce flood risks to any structures in the Study Area. Additionally, there were concerns of the significant cultural and environmental impacts within the Alabama River such as critical habitats and farmlands in the area that would be adversely impacted by channel construction.
- Channel Modification – Screened Out: Channel modification was determined to be impractical along the Alabama River near Selma. There were no constriction points identified which could be modified to effectively increase conveyance and reduce flooding. Furthermore, preliminary hydraulic modeling showed that increased storage in the Alabama River would not produce a meaningful reduction in peak river stages for flood events that affected structures in the Study Area. Additionally, modifying the river would adversely impact significant cultural and environmental resources due to known cultural Civil War sites within the Alabama River watershed.

Non-Structural

- Elevating Structures – Carried Forward: This measure would be implementable if applied at a level with which the NFS could carry out.
- Acquisition/Buyouts – Carried Forward: This measure would be implementable if applied at a level with which the NFS could carry out.
- Relocation of Structures – Carried Forward: This measure would be implementable if applied at a level with which the NFS could carry out.
- Flood Warning System (FMEEP) – Carried Forward: Though the Alabama River exhibits a slow rising flood stage, citizens would benefit from evacuation routes and zones if given ample notice. This measure could be beneficial in conjunction with any alternative.
- Land Use Regulation Changes – Carried Forward: New structures are required to meet current building codes and municipal restrictions. Several structures within Ward 8 are abandoned and/or heavily degraded. As structures are removed due to blight and/or condemnation, land use regulations would ensure that no further development would occur within certain flood prone areas. Additionally, through inclusion with the FMEEP land use regulation would urge no future development within flood prone areas; therefore, this measure could be combined with the FMEEP and determined to be applicable with any alternative.

- Green Infrastructure – Screened Out: Wetland conversion and recreational area conversion were considered as a green infrastructure; however, this measure was impractical due to the topography of the surrounding area and the volume of water that overtops the riverbanks.
- Flood proofing Structures – Screened Out: Would not be effective in floods greater than three feet, flooding in impacted areas is either above three feet or impacted structures are at a higher elevation.

4.2. Alternatives

From the screened measures, multiple alternative plans were developed, either from a single measure or multiple measures combined. The initial alternatives were developed by comparing the alternatives against the study objectives and constraints as well as the screening criteria discussed in **Section 4.2.1**. Alternatives could be combined based on their capability not only to address objectives and avoid constraints, but also for technical feasibility, environmental acceptability, and being economically justified, as well as for the level of life safety risk reduction and cultural resource protection that could be realized. **Table 8** provides a listing of the initial array of alternatives along with a brief description of each. Additionally, because a FMEEP could be combined with any alternative, it was not incorporated into each alternative description.

Table 8: Initial Array of Alternatives Description

Array of Alternatives	Plan Description
No Action Alternative (NAA)	No Federal undertaking would occur and the results would be consistent with FWOP conditions.
Alt. 1: Non-Structural (A-Buyouts, B-Raise Structural Elevation, Structural move)	There are two (2) non-structural alternatives considered. Alternative 1.A includes buyouts which entails the acquisition of parcels, relocation of inhabitants, and demolition of structures. Alternative 1.B includes elevating structures or moving structures altogether out of the floodplain within Ward 8.
Alt. 2: 1967 Selma Levee	1967 Selma Levee with Selmont Levee alignment with floodgates/pumps where needed, buyout as necessary
Alt. 3: Optimized (Short) Selma Levee	Shortened/optimized levee alignment, U.S. Highway 80 tie in, floodgates/pump station where needed, buyout as necessary
Alt. 4: Bank Stabilization	Provide bank stabilization along all or part of RM 256-261
Alt. 5: Bank Stabilization + Buyouts	Combines Alternatives 4 & 1.A-Buyouts.
Alt. 6: Optimized Selma Levee (L3) + Buyouts + Bank Stabilization	Combines Alternatives 3 & 4 & Partial Non-Structural Alt.1 in areas not within the Optimized Levee alignment
Alt. 7: Optimized Selma Levee (L3) + Valley Creek Levee + Pump Station & Sluice Gate + Bank Stabilization	Combines Alternatives 3 & 4 & a smaller levee at Valley Creek & a pump station with a sluice gate at Beaver Dam Branch (maximum structural protection)
Alt. 8: Optimized Selma Levee (L3) + Valley Creek Levee + Buyouts + Bank Stabilization	Combines Alternative 6 plus Valley Creek levee (only purchase, relocation or raising elevation in the Ward 1 considered)
Alt. 9: Optimized Selma Levee (L3) + Valley Creek Levee + Buyouts	Combines Alternative 3, levee at Valley Creek (purchase, relocation or raising elevation in the Ward 1 considered)

Array of Alternatives	Plan Description
Alt. 10: Optimized Selma Levee (L3) + Valley Creek Levee + Pump Station with Sluice Gate	Alternative 7 with No bank stabilization (maximum structural protection without bank stabilization)

The initial array of alternatives was presented at the AMM IPR on January 16, 2019, and were approved by the Vertical Team for continued evaluation and comparison. The initial array of alternatives was screened to identify a focused array of alternatives.

4.2.1. *Screening Criteria*

The alternatives were evaluated and screened throughout the formulation process using the following criteria:

Engineering Criteria

- The plan must represent sound, acceptable, and safe engineering solutions.

Environmental Criteria

- Fully complies with all relevant environmental laws, regulations, policies, executive orders;
- Represents an appropriate balance between environmental sustainability and economic benefits; and
- Developed in a manner that is consistent with the USACE Environmental Operating Principles (EOPs).

Economic Criteria

- Tangible benefits of a plan must exceed economic costs, and
- Each separable unit of improvement must provide benefits at least equal to costs.

Planning Criteria

- Four Planning Criteria: Completeness, Effectiveness, Efficiency, and Acceptability; and
- Four P&G Accounts: NED, RED, OSE, and EQ.

4.2.2. *Initial Array of Alternatives Overview*

The initial round of screening was presented at an IPR held June 26, 2019 and captured in a Memorandum to the Chief of Planning and Policy Division at SAD dated August 1, 2019. A number of recommendations for buyout options were identified that included recreation benefits as part of the array of alternatives. It was determined no additional benefits would derive from recreation in the buyout area as Ward 8 is too far removed from the economic/tourism hub of downtown Selma. Further analysis of the economic/tourism benefits of downtown Selma are detailed in **Appendix C**.

The remaining alternatives were then further refined to include identification for sub-options of the buyout and levee alignments. These were presented at the IPR held October 9, 2019. Discussion on the feasibility of each of the options are provided in **Section 4.2.2.1**.

Table 9 demonstrates a qualitative check to determine which of the initial alternatives met study objectives and avoided constraints. Alternatives that either met and/or partially met the objectives and avoided constraints were kept for further consideration. After additional review and coordination, a reassessment of the levees as a structural alternative was conducted (Memorandum to the Chief of Planning and Policy dated January 22, 2020). Consequently, levee alignments (Alt. 2 - 1967 Levee and Alt. 3 - Optimized Levee) were further evaluated. All screened out alternatives are denoted in blue highlight and discussed in **Section 4.2.2.1.**

Table 9: Screening of Initial Array into Focused Array of Alternatives

Alternative Description	Feasible	Meets Objectives	Avoids Constraints
Alt. 1.A – Buyout	Yes	Partially	Partially
Alt. 1.B – Elevation/Relocation of Structures (screened out)	No	Yes	Partially
Alt. 2 – 1967 Levee	Yes	Yes	Partially
Alt. 3 – Optimized Levee	Yes	Yes	Partially
Alt. 4 – Bank Stabilization+ Riprap	Yes	Partially	Yes
Alt. 5 – Bank Stabilization + Buyout	Yes	Yes	Partially
Alt. 6 – Optimized Levee + Buyout + Bank Stabilization	Yes	Yes	Partially
Alt. 7 – Optimized Levee + Valley Levee + Pump Station/Gates + Bank Stabilization (screened out)	No	Partially	No
Alt. 8 – Optimized Levee + Valley Levee + Buyout + Bank Stabilization (screened out)	No	Yes	No
Alt. 9 – Optimized Levee + Valley Levee + Buyout (screened out)	No	Partially	No
Alt. 10 – Optimized Levee + Valley Levee + Pump Station w/ Sluice Gate (screened out)	No	No	No

4.2.2.1. *Evaluation and Screening Discussion of Initial Array and Options*

4.2.2.1.1. *Alternative 1.A: Buyout Options*

4.2.2.1.1.1. Buyout Option 1 (330 parcels) and Option 2 (157 parcels)

As discussed in **Section 3.1.1.1**, the majority of flooding occurs in Ward 8. As such, buyout options were targeted for this area. Buyout option 1 selected the majority of Ward 8 in order to reduce the greatest amount of structures at risk for flood damages. A total of 330 parcels for option 1 were identified; however, implementation of this option would cause significant impacts to the City of Selma. Similarly, option 2 was refined to 157 parcels to reduce the adverse impacts while still removing a large portion of residents within Ward 8. For owner-occupants, Housing of Last Resort will ensure availability of DSS housing, notwithstanding cost implications; however, for tenant-occupants, preliminary market research has indicated a shortage of DSS rental accommodations that would be in the financial capability of displaced and within general project area. In the opinion of the USACE, Mobile District Real Estate Division, the City of Selma does not have sufficient manpower to manage and/or execute this level of relocation assistance/buyout in accordance with P.L. 91-646; therefore, these options were screened out from further analysis and not selected as the Alternative 1.A buyout footprint.

4.2.2.1.1.2. Buyout Option 3 of 25 parcels

This buyout footprint was reduced to 25 parcels based on the number structures in Ward 8 that received greater flood damages at higher flood depths during the 0.1 AEP, or 10-year, flood event. This option excluded certain industrial parcels in 0.1 AEP. As such, this option was chosen as the Alternative 1.A buyout footprint.

Since 25 owners would be involved, and several of these would involve non-residential displacements, hypothetically a P.L. 91-646 involuntary relocation may be plausible. Nevertheless, shortage of DSS tenant-based housing would be a prevailing issue impacting the project's schedule, as well as questions regarding the capability of the City of Selma to execute the plan in accordance with P.L. 91-646. The USACE, Mobile District, Real Estate Division opinion is the same for each of the buyout options.

4.2.2.1.2. *Alternative 1.B: Elevation/Relocation of Structures*

Elevation and/or relocation of homes out of Ward 8 was screened due to the age and condition of the structures. Implementation of this alternative would have caused irreparable damage to the structures due to their instability.

4.2.2.1.3. *Alternative 2: 1967 Levee Alignment*

Because this alternative was previously evaluated in the 1967 USACE FRM Study, this alignment was carried forward for comparison purposes.

4.2.2.1.4. *Alternative 3: Optimized Levee Alignment Options*

4.2.2.1.4.1. L2 Option

This alignment focused on only the Selma portion of the entire 1967 levee alignment. Preliminary professional judgment determined that this alignment would not provide additional benefits as compared to L3 option (**Section 4.2.2.1.4.2**) and would cost a substantial amount more; therefore, this alignment was not selected as the "optimized" footprint.

4.2.2.1.4.2. L3 Option

Alignment L3 footprint ran across the southern portion of Ward 8 with a tie-in feature to U.S. Highway 80. A review of the HEC-River Analysis System model showed that U.S. Highway 80 could withstand flooding up to the 0.1 AEP (100-year) flood event with added features such as clay revetment and floodgates. This design was the least costly levee alignment while protecting the same amount of structures; therefore, this footprint was selected as the "optimized levee alignment".

4.2.2.1.4.3. L5 Option

The footprint of L5 was essentially the same as L3; however, the levee ran parallel with U.S. Highway 80 rather than utilizing a tie-in feature. Like L2, preliminary professional judgment determined that this alignment would not provide additional benefits as compared to L3 and would cost a substantial amount more; therefore, this alignment was not selected as the "optimized" footprint.

4.2.2.1.5. *Alternative 4: Bank Stabilization*

Due to severe erosion conditions between RM 256 and 261, bank stabilization was carried forward and further refined as discussed in **Section 4.2.3.1.3**.

4.2.2.1.6. *Alternatives 5 and 6: Combinations*

Alternatives 5 and 6 were carried forward because they are varying combinations of Alternative 1.A Option 3, Alternative 4, and/or Alternative 3 Optimized Levee Alignment Option L3.

4.2.2.1.7. *Alternatives 7-10: Combinations with Valley Creek Levee Alignment*

The analysis showed that of the structures within the Valley Creek floodplain very few were affected by the 0.01 AEP (100-year) flood event or less; therefore, this alignment was not selected as a standalone levee alignment, but rather was combined with the "Optimized Levee" in Alternatives 7-10. Preliminary professional judgment determined that these alignments would be cost prohibitive (both initial construction cost and maintenance), would not provide additional benefits, have the potential to impact cultural and environmental resources, and would likely induce flooding in the adjacent town of Selmont, Alabama.

4.2.3. *Focused Array of Alternatives*

After further refinement and screening of the initial array as discussed in **Section 4.2.2**, the focused array of alternatives was developed and is listed in **Table 10**. The Focused Array of Alternatives was presented to the vertical team at a post-AMM IPR in June 2019. Alternative 4 was defined to target 1500 linear ft of riverbank. This was due to the bulk of the erosion occurring in the area between Church and Franklin Streets.

Table 10: Focused Array

Focused Array of Alternatives
Alt. 1.A – Buyout
Alt. 2 – 1967 Levee
Alt. 3 – Optimized Levee
Alt. 4 – Bank Stabilization+ Riprap
Alt. 5 – Bank Stabilization + Buyout
Alt. 6 – Optimized Levee + Buyout + Bank Stabilization

4.2.3.1. *Evaluation and Screening Discussion of Focused Array and Options*

The focused array of alternatives was screened based on their ability to meet objectives, avoid/minimize constraints, adherence to the four planning criteria, as well as their resiliency and sustainability. Bank stabilization construction methods, or "options", were evaluated based on professional judgment and engineering feasibility to inform the selection for Alternative 4. Of the entire focused array, only Alternative 2 was screened out from further analysis.

4.2.3.1.1. *Alternatives 1.A, 3, 5, and 6*

No Further refinement was needed for these Alternatives. These alternatives were carried forward based on professional judgement and engineering feasibility.

4.2.3.1.2. *Alternative 2*

Alternative 2 met the study objectives but did not avoid the study constraints, in particular the City of Selma's ability to maintain a large levee system. Furthermore, this alternative is more costly and has the potential to have greater environmental and cultural impacts when compared with Alternative 3. **Table 11** provides a first cost estimate that shows Alternative 2 is significantly higher than the cost of the other alternatives as shown in **Table 16**.

The first costs were stated in average annual terms using the Fiscal Year (FY) 20 discount rate of 2.75% and a 50-year POA. Interest during construction (IDC) was added to the Rough Order of Magnitude (ROM) first costs assuming 48 months for Alternative 2. Annual operation and maintenance (O&M) costs were included.

Table 11: Cost Calculation for Alternative 2

Alternative	First Cost	IDC	O&M	Average Annual Cost
2	$297,070,000	$16,717,347	$184,000	$11,806,972

****based on October 2019 price level***

A preliminary qualitative environmental impacts analysis, based on professional judgment, for Alternative 2 showed high impacts across nearly all resources within the surrounding area as shown in **Table 12**.

Table 12: Environmental Impacts of Alternative

Factors	Alt. 2 (1967 Levee)
Physical Environment	HIGH
Wetlands	HIGH
Federally Protected Species	HIGH
Cultural Resources	HIGH
Socioeconomics	HIGH

Table 13 shows the Regional Economic System Model (RECONS) analysis for Alternative 2 with factors for regional development, which is indicative of more development due to a more robust design; however, the O&M burden on the NFS would be significant.

Table 13: Regional Economic System Model for Alternative 2

Factors ($000)	Alt. 2 (1967 Levee)
First Costs	$297,070
Local Capture	$176,172
Output	$216,799
Jobs	1,249*
Labor Income	$64,527
Value Added	$91,070
Results Discussion	*Jobs generated are short-term resulting from construction spending.

Based on this analysis, Alternative 2 was screened out from further consideration.

4.2.3.1.3. *Alternative 4 Bank Stabilization Options*

Alternative 4 was initially refined to focus on 1500 linear ft of bankline along Water Avenue in Selma based on areas most vulnerable to erosion and sloughing. The bulk of the erosion was occurring in the area between Church and Franklin Streets, which coincidentally was where the historic building types were located. Alternative 4 was then further refined to approximately 750 linear ft due to installation of erosion control measures upstream and immediately adjacent to the refined footprint. The downstream limit was selected due to existing structure loss which would not derive substantial benefits from inclusion within the footprint. Construction methods, presented as “options”, included a range of river shoreline stabilization techniques that were based on similar USACE projects.

4.2.3.1.3.1. Bank Stabilization Option 1, Sheet Pile Wall

This option consists of driving sheet pile into the ground to form a continuous wall. The sheet pile would be driven to the necessary embedment as determined by design. Additionally, dependent upon the final configuration, the sheet pile wall would likely require tie backs at a set spacing along the wall, anchored into the existing earth on the dry side of the wall.

Vibrations from the placement (driving) of the sheet-pile wall could affect existing structures and foundations and lead to failure of the structures. Contractors may be reluctant to assume the liability for this construction method. Because this variant of the alternative could negatively impact the stability of the historic structures along the bankline, this option was screened out from further evaluation and comparison.

4.2.3.1.3.2. Bank Stabilization Options 2a/b, Riprap and/or Extension

This option consists of reinforcing the bank by providing a large amount of riprap/large stone to the existing bank, creating a more gradual slope that extends out into the river. This construction method presents both constructability and aesthetic concerns. This method would require a severe setback and the toe would extend far into the Alabama River, which would cause navigation impediments. As such, this configuration was screened out from further analysis.

4.2.3.1.3.3. Bank Stabilization Option 3, Cast in Place

This option consists of dewatering, excavating, prepping the foundation, constructing formwork, and pouring a continuous cast-in-place concrete wall along the length of bank to be stabilized. This construction method is aesthetically pleasing; however, it requires coffer dams and dewatering which adds a significant amount to the cost of construction. Environmental impacts resulting from the dewatering would be substantial; therefore, this configuration was screened out from further analysis.

4.2.3.1.3.4. Bank Stabilization Option 4, Soldier-Pile Wall and Riprap

This option is similar to the sheet pile wall discussed above. It consists of utilizing intermittently spaced piles, commonly referred to as soldier piles, which form part of the main structural resisting system. As opposed to the driving method of embedding the sheet piles, the soldier piles can be installed into pre-drilled holes and grouted in-place. Horizontally spanning members, commonly referred to as lagging, span between the soldier piles and collect most of the retained earth pressures which are then transferred to the soldier piles. A concept of the soldier pile wall is provided in **Figure 36**. Riprap will be used to reinforce the upstream and downstream ends of the wall.

Since driving the piles can be avoided, construction is not likely to affect existing structures and foundations. This option also presents the least environmentally damaging impacts to natural resources, cultural artifacts, and UXOs; therefore, this configuration was selected as the Bank Stabilization structural design for Alternative 4.

4.2.4. *Final Array of Alternatives**

As a result of the above evaluation and Vertical Team coordination, the following were identified as the final array of alternatives:

- Alternative 1.A (Buyout);
- Alternative 3 (Optimized Levee);
- Alternative 4 (Soldier-Pile Wall);
- Alternative 5 (Soldier-Pile Wall and Buyout); and
- Alternative 6 (Combination of Alternative 1.A and 5, but with a modified buyout footprint to capture parcels within Ward 8 and outside the levee alignment).

4.2.4.1. *Description of Work to be Performed**

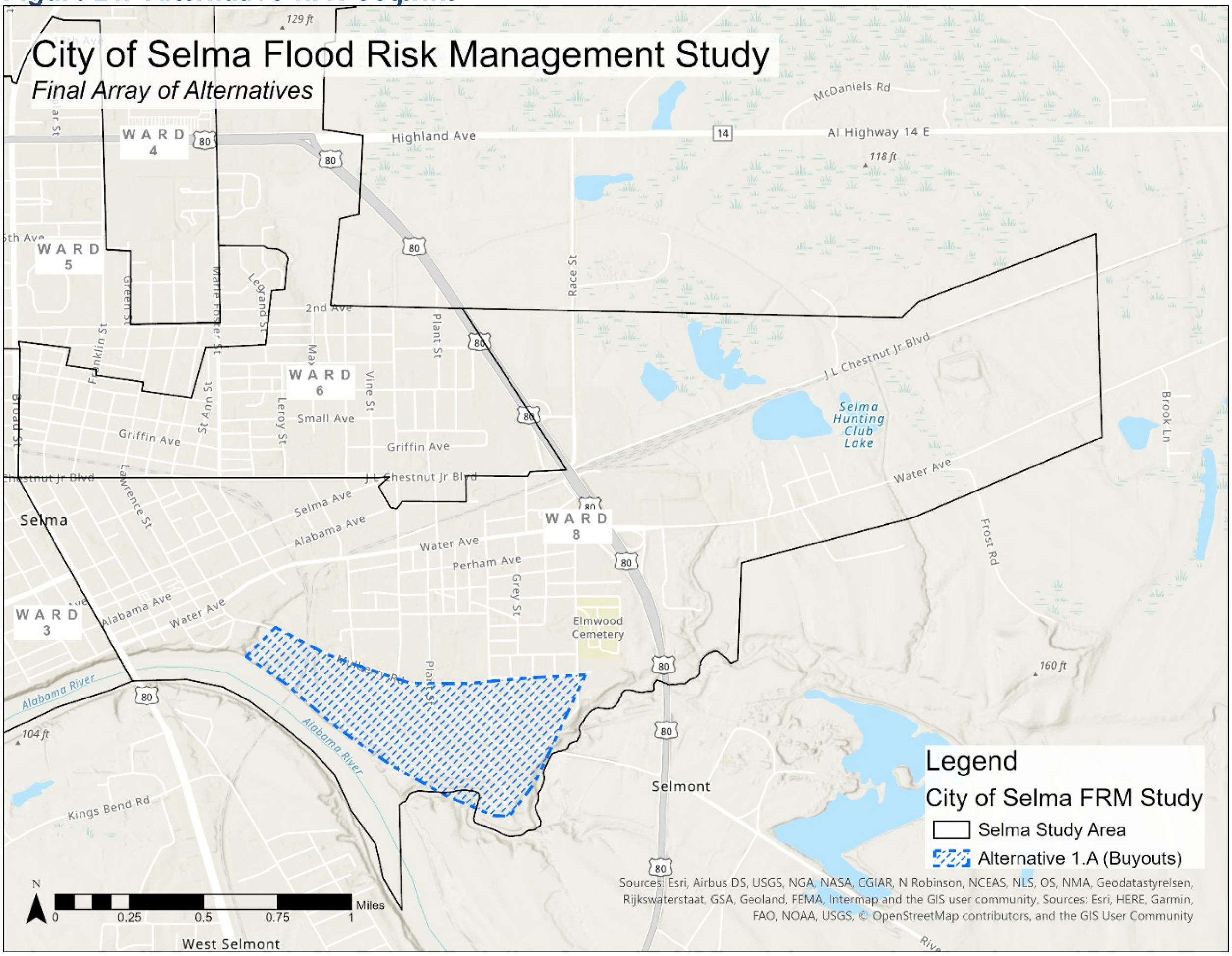
4.2.4.1.1. *No Action Alternative**

The NAA is based upon a 50-year POA in which no work is performed. This alternative is representative of the FWOP condition which is the baseline from which to evaluate all other alternatives.

4.2.4.1.2. *Alt. 1A: Buyouts**

Approximately 25 parcels were identified within the buyout footprint encompassing approximately 170 acres as shown in **Figure 24**. Implementation of this alternative would require acquisition of structures and relocation of inhabitants. Structures would then be demolished. Staging areas for demolition would be located within each parcel. Access would be obtained using existing roads. This alternative would take approximately 18 months to complete.

Figure 24: Alternative 1.A Footprint



4.2.4.1.3. *Alt. 3: Optimized Levee Alignment**

The entirety of the Alternative 3 optimized levee alignment is shown in **Figure 25.** This alignment is comprised of two components: (1) “new” levee construction, and (2) U.S. Highway 80 revetment and reinforcement. The alignment would span approximately 1.6 mi of “new” levee construction across the southern portion of Ward 8 and approximately 2.0 mi of U.S. Highway 80 revetment and reinforcement for a total of 3.6 mi. The base of the “new” levee within Ward 8 would span approximately 94 ft wide; therefore, the “new” levee construction would encompass approximately 18 acres. Two flood gates would be placed at intersections along U.S. Highway 80. **Table 14** itemizes the quantities of fill material for each section of the alternative. Disposal areas would be required to place excavated material. Staging areas would also be required to contain all construction material necessary to build the levee and reinforce U.S. Highway 80; however, potential locations for this alternative have not been identified. Access would be obtained using existing roads. This alternative would take approximately 36 months to complete.

Figure 25: Alternative 3 Footprint

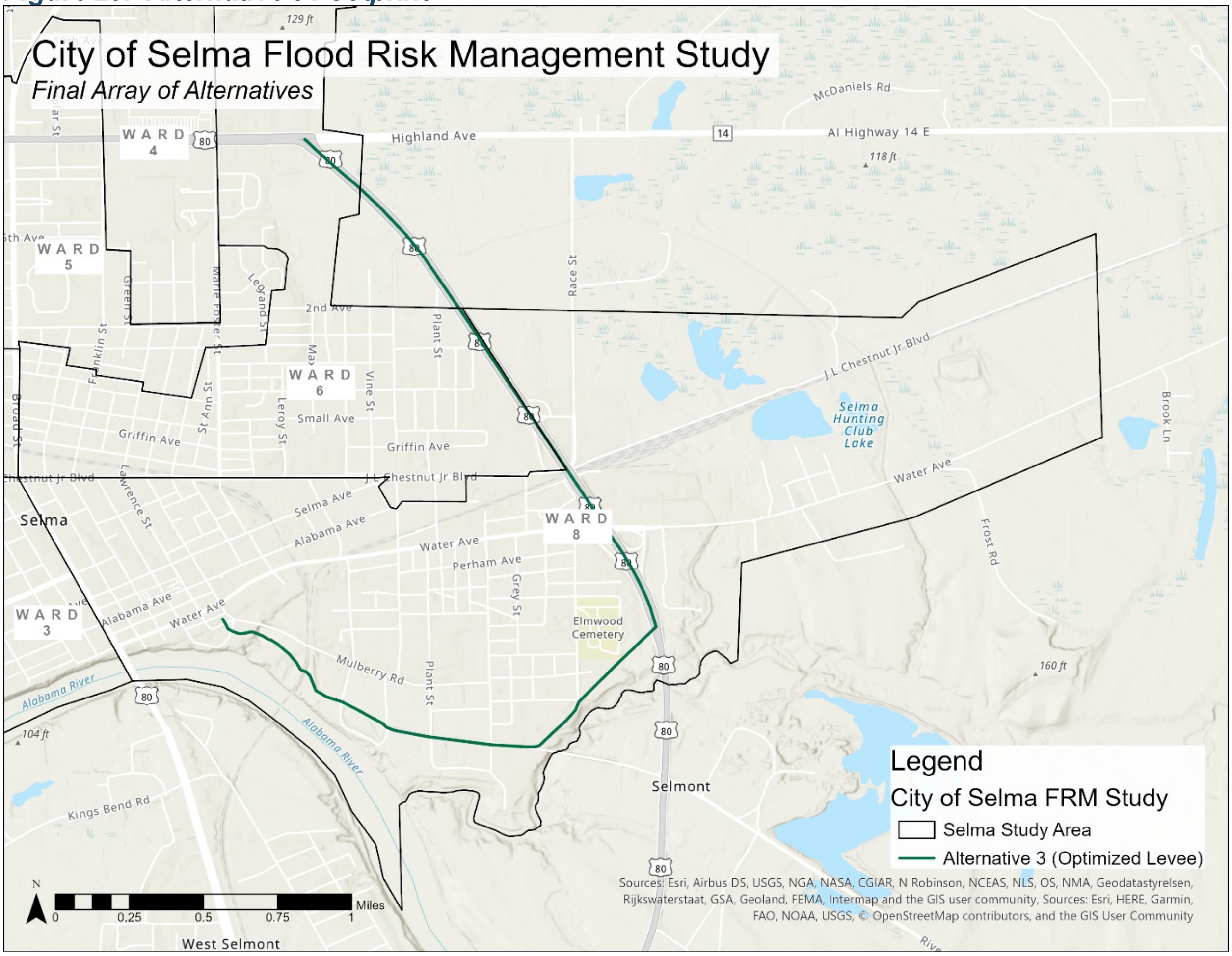


Table 14: Levee Alignment Fill Materials and Quantities

Material	Levee (1.6 mi)	U.S. Highway 80 (2.0 mi)
Clay Core	80,592 cy	40,000 cy
Select Fill	241,777 cy	60,000 cy
Total Fill	322,369 cy	100,000 cy

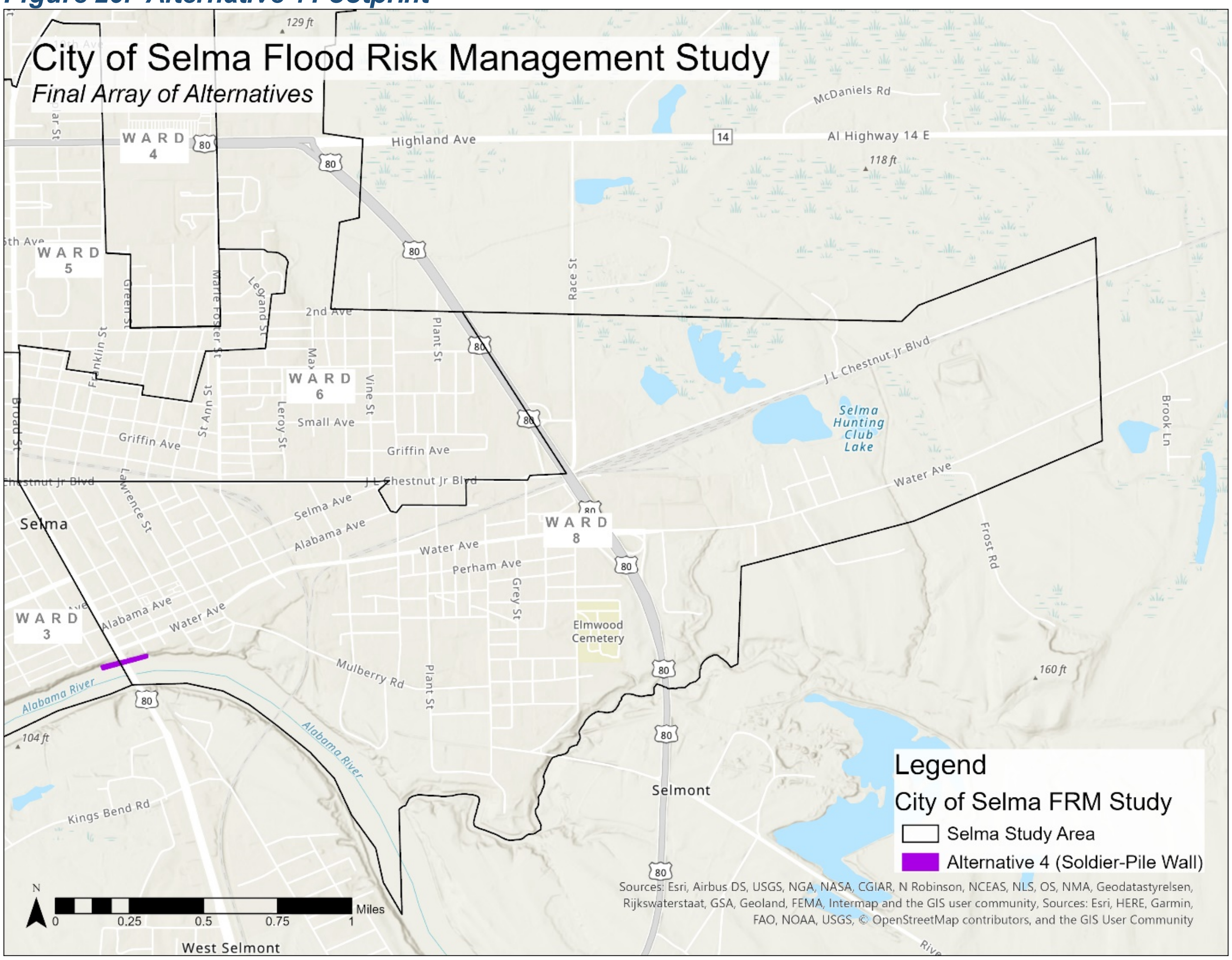
4.2.4.1.4. *Alt. 4: Soldier-Pile Wall**

The footprint for Alternative 4 is shown in **Figure 26**. Staging, construction, and access of the Soldier-Pile Wall would occur from the Alabama River. **Table 15** is a preliminary/conceptual estimation of materials and quantities necessary to construct the Soldier-Pile Wall. Approximately 94 H–Piles would be set at approximately 8 ft on center throughout the approximate 750 linear ft of design length and would be drilled in place. Tiebacks would be required for each H-Pile. Concrete wall panels will be placed between each H-Pile and riprap would cap each end. The geotechnical investigation is tentatively scheduled to be completed in March 2021, at which time the proposed layout and footprint of the Soldier-Pile Wall would be finalized. The H-Piles would be lowered into holes drilled using equipment such as an auger, then each H-Pile would be grouted at the location of each hole using material similar to Portland cement concrete. At this phase of the study it has not been determined if clearing and grubbing of the riverbank would be required; however, the maximum potential vegetation removal would encompass eight (8) acres. In total, this alternative would take approximately 30 months to complete.

Table 15: Soldier-Pile Wall Materials and Quantities

Material	Soldier-Pile Wall (~750 linear ft)
H-Piles	94 (approximate)
Steel Anchor Tiebacks	94 (approximate)
Concrete Panels (4 ft x 8 ft x 8")	22,500 square feet (sq ft)
Granular Fill	12,500 cy
Riprap	3,333 cy
Total Fill	**15,833 cy (approximate)**

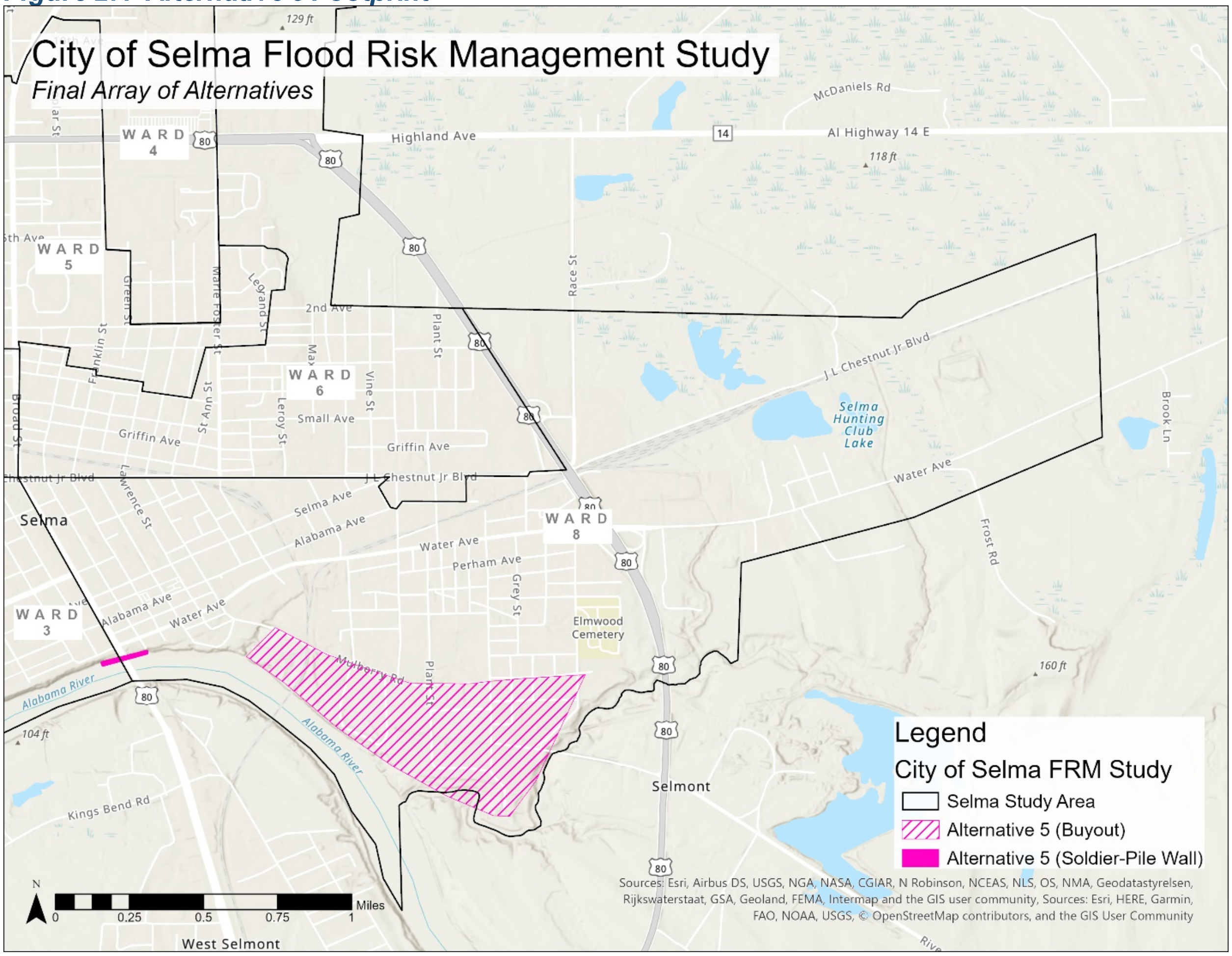
Figure 26: Alternative 4 Footprint



4.2.4.1.5. *Alt. 5: Soldier-Pile Wall and Buyout**

Alternative 5, shown in **Figure 27**, is a combination of Alternatives 1.A and 4 accounting for approximately 178 acres. This alternative would take approximately 30 months to complete.

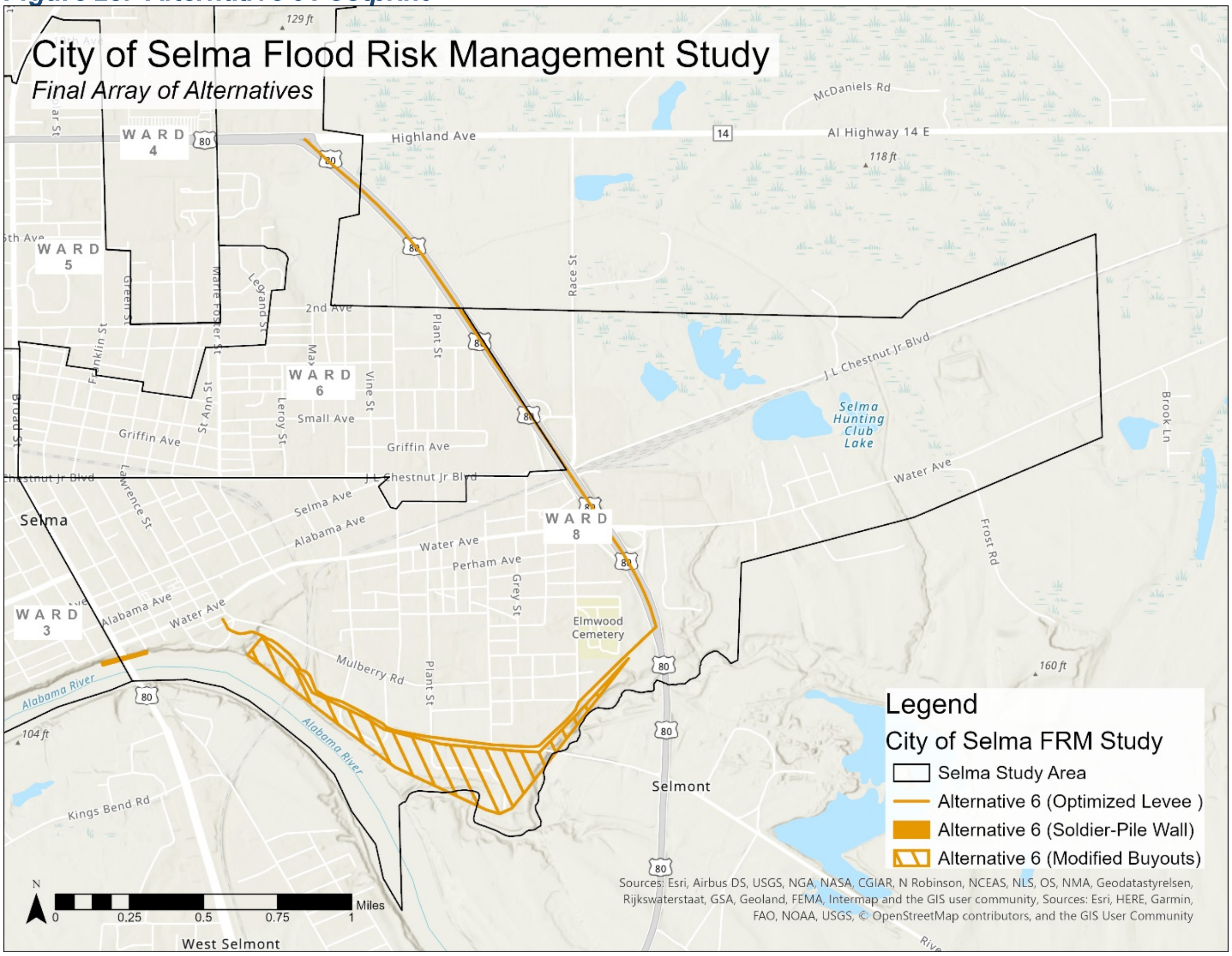
Figure 27: Alternative 5 Footprint



4.2.4.1.6. *Alt. 6: Optimized Levee Alignment, Soldier-Pile Wall, and Buyout**

Alternative 6 is a combination of Alternatives 3 and 5 with the exception of buyout footprint, as shown in **Figure 28**. A total of nine (9) parcels in Ward 8 identified within the 68-acre buyout footprint for this alternative would be located outside the levee alignment. This alternative would take approximately 42 months to complete.

Figure 28: Alternative 6 Footprint



4.2.4.2. *Comparison of Final Array*

The alternatives were then evaluated using the objective/constraint criteria, engineering feasibility and cost, and assessed in the four P&G accounts of NED, RED, EQ and OSE. The NED analysis determines the plan that maximizes net benefits to the Nation. RED evaluates the regional economic activity of the Study Area. EQ is analyzed through the NEPA analysis which is detailed in **Section 5.0**. The OSE assessed historic importance, life and safety, social connectivity, and social vulnerability. Additionally, a Least Cost Analysis was performed as directed.[1] A summary of the four P&G accounts is included in **Appendix E**.

4.2.4.2.1. *Economic Analysis*

4.2.4.2.1.1. Economic Cost and Benefit Analysis (NED)

Continuing the evaluation process, first cost estimates were developed for the final array of alternatives that were evaluated. The ROM costs were provided by Mobile District's Cost Engineering Section based on October 2019 price levels. For comparison to the benefits, which are average annual flood damages reduced, the first costs were stated in

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[1] Memorandum for the Commander dated July 16, 2020 from HQ USACE to SAD

average annual terms using the FY20 discount rate of 2.75% and a 50-year POA. The IDC was added to the ROM first costs assuming 18 months for Alternative 1.A, 36 months for Alternative 3, 30 months for Alternatives 4 and 5, and 42 months for Alternative 6. In addition, annual O&M costs were also added to the alternatives. **Table 16** displays the results of the costs calculation.

Table 16: Project Alternative Costs

Alternative	First Cost	IDC	O&M	Average Annual Cost
1.A	$4,950,000	$102,000	-	$187,000
3	$74,040,000	$4,167,000	$27,000	$2,924,000
4	**$27,537,000**	$955,000	**$4,000**	$1,059,000
5	$32,400,000	$1,124,000	$4,000	$1,246,000
6	$104,860,000	$5,140,000	$29,500	$4,104,000

For the final array of alternatives, the equivalent annual benefits were then compared to the average annual cost to develop net benefits and a benefit-to-cost ratio (BCR) for each alternative. The net benefits for each alternative were calculated by subtracting the average annual costs from the equivalent average annual benefits, and a BCR was derived by dividing average benefits by average annual costs. Net benefits were used for identification of the NED plan in accordance with the Federal objective. For comparative purposes, **Table 17** summarizes the equivalent annual damages (benefits), average annual costs, first cost, net benefits, and BCR for each alternative. A range is presented to incorporate transparency in the estimation of benefits (reference **Appendix C** for more information).

As a result of the comparison of the alternatives, no alternatives could be clearly identified as the NED Plan in accordance with the Federal objective. Based on the results of this analysis, USACE, Mobile District requested an exception to the standard identified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, specifically that the selected plan should have "…the greatest net economic benefit (the NED Plan) consistent with protecting the Nation's environment, unless the Secretary…grants an exception to this rule." This exception was endorsed.[2]

Table 17: Final Array Comparison of Benefits and Costs

Alternative	Average Annual Benefits	Average Annual Costs	First Cost	Net Benefits	Benefit-to-Cost Ratio
1.A	$111,000	$187,000	$4,950,000	($76,000)	0.59
3	$361,000	$2,924,000	$74,040,000	($2,563,000)	0.12
4	$4,759,000-$36,000	$1,059,000	**$27,537,000**	$3,700,000-($1,023,000)	4.50-0.03
5	$4,870,000-$147,000	$1,246,000	$32,400,000	$3,624,000-($1,099,000)	3.91-0.12

2 *Id.*

Alternative	Average Annual Benefits	Average Annual Costs	First Cost	Net Benefits	Benefit-to-Cost Ratio
6	$5,120,000-$397,000	$4,104,000	$104,860,000	$1,016,000 ($3,707,000)	1.25-0.1

4.2.4.2.1.2. Bank Stabilization Least Cost Analysis

As stated in **Section 1.1**, this study was granted the permission to continue evaluating bank stabilization in accordance with Section 1203 of Water Resources Development Act of 2018 as authorized.[3] Additionally, HQUSACE allowed for an erosion control measure using CAP Section 14 methodology of the Flood Control Act of 1946 (Public Law 79-526), as amended, for emergency streambank and shoreline protection for public facilities and services.[4] This methodology calls for formulation and evaluation of an alternative using the least cost approach. The plan is justified if the total cost of the alternative is less than the costs to relocate the threatened structures.

In the case of the Selma FRM study, the control measure that reduces flood induced erosion is a Soldier-Pile Wall with approximate length of 750 ft with riprap end caps and seeks to stabilize a portion of the northern bank of the Alabama River in Selma, Alabama. The viewshed, currently estimated at approximately 11 structures, along this bank are nationally registered properties and part of the Water Avenue and Civil Rights Historic Districts. These structures compose the viewshed of the National Historic Landmark, the Edmund Pettus Bridge. Although the market value of these estimated 11 structures is approximately $5.4 million, the historic and regional economic value of these structures and what they represent for not only the City of Selma but for the nation and the local economy cannot be overstated. The structures are the viewshed of the Edmund Pettus Bridge, one of the most recognizable Civil Rights sites in the U.S. and comprise the tourism hub of Selma, Alabama. Loss of these structures would be detrimental to Selma's economy and the negative economic impacts would reverberate significantly in Civil Rights tourism throughout the region of central Alabama (this is investigated more in the RED analysis).

Many of the threatened structures were constructed during the late 1800s or early 1900s making relocation exorbitantly expensive, if not impossible. Adding to the difficult nature of replacement cost is the fact that these structures were built on the edge of the bank, implying relocation would have to be carefully conducted brick by brick (i.e. deconstruction and then reconstruction). Taking these factors into account brings potential relocation costs to approximately $132.0 million.[5] This relocation effort would also reduce the historic integrity of these structures, making them ineligible for listing on the National Register of Historic Places, in addition to irrevocably altering the viewshed for the Edmund Pettus Bridge. **Table 18** outlines the least cost alternative method using

[3] *Id.*
[4] *Id.*
[5] Approximated costs are based on best professional engineering judgment.

the Section 14 methodology in which the cost analysis utilized the relocation cost as a base comparison.

Table 18: Bank Stabilization Least Cost Analysis

Alternative	Construction Costs	O&M Costs	Average Annual Cost
Relocation (base cost)	$132,000,000	$0	Not evaluated
Soldier-Pile Wall	$**$27,537,000**	**$4,000**	$1,059,000

4.2.4.2.1.3. Regional Economic Development Analysis (RED)

A qualitative assessment of assumed regional industry benefits, tourism and recreation, and income shared between Selma and local towns with Federal interest in the region (i.e. Maxwell/Gunter AFB, National Historic Landmarks/Trails, Navigation interest, etc) was conducted. There are a number of top employers in the region that provide jobs to the residents of Selma and the surrounding area, they include: International Paper Company, Honda Lock-America, Bush Hog, and American Apparel, each employing more than 500 people between Selma and Montgomery.

The larger RED analysis demonstrated overall regional ties to various business interests (local and international) in the area. The local analysis within Selma shows a steady decline in population with fluctuations occurring with various plant closures and change over in textile industry needs as the nation/world move from hard textiles products to more computer-based commodities and outsourcing of jobs overseas. The RED analysis focused on heritage tourism in Selma, Alabama and its interdependency with other Civil Rights tourism in central Alabama.

The structural instability along Water Avenue, including properties, roadways, and utilities, present a direct threat to Selma's ability to maintain heritage tourism and thus a direct threat to the financial stability of the city, the county, and the region, as the annual Selma Bridge Crossing Jubilee attracts national and international visitors and vendors, many of whom tour the entire Selma to Montgomery Trail. The bank stabilization alternative provides RED benefits since this alternative proposes to reduce the likelihood of bank failure, thus protecting the regionally significant economic interest along Water Avenue.

With regards to buyouts and levees, there would be a temporary benefit to RED due to construction but over time, RED benefits would become zero sum. For the case of buyouts, it is assumed that due to the limited housing availability in Selma, residents would be relocated to Montgomery. Although this would create a positive economic impact in Montgomery (i.e., population increase), the impact to Selma would be negative.

In short, when the economic activity lost in the Study Area can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts of the employment, income, and output of the regional economy are considered part of the RED account. The input-output macroeconomic model RECONS was used to address the impacts of the construction spending and buyout associated with the TSP. For this Regional analysis, the RED effects of implementing the Alternatives are displayed in **Table 19**. Alternative 5 is not displayed within the table since it is a combination of Alternatives 1.A and 4, and using the first cost of Alternative 1.A (a buyout or acquisition measure) is not a suitable input to the RECONS model. Thus, in connection to the transitive property, it too would be inappropriate to use the addition of the first costs of Alternative 1.A and Alternative 4 as an input for the first cost of Alternative 5, hence its omission. A detailed discussion of the full RECONS results is included in **Appendix C**.

Table 19: Regional Economic System Model for Final Array of Alternatives

Factors ($000)	Alt. 1.A Buyouts	Alt. 3 Optimized Levee	Alt. 4 Soldier-Pile Wall	Alt. 6 Opt. Levee & Wall & Buyouts
First Costs	$4,950	$74,040	**$27,537***	$104,860
Local Capture	N/A	$43,908	$16,283	$62,185
Output	N/A	$54,034	$20,038	$76,526
Jobs	N/A	311**	115**	440**
Labor Income	N/A	$16,082	$5,964	$22,777
Value Added	N/A	$22,698	$8,417	$32,146
Results Discussion	Buyout costs may not be appropriate inputs to RECONS.	**Jobs generated are short-term resulting from construction spending.	*Excludes Buyouts **Jobs generated are short-term resulting from construction spending.	**Jobs generated are short-term resulting from construction spending.

4.2.4.2.2. *Environmental Quality (EQ)*

This report was developed to comply with NEPA, applicable Federal laws, Executive Orders, and USACE policies and guidelines. An EQ assessment of the direct, indirect, and cumulative impacts of affected resources is discussed in **Section 5.0**.

4.2.4.2.3. *Other Social Effects (OSE)*

Due to the unique social factors present in the City of Selma, an OSE analysis was conducted to assess any possible impacts the final array of alternatives may have on factors such as Historic Importance, Life and Safety, Community Resiliency and Cohesion, and Social Vulnerability.

The analysis found that a NAA would have negative impacts on all social factors. Nationally Registered historic properties and sites would be threatened by bank failure. Life and safety concerns would be introduced by bank failure and subsequent infrastructure failure, in addition to property damage seen in Ward 8. Community Resiliency would be significantly reduced due to needed continuous repairs and replacement of infrastructure in Ward 8 and along the riverfront. Community Cohesion would continue to decline as the City would not be able to prioritize retention of businesses and residents. Social Vulnerability would intensify as threats to community cohesion and resiliency would continue.

For a non-structural alternative (buyouts/relocation), since the buyouts are outside of a known historic district, there are no anticipated impacts for Historic Importance. However, removing residents from the floodplain creates a beneficial impact in the Life and Safety Social Factor. Buyouts/Relocation, regardless of the magnitude, presents a beneficial impact to Community Resiliency as it lessens the burden of the City and its residents to repair and maintain structure and infrastructure within the floodplain. A buyout/relocation would have adverse impacts on Community Cohesion and Social Vulnerability. Many residents in the buyout area are low-income and due to Selma's limited housing market, many of these residents would be displaced outside of Selma and possibly outside of Dallas County. The relocated residents would likely incur a significant increase to their cost of living. The city of Selma would also lose a portion of its tax base.

A levee alternative produces significant negative impacts to the social vulnerability of Selma. Despite it immediately reducing life and safely risk from inundation provided by its protection, a levee also introduces new life and safety risk associated with potential failure. The alternative could have significant impact on any unknown cultural resources sites within the levee alignment but these impacts can be mitigated. While a levee would have positive impacts on Community Resiliency, Cohesion, and Social Vulnerability, as it would reduce the burden of repairs and the burden of providing essential emergency services associated with the structures and their residents in Ward 8, the deleterious O&M costs associated with this alternative would far outweigh the positive effects and thus be detrimental all social factors assessed. A limited buyout would have no effect on the factors of Community Cohesion and Social Vulnerability due to the buyout's targeted nature.

A bank stabilization alternative produces positive benefits for all Social Factors assessed, particularly Historic Importance and Community Resiliency. Stabilizing the failing northern bank of the Alabama River will protect Nationally Registered properties, thus eliminating the city's burden of repairing and replacing infrastructure and preserving its commercial property tax base along Water Avenue. This alternative also reduces Life and Safety concerns associated with roadway cave-ins and structure condemnations. This alternative will have more indirect impacts to Social Factors such as Community Cohesion and Social Vulnerability as it can be reasonably assumed that the City of Selma would be able to prioritize resident and business retention and attraction due to the revitalization of one of the top tourist destinations in the region.

4.2.4.3. *Evaluation and Screening Discussion of Final Array*

4.2.4.3.1. *Alternative 1.A (Buyout)*

Alternative 1.A is not economically justified, does not improve community resilience, and provides no protection to historic resources along the threatened riverbank.

Although a NED Exception was endorsed for the Selma Alabama FRM Study it was determined that buyouts do not provide the best solution to flooding concerns within the City of Selma.[6] As no buyout plan was incrementally justified on net annual benefits, the primary driver for addressing flooding is life safety. Successful implementation of a FMEEP provides a more cost-effective solution to addressing life safety than buyouts. Based on a qualitative assessment of the velocity and depth of flooding and the nature of the floodplain, a blueprint was developed for a FMEEP for certain areas of Selma.

Furthermore, this alternative may be impacted by the sponsor's willingness to prioritize the buy-outs and provide the upfront funding, their ability to provide the resources for the

[6] HQ USACE, *supra*.

acquisitions and relocations, the limited availability of DSS housing within the city, and the USACE requirement that buy-outs be mandatory in accordance with P.L. 91-646.

For these reasons, this alternative was not selected as the TSP.

4.2.4.3.2. *Alternative 3 (Optimized Levee Alignment)*

As shown in the P&G Accounts analysis, Alternative 3 is not economically justified, does not protect historic resources along the Alabama River, and adversely impacts the human and natural resources in the surrounding area through induced flooding. Construction of the optimized levee would require mitigation from induced flooding for the affected areas in Selmont and downstream reaches of the Alabama River. O&M costs of the optimized levee would exceed what the City of Selma could provide. Though Alternative 3 would address the problems and meet the objectives of the study, this alternative was not selected as the TSP due to the economic viability of the alternative.

4.2.4.3.3. *Alternative 4 (Soldier-Pile Wall)*

The P&G Accounts analysis shows that Alternative 4 would provide the most benefits under RED and OSE. ER 1105-2-100 describes the process for the calculation of benefits for an FRM study; however, the majority of benefits for an FRM study using the HEC-Flood Damage Reduction Analysis model largely accrue from inundation reduction benefits. The model fails to capture the damage(s) that may be caused by the repeated inundation of foundations and soils sitting on a bluff, as the case for Selma's Historic Riverfront. According to the Engineering study, the historic structures in Selma are threatened by shear failures occurring as flood waters recede after inundating the structures' foundations and soils.

Consequently, this study utilizes the approach to formulating a project as applied under CAP Section 14 of the Flood Control Act of 1946, as amended. As in Section 14 projects, the formulation and evaluation focus on the least cost alternative solution and that alternative plan is considered to be justified if the total costs of the alternative is less than the costs to relocate the threatened facility. The costs for the relocation of the structures and the potential degradation of the historic viewshed are evaluated in the comparison of the final array and the results are described in the System of Accounts. The soldier-pile wall design is the most cost effective and least environmentally damaging. Combined with a FMEEP, Alternative 4 was selected as the TSP.

4.2.4.3.4. *Alternative 5 (Soldier-Pile Wall + Buyouts)*

As stated in **Section 4.2.4.3.1**, it was determined that buyouts were not an effective approach to address flooding concerns within the City of Selma given that a FMEEP could better address life safety concerns and would be a more cost effective solution. Combined with the challenges of the real estate requirements, buyouts were removed from further discussion. As such, Alternative 5 was not selected as the TSP.

4.2.4.3.5. *Alternative 6 (Soldier-Pile Wall + Optimized Levee Alignment + Modified Buyout)*

Because buyouts and an optimized levee design were not selected as the TSP, as discussed in **Sections 4.2.4.3.1** and **4.2.4.3.2** neither was Alternative 6. Alternative 6 would provide no additional benefits through the combination of the two alternatives. Though the buyout location for Alternative 6 is located in a separate footprint, the same principle applies in that the City of Selma would be better served to implement a FMEEP. Additionally, the City of Selma would have limited capacity to acquire the real estate and maintain a levee system.

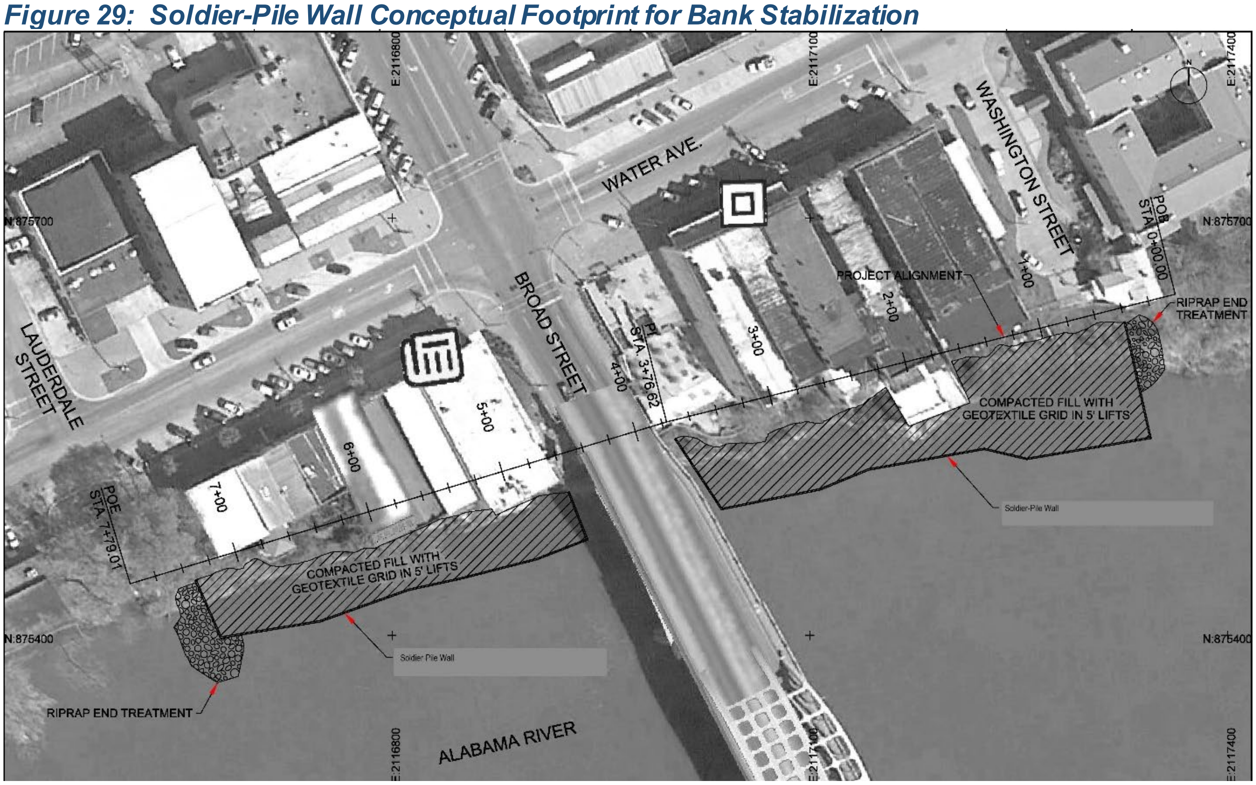
Alternative 6 is a more complete plan but comes with significant risk from an environmental impacts assessment and a cost to the overall project or with regards to the sponsor’s ability to pay. Alternative 4 is the preferred plan as it meets study objectives, avoids constraints, unlike with a levee alignment that have significant environmental impacts.

4.3. Tentatively Selected Plan*

(This section is also known as the Proposed Action for NEPA purposes)

The TSP for this study is Alternative 4 in conjunction with a FMEEP measure. **Figure 29** depicts the conceptual design and footprint for the Soldier-Pile Wall. The FMEEP will identify hazards within the city limits, discuss effects of flooding and provide recommendation for addressing flood risk through responsible future development of the floodplain. The FMEEP would also provide a detailed plan for the City to implement the use of emergency notification and evacuation of flood prone areas in the event of an approaching flood event.

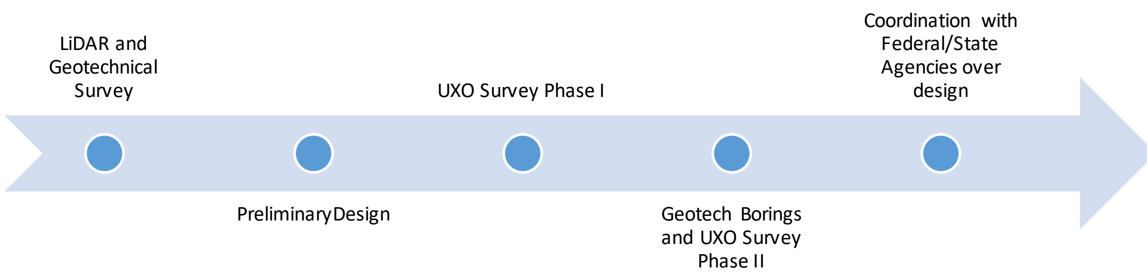
Figure 29: Soldier-Pile Wall Conceptual Footprint for Bank Stabilization



4.3.1. *Design and Construction Methods**

Bank stabilization would be achieved through a Soldier-Pile Wall with riprap caps on the upstream and downstream ends. Construction of the wall would be accomplished via barge from the Alabama River. Potential staging areas to load barges have yet to be determined. Access would be obtained via river. The conceptual design including construction materials was developed in order to estimate first costs of the alternative, which are listed in **Table 15**. **Figure 30** outlines a rough timeline for the components necessary to achieve a more robust design of the Soldier-Pile Wall. Prior to construction, any UXOs within the footprint would be identified and relocated. Additionally, coordination with the USFWS, including relocations for Tulotoma Snails within the footprint, would be required prior to any ground disturbance activities.

Figure 30: Path forward to design



4.3.2. *Project First Cost*

Table 20 shows the project first cost apportionment for the City of Selma FRM study.

Table 20: Project First Cost Apportionment Summary

Cost Item	**Federal (USACE)**	**Non-Federal Sponsor**	**Project First Costs**
Initial Construction**	$17,899,000	$9,257,950	$27,157,000
Lands, Easements, Right of Way, Relocations, and Disposal sites (LERRDs)***	$0	$380,000	$380,000
First Costs by Entity	**$17,899,000**	**$9,637,950**	**$27,537,000**
Cost Share Percentages	65%	35%	--
OMR	--	**$4,000**	--

**based on October 2019 price levels*
***Includes PED and Construction Management Fee*
****LERRDs Disclaimer: Subject to change based on appraisal, actual costs, and Real Estate review of credit package*

4.3.3. *Four Planning Criteria*

To address the Four Planning Criteria, a synopsis of the TSP only is listed below; however, following the Smart Planning Process ensured adherence to the criteria listed below:

- *Acceptable*: The City of Selma supports the bank stabilization because it will limit the flood induced erosion threatening the historic landmarks along the Alabama River adjacent to the Edmund Pettus Bridge. Coordination with Federal and State Agencies aims to achieve satisfaction through compatibility with laws, regulations, and policies. The plan is feasible from a technical perspective as it relates to engineering constructability, has minimal environmental impacts, and is policy compliant.[7]
- *Effective*: The plan addresses the specific FRM problems by developing a FMEEP which addresses loss of life and residual risk through cost effective means. **Section 2.0** stated one problem for this study is the existing erosion occurring along the downtown Selma riverbank. This plan limits the flood induced erosion threatening the historic structures that sit along the riverbank by armoring the shoreline. This plan also reduces shoaling downstream by reducing erosion rates of the riverbank within the TSP footprint; therefore, this plan alleviates the specified problems and achieves the specified opportunities.
- *Efficient*: Through incorporation of the FMEEP, the plan is the most cost-effective means of alleviating the specified problems. Additionally, selection of the Soldier-Pile Wall construction method produces the most efficient means of achieving bank stabilization as discussed in **Section 4.2.3.1.3**. The plan is the least damaging structural solution to the natural and human environment. This plan also provides a good/service by reducing erosion and sediment inputs into the Alabama River, thus potentially reducing the need for frequent dredging activities downstream.
- *Complete*: Extensive Vertical Team coordination was conducted to thoroughly evaluate all alternatives which ensures that this TSP is well thought out. The plan does not rely on Federal/State Agencies or other non-project components to achieve implementation or benefits. Regardless of the evaluated benefits, riverbank stabilization and FMEEP is in the public interest. The plan addresses the study goals and objectives to reduce the life and safety risk to persons within the floodplain through effective evacuation methods. The plan also reduces flood induced erosion which threatens the historic landmarks/structures along the Alabama River by armoring the river shoreline. The plan provides and accounts for necessary investments and actions to ensure realization of the planned FRM goals and objectives specific to the TSP.

4.3.4. *Life Safety and Residual Risk*

[7] *Id.*

Modeled flood frequency events suggest that life safety risks in the Study Area are primarily due to high flood elevations or water depths, lack of access for emergency vehicles, and the potential of localized areas with high velocities of flowing flood waters. Flooding within the Study Area of Selma, Alabama is primarily observed in Ward 6 and Ward 8, which is located on the upstream right bank of the Alabama River near downtown Selma. Ward 8 is the first area where flooding typically occurs and the flooding of structures such as buildings located along and near the banks of the Alabama River in downtown Selma begins at the 0.04 AEP flood stage (25-year event). At this stage, flood depths are minor (less than 1 foot) and have minimal impacts to the structures. Life safety risk with respect to these depths is very low and major highways are still accessible by motor vehicles. Flood depths and life safety risks increase as flood waters begin moving inland into Ward 8 at the 0.02 AEP flood stage (50-year event). Flooding of some structures along the river are over 2 feet and several access roads to the area closest to the Alabama River begin to flood, cutting off access to the structures being flooded at the 0.02 AEP stage. Flooding becomes widespread throughout Wards 8 and begins in Ward 6 at the 0.01 AEP flood stage (100-year event) with flood depths in excess of 6 feet in some locations of Ward 8.

Hydraulic modeling of Selma shows flood water velocities remain below 2 feet per second throughout most of the Study Area for all events modeled, which is considered a flow velocity for flood waters that presents little life safety risk. However, there are localized areas of higher velocities exceeding 5 feet per second in Ward 8. These are primarily at locations where the grade of the ground changes significantly and quickly, such as over elevated roadways. It is also possible that additional localized high velocity zones may occur during flood events but are not observed in model results. For instance, overflowing stormwater outfalls and culverts have not been modeled in the urban area to a degree that would accurately show some resulting localized high velocity zones.

The recommendation to address life safety in these areas through the FMEEP, which is part of the recommended plan, would address life safety in two ways. First, it would provide the City of Selma with a comprehensive plan to direct evacuations of areas forecast to experience flooding. The Alabama River is a slow-moving river due to the gradual sloped terrain below the fall line, where the topography transitions from fairly-steep in the headwaters of the basin to extremely flat in the vicinity of Selma. Flooding in Selma from the Alabama River is typically the result of significant precipitation occurring in the middle of the basin near Childersburg and Gadsden, Alabama as well as the northern portion of the basin near Rome, Georgia. Flood waters from these locations typically take several days to reach peak stage at Selma, Alabama; therefore, a properly utilized emergency evacuation component would provide adequate time for the City to prepare and move residents out of flood prone areas. Flood forecasting is currently provided by the Southeast River Forecast Center using existing stream gages near Selma, at the Robert F. Henry Lock and Dam, and within Montgomery, Alabama; however, an evacuation plan would assist the City in directing the evacuation of residents based on certain forecasted flood elevations. This would include recommended locations to be evacuated, safe evacuation routes, and identification of those locations that would be inaccessible, all based on a forecasted flood elevation. Second, the floodplain management component would address future use of the floodplain within the city limits.

As structures are condemned in the future and residents move out of heavily flood prone areas, responsible redevelopment of the floodplain or prohibiting development in the floodplain can reduce residual and life safety risk in the future.

Residual Risk is the flood risk that remains in the Study Area after a recommended plan is implemented. In theory, this plan would reduce flood risk with respect to life safety and flood damages (by preventing redevelopment) from the areas it covers. If followed, residents would have adequate time to fully evacuate. In practice, this will greatly reduce life safety risk but not eliminate it. Even mandatory evacuations are often ignored by residents who decide to accept the risk of remaining in flood prone locations during a flood event. Historically, it has been impractical to fully enforce a complete evacuation of an area. Furthermore, future floodplain management of the area will ultimately be at the discretion of the City of Selma to enforce. It will likely involve local legislation to enforce the recommendations laid out in the floodplain management portion of the plan to prevent residential redevelopment of the floodplain. In this case, residual risk is directly correlated to the degree at which this document is utilized and enforced by the City of Selma.

5.0 ENVIRONMENTAL CONSEQUENCES*

5.1. Environmental Impacts*

A qualitative assessment of the final array of alternatives was conducted to analyze environmental impacts to resources within the Study Area. The NAA is consistent with FWOP conditions, which is the baseline from which to compare all alternatives. Because no Federal undertaking occurs under this NAA, impacts are assessed upon a “consequences” criteria.

The conceptual model depicted in **Figure 31** summarizes the direct and indirect relationship between each resource as well as the impacts that a levee, Soldier-Pile Wall, and buyout components would have on those resources within the Study Area. Direct links are depicted in solid lines while indirect links are dashed. Likewise, feedback loops are depicted with double arrows while unidirectional impacts are single-arrowed. Impacts are color coordinated with the respective component and represent the key impacts that are discussed in the accompanying section. By showing how each resource is interconnected, **Figure 31** summarizes the effect that each component has on the environment as a whole.

5.1.1. *Physical Environment**

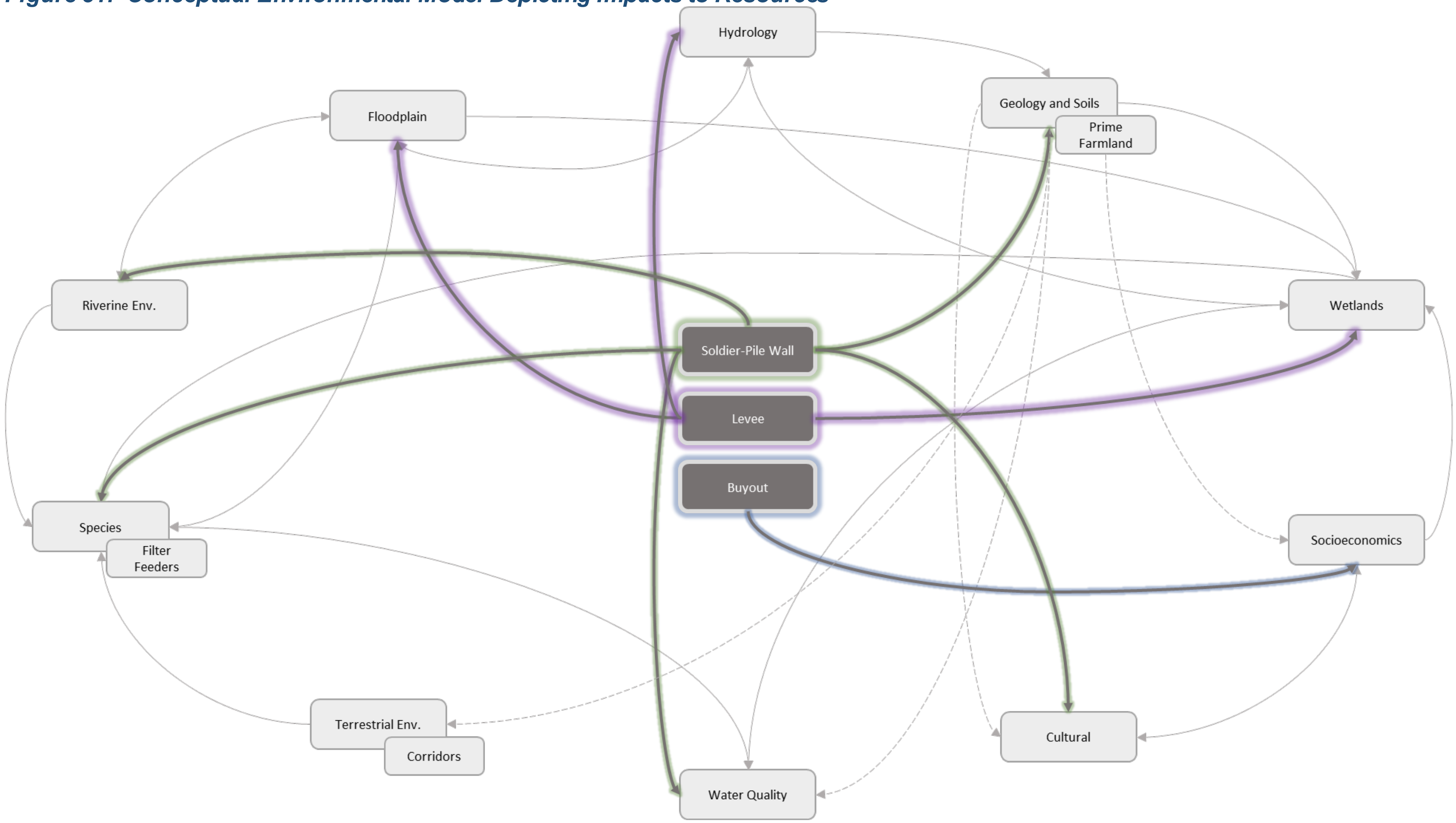
5.1.1.1. *Water Resources**

5.1.1.1.1. *Hydrology**

5.1.1.1.1.1. No Action Alternative Impacts*

Direct Impacts: No construction or demolition would occur as a result of the NAA.

Figure 31: Conceptual Environmental Model Depicting Impacts to Resources



Indirect Impacts: Under FWOP conditions the Alabama River is anticipated to continue experiencing frequent flood events. Hydrology within this reach of the Alabama River flows through the river channel and overtops into the surrounding floodplain. Development of the floodplain could alter the permeable surface conditions which could have an impact on hydrology. The climate change assessment revealed that substantial development (i.e land use changes) would occur within the headwaters of the Alabama River which would result in increased runoff and increase peak flows by 2%. This increase would occur as a result of actions far outside of the Study Area; therefore, no significant indirect consequences to the Study Area would occur as a result of the NAA.

5.1.1.1.1.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: The alternative would neither result in the construction of any floodplain blocking structures nor addition of impervious surfaces; therefore, no direct impacts to hydrology would occur.

Indirect Impacts: The buyout footprint is not large enough to have a significant impact on the hydrology of the Study Area. Removal of the structures would increase the floodplain; however, not enough to reduce flooding impacts in the Study Area; therefore, no significant indirect impacts to hydrology are anticipated.

5.1.1.1.1.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: The levee alignment would have wide-spread direct impacts on hydrology within and surrounding the Study Area through induced flooding. Increased damages would occur as isolated pockets within Ward 1 of Selma as well as the City of Selmont.

Indirect Impacts: FWOP conditions show an increase in land use changes in the headwater portions of the Alabama River which would alter the hydrology regime within the Study Area. Although no substantial land use changes would occur as a result of the optimized levee alignment, an increase of peak flow due to headwater land use changes would indirectly compound the direct effects of induced flooding.

5.1.1.1.1.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: No significant change to the Alabama River would occur as a result of the Soldier-Pile Wall. Construction would not require either coffer dams or any other means to direct the flow of the river. The immediate vicinity may experience increased velocity during flood events; however, the potential for this effect would be minimized during the PED phase of the project.

Indirect Impacts: No significant indirect impacts would occur.

5.1.1.1.1.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: Inclusion of Soldier-Pile Walls and other bank stabilization measures may increase the velocity of hydrology which could lead to scouring. The Soldier-Pile Wall would be designed to reduce velocity during the PED phase of the project; therefore, no significant adverse impacts to hydrology would occur as a result of the alternative.

Indirect Impacts: The demolition of structures within the floodplain would indirectly benefit hydrology by decreasing impervious ground surface; however, benefits would be insignificant due to the small portion of structures within the buyout footprint. Additionally, the Alabama River experiences flooding due to riverbank overtopping from accumulated rainfall in the upper portion of the river. A minor land use change would not contribute significantly to reduce flooding depths in the Study Area.

5.1.1.1.1.6. Alternative 6 (Combination) Impacts*

Direct Impacts: The levee alignment would have significant direct impacts on hydrology within and surrounding the Study Area. Induced flooding from the levee would cause increased flood damages within isolated pockets of Ward 1 of Selma as well as the City of Selmont. The Soldier-Pile Wall would not result in induced flooding.

Indirect Impacts: The alternative includes buyouts and demolition of structures outside the levee alignment and would be consistent with indirect impacts related to Alternative 5 buyout impacts; however, at a lesser magnitude due to a smaller footprint. The buyout footprint would convert a maximum amount of 68 acres. This conversion from 68 acres of developed land use to floodplain habitat would not alleviate the amount of induced flooding caused from the levee component.

5.1.1.1.2. *Water Quality**

5.1.1.1.2.1. No Action Alternative*

Direct Impacts: No construction within Waters of the U.S. would occur as a result of the NAA; therefore, no direct consequences to water quality are anticipated.

Indirect Impacts: The Study Area does contain 303d listed impaired waterbodies. Should the NAA be selected, no stabilization of the riverbank would occur. Flooding would continue to occur in the FWOP conditions which would continually erode the riverbank. Erosion would lead to increased turbidity and may result in long-term degradation. Additionally, due to the lead-contaminated riverbank, continued erosion would transport harmful material downstream further expanding the footprint of decreased water quality. Thus, the NAA would have a minor negative indirect consequence on water quality within and surrounding the Study Area.

5.1.1.1.2.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: No demolition would occur within the immediate vicinity of streams. Demolition within each parcel would contain runoff through the use of Best Management Practices (BMPs); therefore, no significant adverse impacts are anticipated as a result of the alternative.

Indirect Impacts: Conversion of residential structures to an extension of the floodplain may contribute towards increased wetland habitat. Wetlands are a significant resource for clean water quality. Should the parcels eventually convert to wetlands habitat, minor beneficial impacts to water quality may occur; however, these impacts would be *de minimus* due to the small footprint of the alternative.

5.1.1.1.2.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: No impaired waterbodies are classified within or near the proposed levee alignment. The optimized levee alignment would not cross any stream or waterbodies and would not directly affect water quality. Access would be obtained using existing roads. Potential staging areas have not been identified; however, should any staging occur within or nearby Waters of the U.S. additional coordination would be required to obtain Water Quality Certification (WQC) from the Alabama Department of Environmental Management (ADEM).

Indirect Impacts: Construction of the levee may increase turbidity as a result of runoff; however, BMPs would be used to minimize the amount. Potential runoff would not enter impaired waterbodies for criteria pollutants. To complete the full levee alignment, approximately 322,369 cy of material would be required to construct the levee and 100,000 cy of material would be required to fortify U.S. Highway 80. Runoff not captured using BMPs would minimally increase turbidity. These effects would subside upon project completion and would revert to preconstruction conditions; therefore, adverse impacts to water quality as a result of the alternative would be minor.

5.1.1.1.2.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: No impaired waterbodies for criteria pollutants are located near the Soldier-Pile Wall footprint. Construction of the Soldier-Pile Wall would require 94 pilings to be drilled into the riverbed. Dredging would not be required. Additionally approximately 3,333 cy of riprap and 12,500 cy of granular (sand) material would be placed behind the Soldier-Pile Wall to ensure stability of the riverbank; therefore, roughly 15,833 cy of material would be directly placed within the Alabama River. Coordination with ADEM will be conducted and WQC would be obtained prior to implementation. A copy of the Draft 404(b)1 is included in **Appendix B**.

Indirect Impacts: The footprint of the Soldier-Pile Wall lies within the middle of the largest and healthiest Tulotoma Snail population, which are benthic filter feeder species. These species contribute towards water quality within the Study Area. Relocation of these Federally protected species would occur prior to implementation to a suitable location in the immediate vicinity; therefore, the indirect adverse impacts of the alternative would be neutral given that the species will remain within or nearby the Study Area.

5.1.1.1.2.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: No impaired waterbodies for criteria pollutants are located near the buyout boundaries. Demolition would not occur within or adjacent to any rivers or streams; therefore, demolition from buyouts would not directly affect water quality. Construction of the Soldier-Pile Wall would cause increased turbidity within the immediate and downstream vicinity. BMPs would be utilized to minimize the spread of turbidity. No impacts to water quality would occur from the FMEEP. WQC for the Soldier-Pile Wall would be obtained from ADEM prior to implementation.

Indirect Impacts: Conversion of developed parcels into floodplain may slightly benefit water quality through the possibility of long-term wetlands development; however, a significant quantity of wetland surface area would be required to have a beneficial impact on water quality; therefore, the benefits related to conversion of 25 parcels into undeveloped land are anticipated to be *de minimus*.

5.1.1.1.2.6. Alternative 6 (Combination) Impacts*

Direct Impacts: The combined impacts from Alternatives 3 and 5 would occur.

Indirect Impacts: The combined impacts from Alternatives 3 and 5 would occur.

5.1.1.2. *Geology and Soils**

5.1.1.2.1. *No Action Alternative Impacts**

Direct Impacts: In general, activities that would contribute to significant geologic or soil alteration would include but are not limited to fracking, injection wells, and large-scale grading. Under the NAA, no construction/demolition, staging, or land use changes would occur; therefore, no direct consequences to the geology and soils within the Study Area would occur.

Indirect Impacts: Indirect effects of the NAA would adversely impact geology and soils of the riverbank as continued erosion would occur under FWOP conditions. Erosion of the riverbank could negatively affect additional resources such as water quality, riverine habitat, cultural resources, aesthetics, as well as public health and safety; therefore, slightly adverse indirect consequences to geology and soils would occur.

5.1.1.2.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The scope of this alternative identified structures within Ward 8 below Mulberry Road. The City of Selma has been heavily developed for many years; therefore, the majority of the original topsoils have been removed and replaced with red clay suitable for construction of structures and buildings. The removal of these structures would not directly result in the restoration of the original topsoils, nor would the surface grade be significantly altered.

Indirect Impacts: Though the geology and soils beneath the structural foundations have been degraded, reintroduction of native soils from flooding events could occur over many decades. Thus, indirect benefits could occur to the soils within the buyout footprint as a result of this alternative but are anticipated to be *de minimus*; however, because the alternative would not limit flood induced erosion, the alternative would have an overall slightly adverse indirect impact to geology and soils.

5.1.1.2.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: The Alternative 3 levee alignment totals approximately 3.6 mi including 1.6 mi of “new” construction and 2.0 mi of U.S. Highway 80 reinforcement. Construction, which would require extensive grading within Ward 8 and reinforcement of U.S. Highway 80. Approximately 322,369 cy of fill would be required to construct the levee portion and 100,000 cy of material would be required to reinforce U.S. Highway 80.

Disposal areas would be required to place excavated material. Access would be obtained using existing roads. Staging areas would also be required to contain all construction material; however, potential locations have not been identified.

Indirect Impacts: Impacts resulting from this action would be consistent with the FWOP conditions. Continued flooding events may transport additional sediment to Study Area floodplain; however, sediment accrual as a result of this phenomenon are anticipated to be *de minimus*. No significant geological events, such as major earthquakes, are anticipated to occur under FWOP conditions; however, because the alternative would not limit flood induced erosion, the alternative would have an overall slightly adverse indirect impact to geology and soils.

5.1.1.2.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall would span approximately 750 linear ft and would use H-Piles to support concrete walls. Subsurface conditions are currently unknown; however, geotechnical surveys to examine existing geology, slope, and soils is tentatively scheduled for March 2021. The estimated footprint would be developed using the geotechnical surveys. Any underlying geology and soils would be buried beneath the structure.

Indirect Impacts: Inclusion of hard structures (e.g. retaining walls) within a riverine environment could lead to increased velocity and scouring of the riverbed immediately surrounding the structure. Under FWOP conditions, continued erosion would occur; therefore, compared to FWOP conditions the alternative impacts would be neutral and no significant.

5.1.1.2.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: No significant direct impacts to buyout footprint geology and soils would occur, as detailed **Section 5.1.1.2.2**. Geology and soils underlying the footprint of the Soldier-Pile Wall would be directly impacted; however, the full extent is unknown at this time. Once subsurface surveys are completed the full scope of direct impacts will be analyzed.

Indirect Impacts: As stated in **Section 5.1.1.2.2** though the removal of structures would not immediately result in the restoration of the original topsoils, a reintroduction of native soils may occur from flooding events over a period of many decades; therefore, compared to FWOP conditions the alternative impacts would be neutral and no significant.

5.1.1.2.6. *Alternative 6 (Combination) Impacts**

The combined effects of Alternatives 3 and 5 would occur.

5.1.1.3. *Prime and Unique Farmlands**

5.1.1.3.1. *No Action Alternative Impacts**

Direct Impacts: The majority of prime and unique farmland soils occur in the surrounding areas. Under the NAA, no construction or land acquisition would occur that would directly convert any designated prime or unique farmlands; therefore, no direct consequences would occur.

Indirect Impacts: Impacts resulting from this action would be consistent with the FWOP conditions. No significant land use development is anticipated under FWOP conditions; therefore, no significant alterations or conversions of prime and unique farmlands would occur as a result of this action. In summary no significant indirect consequences would occur.

5.1.1.3.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The Study Area is heavily urbanized and no prime and unique farmlands occur within the footprint of the buyout locations; therefore, no direct impacts would occur as a result of the alternative.

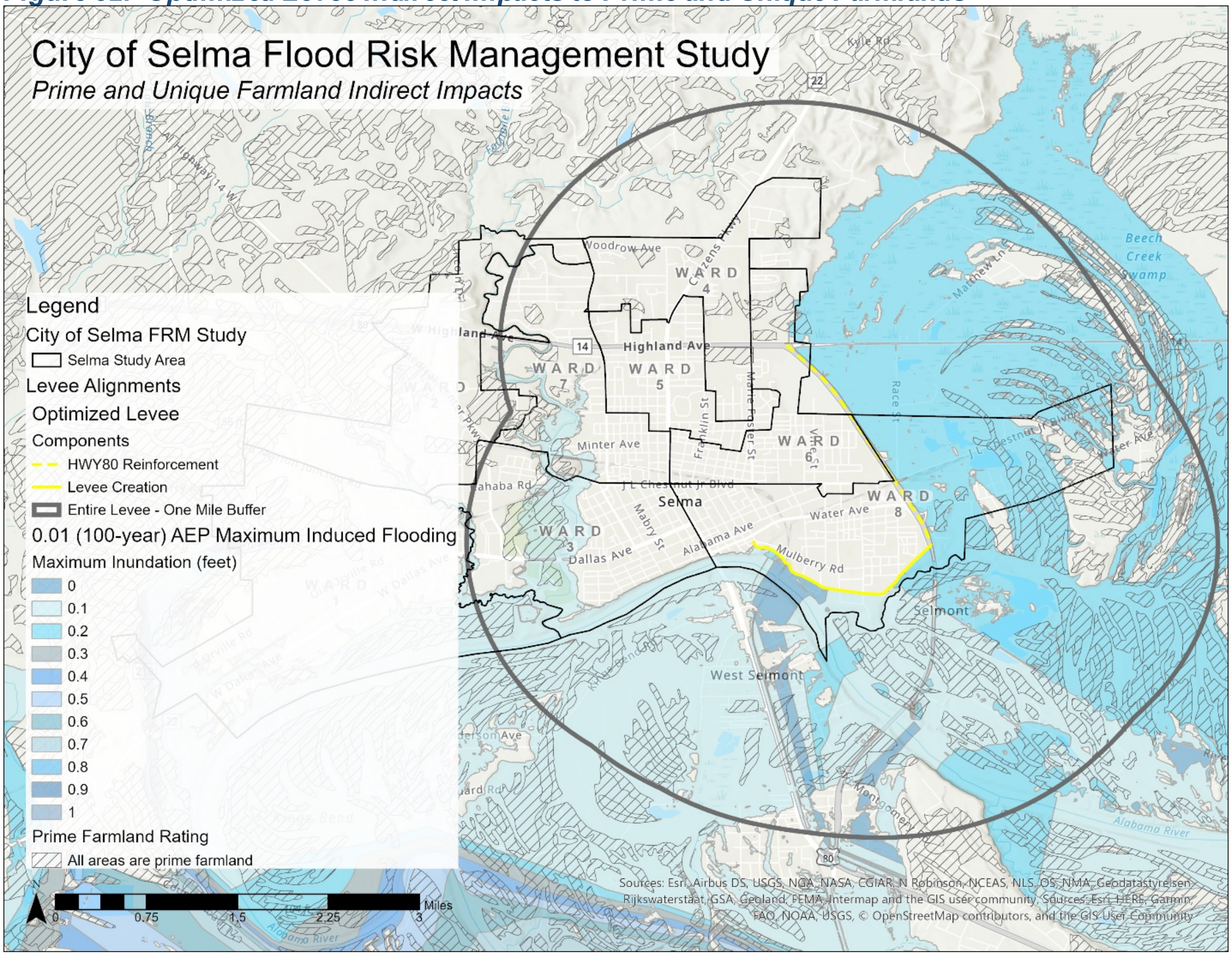
Indirect Impacts: Conversion of residential parcels into a floodplain setting could have a positive benefit to prime and unique soils over a long period of time through the possible reintroduction of unique soils following flooding events; however, these indirect benefits are anticipated to be minor and inconsequential.

5.1.1.3.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Alternative 3 would require construction of a levee and reinforcement of U.S. Highway 80 within Ward 8. Much of the prime and unique soils within the City of Selma were removed during development of the city. Access would be obtained using existing roads. The complete levee alignment would not directly impact prime and unique farmland soils; however, unidentified staging areas may be placed over this resource. Coordination with the USDA Natural Resources Conservation Service (NRCS) would be required should the location of any staging result in the conversion of designated prime and unique farmlands.

Indirect Impacts: Construction of a levee would contribute to induced flooding of the surrounding areas. A flood-depth increase of up to one foot in some locations over a 100-year period was modeled, as represented in **Figure 32**. An increase of flooding in areas operated as farmland may result in crop yield decrease. Consultation with the NRCS is ongoing.

Figure 32: Optimized Levee Indirect Impacts to Prime and Unique Farmlands



5.1.1.3.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: No prime and unique farmland soils occur within the footprint of the alternative. As such, no direct impacts would occur to the resource.

Indirect Impacts: No significant induced flooding would occur as a result of the alternative; therefore, no indirect impacts to prime and unique farmlands would occur.

5.1.1.3.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: The majority of prime and unique farmlands have been removed due to the heavily urbanized development; therefore, no direct impacts to prime farmlands would occur under FWOP conditions.

Indirect Impacts: The alternative would not significantly induce flooding into the surrounding area; therefore, no indirect impacts to prime farmlands would occur under FWOP conditions.

5.1.1.3.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Due to the heavy land use development of the Study Area, no direct impacts to prime and unique farmlands are anticipated with respect to the direct footprint of each component of the alternative. Access for optimized levee construction would be obtained using existing roads while access to construct the Soldier-Pile Wall would occur via river. Parcels within the buyout footprint may be utilized for staging areas which may impact prime or unique farmland soils.

Indirect Impacts: The optimized levee alignment would induce flooding throughout a wide-spread area which could indirectly impact prime and unique farmlands.

5.1.1.4. *Climate**

5.1.1.4.1. *No Action Alternative Impacts**

Direct Impacts: No construction, staging, or demolition would occur that would permanently increase emissions within the Study Area. As a result, no significant direct consequences are anticipated.

Indirect Impacts: As discussed in **Section 3.1.4.1**, the Study Area FWOP conditions would not be drastically changed from current conditions. Additionally under FWOP conditions, the Study Area is anticipated to remain in a similar state with respect to development, recreation, traffic, and land use; therefore, no significant increased emissions which could indirectly affect the Study Area climate are anticipated from heavy machinery and/or vehicular use. Additionally, no construction would occur as a result of the NAA. As a result, no significant indirect consequences to the climate are anticipated.

5.1.1.4.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Emissions have the capability of influencing climates whenever they occur in a significant quantity for a long and continuous period of time; however, increased emissions from demolition activities would be temporary and localized. BMPs would be used to reduce an accumulation of harmful chemicals. Additionally, vegetation has the capability of impacting the climate on a large-scale due to the relationship between water vapor and photosynthesis; however, no significant amount of vegetation would be lost as a result of the alternative. Consequently, the alternative would not have a significant influence on the Study Area climate.

Indirect Impacts: With the removal of structures, traffic within the buyout footprint would be reduced; however, such a reduction would not accumulate enough to positively influence the climate.

5.1.1.4.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Heavy machinery would be used during the construction of the levee. A fully developed construction timeframe was not developed; however, based on professional judgment, construction would occur over approximately 36 months. Because the Study Area is not located within or near a nonattainment zone for Air Quality, the potential for human influence on climate change in this region is minimal. Additionally, BMPs would be used to limit the accumulation of emissions. Upon completion, air quality would revert to normal conditions and would have no influence on the climate.

Indirect Impacts: Implementation of the levee would result in increased local transportation time due to increased travel distance required to commute around the levee alignment; however, these increases are anticipated to be minor and would not significantly increase emissions to a critical level that would alter the climate of the Study Area.

5.1.1.4.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall would occur throughout a one-year process and would increase emissions from heavy machinery temporarily. Those emissions would dissipate upon completion of the alternative. BMPs would be utilized to reduce harmful accumulations of toxic chemicals. No significant amount of vegetation would be removed during construction. Additionally, the FMEEP would temporarily increase traffic as select areas evacuate; however, because the population is low no significant accumulation of emissions would occur. As such, the alternative would not contribute significantly to climate change or otherwise have any influence of the Study Area climate.

Indirect Impacts: No indirect impacts to the climate are anticipated as a result of the alternative.

5.1.1.4.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall and demolition of the residential structures would occur over approximately 30 months and would require heavy machinery to complete. BMPs would be used to reduce the accumulation of emissions which would reduce the overall effect on the Study Area climate. Additionally, no significant amount of vegetation loss would occur that could have an influence on the climate; therefore, no significant impacts to climate would occur as a result of the alternative.

Indirect Impacts: Implementation of the alternative would not result in increased local transportation. Construction of the Soldier-Pile Wall would be necessary to maintain stability of the riverbank for the protection of the historical structures, trails, and districts. Without the integrity of the historical resources, recreational traffic would be reduced; therefore, implementation of the alternative would result in maintaining the existing conditions of recreation and consequently air quality. As such, no indirect impacts to the climate are anticipated as a result of this alternative.

5.1.1.4.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall and levee as well as demolition of the residential structures would occur require heavy machinery over a period of approximately 42 months to complete. BMPs would be used to limit the accumulation of emissions which would reduce the overall influence those emissions have on climate change. No significant amount of vegetation would be removed; therefore, no significant impact to the climate is anticipated.

Indirect Impacts: Implementation of the levee would result in increased local transportation time due to increased travel distance required to commute around the levee alignment; however, these increases are anticipated to be minor. Given that the Study Area is located far away from any nonattainment zones, vehicular emissions from the Study Area would not contribute towards climate change.

5.1.1.5. *Air Quality and Greenhouse Gasses**

5.1.1.5.1. *No Action Alternative Impacts**

Direct Impacts: Adverse impacts to air quality primarily occurs via emissions from natural (e.g. volcanic eruptions) and man-made contributions. No project construction, meaning no heavy machinery or emission releases, would occur as a result of the NAA. Additionally, no natural geologic features or natural phenomenon, such as methane leaks, occur within the Study Area. As a result, no significant direct consequences are anticipated.

Indirect Impacts: While adverse impacts to air quality are primarily driven by emissions, vegetation plays a considerable role in filtering air chemicals (Baldauf and Nowak, 2014). Though abundant vegetation can benefit air quality, a significant reduction in vegetation would have the opposite effect. Under FWOP conditions, no significant increase or decrease to vegetation is anticipated to occur within or surrounding the Study Area. Additionally, the Study Area is anticipated to remain in a similar state with respect to development, recreation, traffic, and land use; therefore, no significant indirect consequences are anticipated.

5.1.1.5.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Demolition within the 25 parcels would temporarily and locally increase emissions from heavy machinery. Duration of this alternative would last approximately 18 months. Upon completion, air quality would revert to pre-construction levels. Because the Study Area is not located within or near a nonattainment zone for Air Quality, neither a State Implementation Plan nor additional restrictions to emission standards are required; therefore, no significant direct adverse impacts to air quality would occur as a result of the alternative.

Indirect Impacts: Removal of residential structures would reduce local traffic through the buyout footprint which could have a minor beneficial impact in the immediate vicinity; however, these changes would be minor and inconsequential.

5.1.1.5.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Because the Study Area is not located within or near a nonattainment zone for Air Quality, neither a State Implementation Plan nor additional restrictions to emission standards are required. Construction of the levee would require the use of heavy machinery. Duration of this alternative would last approximately 36 months. Following completion, air quality would revert to normal conditions.

Indirect Impacts: A loss of vegetation has the potential to reduce the capacity of air chemical filtration; however, a significant amount of loss is necessary before adverse effects to air quality are realized. Alternative 3 would not remove a significant portion of vegetation from either levee footprint or staging areas. Access would be obtained using existing roads; therefore, no significant adverse indirect impacts to air quality is anticipated as a result of this alternative.

5.1.1.5.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall would temporarily increase emissions from the use of heavy machinery over the course of 30 months. Because the Study Area is not located within or near a nonattainment zone for Air Quality, neither a State Implementation Plan nor additional restrictions to emission standards are required. BMPs would be used to minimize toxic chemical accumulation. Upon completion, air quality would revert to pre-construction levels. Additionally, during flood events select locations identified within the FMEEP would evacuate; however, the low population of the Study Area would not be capable of contributing to a significant accumulation of emissions during these events. Following evacuations, the air quality would revert to normal levels; therefore, no significant adverse impacts to air quality are anticipated.

Indirect Impacts: No indirect impacts to air quality are anticipated as a result of the alternative. The Soldier-Pile Wall would neither contribute to the filtration of air nor would it increase the spread of air chemicals.

5.1.1.5.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: The Study Area is not located within a nonattainment zone and does not require maximum emission standards be met through a State Implementation Plan. Construction of the Soldier-Pile Wall and demolition of the residential structures would require the use of heavy machinery over the course of 30 months at which time air quality would revert to normal conditions.

Indirect Impacts: As explained above, vegetation can influence air quality. The alternative would involve the removal of structures and vegetation of the parcels. As such, the increased vegetation would have a slightly beneficial impact; however, the amount of increased vegetation is anticipated to be *de minimus* and benefits received as a result of this alternative cannot be quantified.

5.1.1.5.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Direct impacts for this alternative would be an accumulation of impacts discussed for Alternative 3 and 5. This alternative would require the longest hours and use of heavy machinery and would have the most adverse impacts to air quality from other alternatives. Duration of this alternative would last approximately 42 months. Upon completion air quality would revert to normal conditions.

Indirect Impacts: Parcel acquisition for Alternative 6 differs in amount and location from Alternative 5. The slightly beneficial impacts from conversion of developed parcels to floodplain would not offset the direct impacts caused from an even greater amount of emission releases. Regardless, no significant indirect impacts are anticipated.

5.1.1.6. *Hazardous, Toxic, and Radiological Waste (HTRW)**

5.1.1.6.1. *No Action Alternative Impacts**

Direct Impacts: As stated in **Section 3.1.6**, HTRW material could exist within the riverbank of the downtown Selma vicinity. Numerous structures within the Study Area could contain toxic materials such as lead based paint. The City of Selma has conducted assessments of potential HTRW concerns since 2018. Surveying is anticipated to continue under the FWOP conditions which could reveal additional RECs; however, under the NAA no construction on the riverbank or structural demolition would occur. As such, no addition or removal of HTRW material would occur.

Indirect Impacts: Sites containing HTRW material can be harmful to the natural and human environment. Disturbance of these sites could result in the disbursement of harmful materials to the surrounding environment. Because the NAA does not include stabilization of the riverbank, erosion of the potential lead contaminated material could continue to carry harmful contaminants downriver. Additionally, aquatic species which utilize the riverbank for habitat and/or life cycle needs would remain in contact with harmful materials. In summary, slightly adverse consequences would occur.

5.1.1.6.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: No sites containing RECs are located within the buyout footprint. Residential structures within the buyout footprint may contain lead-based paint, asbestos, and/or toxic mold. Should the presence of these materials be noted prior to implementation, demolition crews approved through the USEPA and the Occupational Safety and Health Administration (OSHA) would remove the contaminants. The alternative would not contribute to an accumulation of HTRW within the City of Selma; therefore, the alternative may slightly benefit the Study Area through the potential removal of contaminated structures.

Indirect Impacts: Because the alternative does not contain a solution to limit flood induced erosion, continued flooding would spread potentially contaminated materials further downstream. This would be consistent with FWOP conditions.

5.1.1.6.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: No HTRW material would be used in construction of the levee. All material would be obtained from locally approved borrow areas. Structures within the alignment of the levee would be demolished. These structures have the potential to contain HTRW material; therefore, demolition crews approved through the USEPA and OSHA would be contracted in the event that HTRW materials are discovered. Overall, no significant direct impacts would occur.

Indirect Impacts: No solution to limit flood induced erosion would occur; therefore, continued flooding would spread potentially contaminated materials further downstream. This would be consistent with FWOP conditions.

5.1.1.6.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: The Soldier-Pile Wall footprint lies directly over known UXOs. These UXOs are a potential HTRW source as they may contain lead, which may have leached into the riverbed soil. An investigative survey will be conducted to target specific locations for UXO removal. Removal of these UXOs would benefit the Study Area by removing a potential source of contamination. Implementation of a FMEEP would not contribute to increased HTRW material.

Indirect Impacts: Should any UXOs be removed from the riverbed, potential benefits to water quality may occur. The UXOs are likely lead-based products and could leech contaminants into the riverbed. Removal of this material would benefit water quality by removing the source of contaminant.

5.1.1.6.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: The alternative would demolish the existing structures within approximately 25 parcels in Ward 8 of the Study Area. The majority of these structures are over 50 years old and may contain HTRW material; therefore, demolition crews approved through USEPA and OSHA would be contracted in the event that HTRW materials are discovered. Additionally, the riverbank within the Downtown section of Selma has a high likelihood of containing lead-contaminated material. This contamination is likely to have occurred from UXOs from the Civil War era that was placed within the river. Prior to implementation, UXO removal would occur which would create a beneficial impact to the surrounding soils; therefore, the alternative would have an overall beneficial impact on the Study Area.

Indirect Impacts: No significant indirect impacts are anticipated as a result of the alternative.

5.1.1.6.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: The combined impacts from Alternatives 3 and 5 would occur; however, due to the reduced buyout footprint of Alternative 6 those impacts would be lesser.

Indirect Impacts: No significant indirect impacts are anticipated as a result of the alternative.

5.1.2. *Biological Resources**

5.1.2.1. *Vegetation**

5.1.2.1.1. *No Action Alternative Impacts**

Direct Impacts: The NAA does not involve construction, demolition, or any activities which would involve the grading of soils and vegetation; therefore, no direct consequences are anticipated as a result of the NAA.

Indirect Impacts: As stated previously, no significant land development within and surrounding the Study Area is anticipated under the FWOP conditions. Because the NAA would not reduce flooding extent, depth, or timing, and would not reduce the hydrologic saturation that vegetation would receive over a 50-year POA. Anticipated FWOP hydrologic conditions account for a 2% increase in peak flow due to upstream land use development; therefore, consequences of this alternative would not be significant.

5.1.2.1.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Staging and demolition for the alternative would occur within each parcel. Access would be obtained using existing roads; therefore, no additional disturbance to vegetation would occur through implementation.

Indirect Impacts: The buyout footprint spans approximately 170 acres total. Conversion of the residential structures to floodplain habitat would result in primary succession species, such as woody vegetation, growth within each parcel; therefore, the alternative may beneficially impact Ward 8, albeit minor.

5.1.2.1.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: The total length of the entire levee alignment is approximately 3.6 mi. Of the total length, approximately 1.6 mi would account for construction of the levee section and 2.0 mi would account for the reinforcement of U.S. Highway 80. Because the Study Area is considered highly developed, vegetation within the alternative footprint has been subjected to frequent human disturbance; therefore, no significant adverse impacts to vegetation are anticipated as a result of the alternative.

Indirect Impacts: Vegetation within and surrounding the Study Area experiences flooding on a recurring basis; however, the alternative would cause significant induced flooding within the City of Selmont as well as isolated pockets within the City of Selma Ward 1. Under the FWOP conditions, the Study Area and surrounding environment would continue to experience frequent flood events. This pattern compounded with induced flooding would accumulate to increased stress on vegetation within and surrounding the Study Area as a result of the alternative.

5.1.2.1.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Construction of the Soldier-Pile Wall would result in the removal of vegetation along approximately 750 linear ft of riverbank. Removal of vegetation would be necessary to maintain structural integrity. Considering the existing degradation of the riverbank, this impact would be minor. No impacts to vegetation would occur from the addition of the FMEEP.

Indirect Impacts: No vegetation would be permitted to grow within the footprint of the Soldier-Pile Wall following construction completion; therefore, no significant indirect impacts are anticipated.

5.1.2.1.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Vegetation along the riverbank is minimal due to the extreme vertical slope and continued erosion. The maximum terrestrial acreage accounts for eight acres. Staging and access for Soldier-Pile Wall construction would occur via barge. The approximate buyout footprint accounts for 170 acres, and staging for demolition of existing structures would occur within each identified parcel. Access for demolition would be obtained using existing roads. The alternative would require properties to be seeded with native grasses following demolition activities. Maintenance of the acquired properties would require regular invasive species removal. Conversely, maintenance of the Soldier-Pile Wall would require vegetation removal to ensure structural integrity. Overall, the alternative would result in a maximum increase of 162 acres of vegetated land as a result of acquisition.

Indirect Impacts: Land use changes of existing parcels from developed to floodplain would result in increased vegetation growth within parcels identified for acquisition and demolition. In total this would account for approximately 170 acres for potential increased grasses, trees, and shrub species.

5.1.2.1.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: A maximum conversion of 68 acres from developed land use to floodplain habitat within the buyout footprint of parcels outside the levee alignment would occur. A decrease in vegetation would occur through levee and Soldier-Pile Wall construction. The amount of converted land use for the construction of the Optimized levee would span approximately 18 acres. The maximum terrestrial area of the Soldier-Pile Wall footprint is approximately eight acres; therefore, the maximum terrestrial land use conversion with the potential to increase vegetation is approximately 42 acres.

Indirect Impacts: No significant indirect impact on vegetation within and surrounding the Study Area.

5.1.2.2. *Fish and Wildlife Resources**

5.1.2.2.1. *Aquatic Species**

5.1.2.2.1.1. No Action Alternative Impacts*

Direct Impacts: No construction, demolition, or staging would occur within or adjacent to the Alabama River as a result of the NAA; therefore, no direct consequences to aquatic species would occur.

Indirect Impacts: Though the Study Area lies between two USACE locks and dams, the aquatic species richness is considered high. Diversity is essential to the stability of the regional ecosystem. Under FWOP conditions, an increasingly eroded riverbank would have compounding effects to the aquatic environment within and downstream of the Study Area. Increased erosion would result in decreased water quality, habitat, and foraging conditions for aquatic species; therefore, the NAA would result in minor adverse indirect consequences to the environment.

5.1.2.2.1.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: Demolition activities typically do not create a significant amount of runoff. Minor amounts of sedimentation runoff into aquatic habitat would be avoided by using BMPs; therefore, no significant impacts to aquatic species would occur.

Indirect Impacts: Removal of structures within the floodplain may create increased wetland habitat which could benefit amphibian species. The buyout footprint would have the maximum capability of converting 170 acres into wetlands; however, conversion would take many decades to occur due to the non-native red clay soils used for creating the structural foundations within each parcel. Consequently, any indirect benefit of the alternative would be minor and inconsequential.

5.1.2.2.1.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: No activities would occur within or adjacent to the Alabama River nor its tributaries as a result of the alternative; therefore, no direct impacts are anticipated as a result of Alternative 3.

Indirect Impacts: Though floodplain territory is considered terrestrial, aquatic species are linked to floodplain importance for numerous benefits during flood events (such as carbon transport, spawning, and foraging access). For example, a reduction in floodplain acreage would reduce carbon transport necessary for aquatic invertebrate growth and fecundity which would then decrease prey sources for mega fauna in the region. Because the Study Area is considered highly developed with poor floodplain quality, a reduction of floodplain acreage as a result of levee construction would not yield a significant adverse impact. Conversely, induced flooding throughout the surrounding area would allow for increased floodplain inundation benefits for aquatic species. These impacts, however, would be minor and inconsequential.

5.1.2.2.1.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: Construction of an approximate 750 linear foot Soldier-Pile Wall would occur within the Alabama River. No channel diversion would be necessary. Construction of the 94 H-Piles would be driven into the riverbed and 22,500 total sq ft of concrete panels sized 4 ft x 8 ft x 8" would be slid in-between each pile. A total of 12,500 cy of granular fill and 3,333 cy of riprap would be filled behind the Soldier-Pile Wall. BMPs would be used to reduce increased turbidity within and downstream of the Study Area. Riverine habitat within the Soldier-Pile Wall footprint would be permanently removed for the Alabama River. Benthic species within this footprint would be impacted during construction. Fishes and other pelagic species would migrate from the construction zone. Upon completion of construction, aquatic species would return; therefore, direct impacts resulting from construction to aquatic species would be minimal. No impacts to aquatic species would occur from the addition of the FMEEP.

Indirect Impacts: No significant increase in river stage would occur as a result of the alternative. Inclusion of hard substrates and structures within a riverine environment could potentially lead to riverbed scour; however, the Soldier-Pile Wall would be designed to minimize increased velocity in the immediate vicinity of the project. Consequently, indirect impacts would be minimal.

5.1.2.2.1.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: The Soldier-Pile Wall would result in temporary and isolated decreased water quality during construction. BMPs would be used to minimize adverse impacts to aquatic resources. Pelagic fish (meaning fish that primarily inhabit the water column), amphibians, and aquatic reptiles within the area would relocate during this time; however, species would return once conditions improve upon project completion. Conversely, construction activities would result in the mortalities of any existing benthic aquatic species within the direct footprint of the Soldier-Pile Wall. Riverine habitat within the Soldier-Pile Wall footprint would be removed resulting from construction; however, the amount of habitat loss is minimal compared to the available riverine habitat in the surrounding area.

Indirect Impacts: Though aquatic habitat reduction would occur as a result of Soldier-Pile Wall construction, the alternative would ultimately provide a significant benefit to aquatic species within the surrounding area. The stabilization of the riverbank would reduce the amount of erosion which in turn would improve the water quality, riverine habitat, and foraging conditions in the immediate and downstream environment.

5.1.2.2.1.6. Alternative 6 (Combination) Impacts*

Direct Impacts: During construction of the Soldier-Pile Wall, most aquatic species would vacate the Study Area and return upon project completion. However, construction activities would result in the mortality of some benthic (i.e. bottom-dwelling) species. The Soldier-Pile Wall would permanently remove aquatic riverine habitat; however, that amount is minimal when compared to the available riverine habitat in the surrounding area.

Indirect Impacts: The optimized levee alignment would result in the permanent disconnection of floodplain within Wards 6 and 8; however, induced flooding in the surrounding area would increase floodplain inundation necessary for aquatic species. The Soldier-Pile Wall would ultimately benefit aquatic species by stabilizing a volatile riverbank. Additionally, a conversion of 68 acres of developed parcels into floodplain habitat would benefit aquatic species reliant on floodplain connectivity. Induced flooding would also benefit aquatic species by increasing carbon transport following flood events.

5.1.2.2.2. *Terrestrial Species**

5.1.2.2.2.1. No Action Alternative Impacts*

Direct Impacts: No terrestrial habitat loss would occur under the NAA. Additionally, no ground disturbances that could result in species' mortality would occur; therefore, no direct adverse consequences to terrestrial species are anticipated as a result of the NAA.

Indirect Impacts: Theoretically, construction or demolition activities temporarily increase noise volume within the local area which results in the temporary and isolated migration of terrestrial species. Since no activities would occur under the NAA, no indirect adverse consequences to terrestrial species are anticipated.

5.1.2.2.2.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: Removal of structures would potentially increase terrestrial habitat by 170 acres for species within the immediate surrounding.

Indirect Impacts: Additional terrestrial habitat may lead to increased food sources for common species throughout the buyout footprint.

5.1.2.2.2.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: Construction of the optimized levee would not likely result in direct species mortality. Species within the area would relocate during construction activities; however ,terrestrial species may not be capable of returning to previously occupied areas due to habitat fragmentation. Consequently, the alternative would negatively impact terrestrial species within the Study Area.

Indirect Impacts: Construction of the optimized levee would result in the fragmentation of terrestrial habitat. Fragmentation of terrestrial habitat eliminates migration between previously used corridors, which could lead to species population divergence. Common terrestrial species within the Study Area have acclimated to the human environment; however, the amount of habitat fragmentation would result in a substantial environmental change. Consequently, the alternative would adversely impact terrestrial species within the Study Area.

5.1.2.2.2.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: The alternative would have no significant direct impacts on terrestrial habitats or species.

Indirect Impacts: The Soldier-Pile Wall would not significantly induce flooding within existing terrestrial habitat. Continued flooding would occur within the Study Area; however, existing species have acclimated. Evacuation of specific locations within the Study Area may lead to temporary increased noise which may indirectly distract terrestrial species; however, species within the Study Area have acclimated to a metropolitan surrounding and would not be determinately impacted from the FMEEP. Consequently, no significant indirect impacts to terrestrial species would occur.

5.1.2.2.2.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: No terrestrial species mortality would likely occur during demolition activities. Staging areas would be located within each parcel identified for acquisition. Access for demolition would be obtained using existing roads while access for Soldier-Pile Wall construction would be obtained via river. Any existing species within the immediate vicinity would relocate during demolition activities and would return upon project completion; therefore the alternative would have no significant impacts to terrestrial species within the Study Area.

Indirect Impacts: Demolition activities would increase noise volumes immediately surrounding the alternative footprint. Noise level increases would cause existing species to relocate; however, species would return upon project completion. Demolition of existing structures within Ward 8 would result in a potential increase of 170 acres of terrestrial habitat; therefore, the alternative would have slightly beneficial impacts to terrestrial species.

5.1.2.2.2.6. Alternative 6 (Combination) Impacts*

Direct Impacts: No mortality is anticipated as a result of the alternative. Existing species within the immediate vicinity of project construction and demolition would vacate the area; however, due to the levee feature vacated species may not be capable of returning to the original location following completion. Consequently, the alternative would negatively impact terrestrial species within the Study Area.

Indirect Impacts: The levee alignment would serve as a barrier within a wildlife corridor which is necessary for wildlife movement and migration. Though Alternative 6 contains acquisition and demolition, benefits with regards to increased habitat area would not offset the amount of habitat fragmentation that would occur.

5.1.2.3. *Protected Species**

5.1.2.3.1. *Threatened or Endangered Species**

5.1.2.3.1.1. No Action Alternative Impacts*

Direct Impacts: Under the NAA, no construction, staging, or demolition would occur; therefore, there would be no direct consequences to Federally listed T&E within the Study Area.

Indirect Impacts: As described within **Section 3.2.3.1** there are seven Federally listed T&E listed for Dallas County, Alabama. The official record of Federally listed species is included in **Table 5**. Habitat suitable for Federally listed Tulotoma Snail occurs within the riverine reach of the Study Area. No adverse impacts to suitable habitat surrounding the Study Area is anticipated under FWOP conditions; however, within the Study Area, long-term continual erosion may negatively impact suitable habitat. These impacts are minor and gradual over a long-term timeframe; therefore, the consequences of the NAA are minor.

5.1.2.3.1.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: The likelihood of T&E presence within the buyout footprint is low. No suitable habitat exists within each parcel. These parcels have been maintained as residential property which involves regular mowing; therefore, the alternative would not directly impact T&E species.

Indirect Impacts: Indirect benefits could occur as the parcels would be converted to floodplain habitat. One such species that could particularly benefit from this conversion is the Price's Potato-Bean which relies on lightly disturbed areas where bluffs descent to streams.

5.1.2.3.1.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: Potential modification to suitable habitat for the Federally threatened Georgia Rockcress and Price's Potato-bean could occur as a result from staging during construction; therefore, this alternative could have slight adverse impacts to Federally listed species.

Indirect Impacts: Induced flooding would have the potential to alter the hydric soils of wetland habitats and rights-of-way in the surrounding area. This alteration would negatively affect potential suitable habitat for the Federally endangered Alabama canebrake pitcher-plant, Federally threatened Georgia Rockcress, and Federally threatened Price's Potato-bean in the surrounding areas.

5.1.2.3.1.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: The footprint of the Soldier-Pile Wall lies within suitable habitat for the Tulotoma Snail, as identified by ALDCNR. Of the entire species population, the largest and healthiest population occurs within the Study Area. This population has not been formally delineated, so the exact range is unknown; however, one can assume that the population spans the entire length of the Soldier-Pile Wall footprint due to the presence of suitable habitat. For this reason, the USACE determined that the alternative "may affect and is likely to adversely affect" the Tulotoma Snail. Through early technical assistance, potential Reasonable and Prudent Measures (RPMs), such as relocation surveys, were identified as ways minimize the impacts to the species and avoid jeopardizing the continued species existence.

Additionally, critical habitats for the Alabama Sturgeon, Orangenacre Mucket, and Southern Clubshell, exist within the Study Area. Technical coordination with the USFWS suggests the Study Area meets all PCEs necessary to sustain classification as critical habitat. Though the riverbed may experience erosional processes periodically, the “stability” required for species’ needs is less than what’s required for the human environment; therefore, the USACE, Mobile District determined that the alternative “may affect and is likely to adversely affect” critical habitat for these species.

The formal consultation process with the USFWS under Section 7 of the ESA has been initiated. A copy of the final Biological Opinion (BO) will be included in **Appendix B** of the Final Integrated FR/EA.

Indirect Impacts: The surrounding area contains a large amount of suitable habitat for T&E reliant on disturbed areas and wetlands. Since the Soldier-Pile Wall would not significantly induce flooding within the surrounding area, existing wetlands would maintain their current hydrologic pattern. Additionally, no significant changes to land use development within and surrounding the Study Area is anticipated; therefore, no indirect impacts to T&E would occur.

5.1.2.3.1.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: No impacts to Federally listed terrestrial T&E within the buyout footprint would occur. Access for demolition would be obtained using existing roads. Staging and construction would occur within each parcel, which contain highly degraded habitat not suitable to Federally listed species; therefore, no direct mortality is anticipated. The Soldier-Pile Wall feature would eliminate suitable habitat for the Tulotoma Snail. Previous surveys conducted by the ALDCNR observed a substantial population of Tulotoma Snail within the footprint of the Soldier-Pile Wall. Construction of the Soldier-Pile Wall would result in the direct mortality of the species.

Indirect Impacts: Minor beneficial impacts to terrestrial T&E would occur as a result of habitat conversion within Ward 8. As developed land is converted to floodplain habitat, increased potential habitat for the Price’s Potato-Bean may occur. Combined with no direct adverse impacts, these indirect benefits would result in an overall beneficial impact to terrestrial species; however, no indirect impacts would occur to aquatic T&E.

5.1.2.3.1.6. Alternative 6 (Combination) Impacts*

Direct Impacts: Alternative 6 would result in the direct mortality of the Tulotoma Snail and the permanent loss of suitable habitat for the species as well as critical habitat for the Alabama Sturgeon, Orangenacre Mucket, and Southern Clubshell.

Indirect Impacts: Because the alternative would result in induced flooding, suitable habitat forFederally listed species within the City of Selmont may be negatively impacted.

5.1.2.3.2. *Migratory Birds**

5.1.2.3.2.1. No Action Alternative Impacts*

Direct Impacts: No construction, staging, or demolition would occur as a result of the NAA; therefore, no consequences to migratory birds would occur.

Indirect Impacts: Floodplain and wetland areas are prime targets for migratory bird foraging and resting habitat. Under FWOP conditions, the continued flooding and limited land use development within the Study Area would maintain existing floodplain and wetland habitat; therefore, under the NAA no adverse consequences to migratory birds would occur.

5.1.2.3.2.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: Implementation of the alternative would not result in the direct mortality of any migratory bird species. Migratory birds would vacate the immediate vicinity upon initial staging and access activities; however, species would return following demolition completion. No tree removal would be required for access since existing roads would be utilized. Staging and demolition would occur within each parcel; therefore, no nest disturbance or destruction would occur.

Indirect Impacts: Noise generated from demolition activities would cause migratory birds to vacate the immediate vicinity of the buyout footprint; however, upon completion noise levels would revert to normal levels and migratory birds would relocate at will.

5.1.2.3.2.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: No direct mortality would occur as a result of the optimized levee construction. Migratory birds within the vicinity of construction activities would relocate during implementation and would resume normal activities upon project completion. The optimized levee alignment lies within a heavily developed footprint; therefore, tree removal would be minimal.

Indirect Impacts: Increased noise volumes would disrupt natural behavior of migratory birds within the immediate vicinity of construction, access, and staging activities; however, upon project completion noise volumes would revert to pre-construction conditions. Additionally, induced flooding may adversely alter floodplain and wetland habitat within and surrounding the Study Area; therefore, the alternative would result in minor and insignificant adverse impacts to migratory birds within and surrounding the Study Area.

5.1.2.3.2.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: Limited vegetation exists along the riverbank. While the possibility of bird nests within this vegetation is minimal, their presence is plausible. Prior to vegetation removal, a qualified biologist will survey for active nests; however, due to the steep terrain of the bluff, removal of nests may not be possible. These impacts are anticipated to be minor. Coordination with the USFWS will be included within **Appendix B** of the Final Integrated FR/EA. No impacts to migratory birds would occur as a result of the FMEEP.

Indirect Impacts: Migratory birds would vacate the immediate vicinity during construction activities due to increased noise levels. Following construction completion migratory birds would resume normal activity.

5.1.2.3.2.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: As with Alternative 4, Alternative 5 may involve the removal of nested trees within the footprint of the Soldier-Pile Wall. Coordination with the USFWS would be required for this alternative.

Indirect Impacts: The natural behavior of migratory birds within the immediate vicinity of construction and demolition activities would be impacted as increased noise levels occur. Species would revert to normal behavior once noise volumes revert to pre-construction conditions upon project completion. As with Alternative 3, land use conversion may increase the probability of wetland creation within the Study Area over long-term trends; however, these minor benefits would be insufficient to outweigh the adverse effects of noise disturbance; therefore, the alternative would have negative impacts on migratory birds within the Study Area.

5.1.2.3.2.6. Alternative 6 (Combination) Impacts*

Direct Impacts: No direct mortality would occur as a result of the optimized levee construction. Migratory birds within the vicinity of construction activities would relocate during implementation and would resume normal activities upon project completion. Direct impacts to species may occur through nested tree removal during construction of the Soldier-Pile Wall. Coordination with the USFWS would be required.

Indirect Impacts: Increased noise volumes would disrupt natural behavior of migratory birds within the immediate vicinity of construction and demolition activities; however, upon project completion noise volumes would revert to pre-construction conditions. Floodplain and wetland areas are prime targets for migratory bird foraging and resting habitat. Induced flooding would adversely alter floodplain and wetland habitat within and surrounding the Study Area. The limited land use conversion from developed parcels bordering the levee to floodplain habitat may increase the probability of wetland creation within the Study Area over long-term trends; however, these benefits would not be sufficient to offset the adverse impacts as a result of induced flooding.

5.1.2.3.3. *Bald and Golden Eagles**

5.1.2.3.3.1. No Action Alternative Impacts*

Direct Impacts: No active or inactive Bald Eagle nests are located within the Study Area. Additionally, no construction, staging, or demolition would occur under the NAA. As such, no tree removal would occur; therefore, no direct consequences of the NAA are anticipated.

Indirect Impacts: No significant land use developments involving tree removal would occur under the FWOP conditions; therefore, no indirect consequences would occur.

5.1.2.3.3.2. Alternative 1.A (Buyouts) Impacts*

Direct Impacts: No eagle nests, active or inactive, are located within the buyout footprint; therefore, no direct impacts to the species are anticipated. No surveys have been conducted to locate eagle nests within a three-mile buffer. Coordination with USFWS and ALDCNR would be required to ensure no adverse impacts to Bald Eagle would occur.

Indirect Impacts: Indirect impacts to Bald Eagles are not anticipated. No significant land use development within the Study Area is anticipated; therefore, no indirect noise disturbances to the species would occur.

5.1.2.3.3.3. Alternative 3 (Optimized Levee) Impacts*

Direct Impacts: The optimized levee alignment would not require tree removal; however, construction activity could potentially occur within the three-mile buffer zone of active eagle nests. Coordination with USFWS and ALDCNR would be required to ensure no adverse impacts to Bald Eagles would occur.

Indirect Impacts: Bald Eagles nest and forage within floodplain habitats. Modification to this suitable habitat would negatively impact Bald Eagles. The fragmented floodplain within Ward 8 and induced flooding in the surrounding area caused by the alternative would potentially alter floodplain characteristics; however, the amount of anticipated changes would be minor. Consequently, no significant indirect impacts to Bald Eagles would occur.

5.1.2.3.3.4. Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts*

Direct Impacts: Limited vegetation exists along the riverbank. The alternative footprint does not either contain active or inactive bald or golden eagle nests; therefore, no direct impacts would occur to the species. No Bald Eagle surveys have been conducted to identify Bald Eagle nests within a three-mile buffer of the alternative footprint. Should any nests be present, construction activities may disturb eagle nesting behavior. Additionally, construction activities may disturb foraging behavior; however, it is presumed that Bald Eagle would forage in a nearby location outside of the Study Area. Coordination with USFWS and ALDCNR would be required to ensure no adverse impacts to Bald Eagles would occur. No bald or golden eagles would be impacts from the FMEEP.

Indirect Impacts: No significant induced flooding would occur as a result of this alternative; therefore, no significant indirect impacts are anticipated.

5.1.2.3.3.5. Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts*

Direct Impacts: Limited vegetation exists along the riverbank. Additionally, neither active nor inactive bald or golden eagle nests exist within the alternative footprint; therefore, no direct impacts would occur to the species. Construction activity could potentially occur within the three-mile buffer zone of active eagle nests. Coordination with the USFWS and the ALDCNR would be required to ensure no adverse impacts to Bald Eagles would occur.

Indirect Impacts: Increased floodplain habitat from the buyout footprint could potentially benefit Bald Eagles; however, the amount of converted land use would be minimal and would still be in close proximity to an active metropolitan area. Consequently, no significant indirect impacts to Bald Eagles would occur.

5.1.2.3.3.6. Alternative 6 (Combination) Impacts*

Direct Impacts: The levee alignment may not require the removal of trees. Construction activity could potentially occur within the three-mile buffer zone of active eagle nests.

Coordination with the USFWS and the ALDCNR would be required to ensure no adverse impacts to Bald Eagles would occur.

Indirect Impacts: The alternative would convert a maximum of 68 acres of developed parcels to floodplain habitat in parcels outside the levee alignment. The alternative would also cause induced flooding within the surrounding area. The buyout footprint would not offset the amount of fragmented floodplain created from the levee. Additionally, induced flooding could potentially alter floodplain characteristics. The amount of these anticipated changes would be minor; therefore, no significant indirect impacts to Bald Eagles would occur.

5.1.2.4. *Wetlands**

5.1.2.4.1. *No Action Alternative Impacts**

Direct Impacts: No placement of dredged or fill material would enter wetland areas under the NAA; therefore, no adverse consequences are anticipated.

Indirect Impacts: Jurisdictional wetlands are required to meet three criteria: hydrologic connectivity, hydric soils, and hydrophyte vegetation. Under FWOP conditions, the Study Area would continue to experience flooding events. Established wetlands within the floodplain would maintain their hydrologic connectivity. Soil transport during flooding events is a common occurrence in fluvial regions; however, soil accumulation trends in impounded systems appear primarily within the river channel. Any soil accumulation not contained within the river channel would be spread throughout the floodplain. Thus, the resulting accumulation within wetlands would be considered *de minimus* and would not impact existing hydric soils. Likewise, wetland vegetation would continue to thrive under FWOP conditions; therefore, consequences to wetlands within and surrounding the Study Area are anticipated.

5.1.2.4.2. *Alternative 1.A (Buyouts) Impacts**

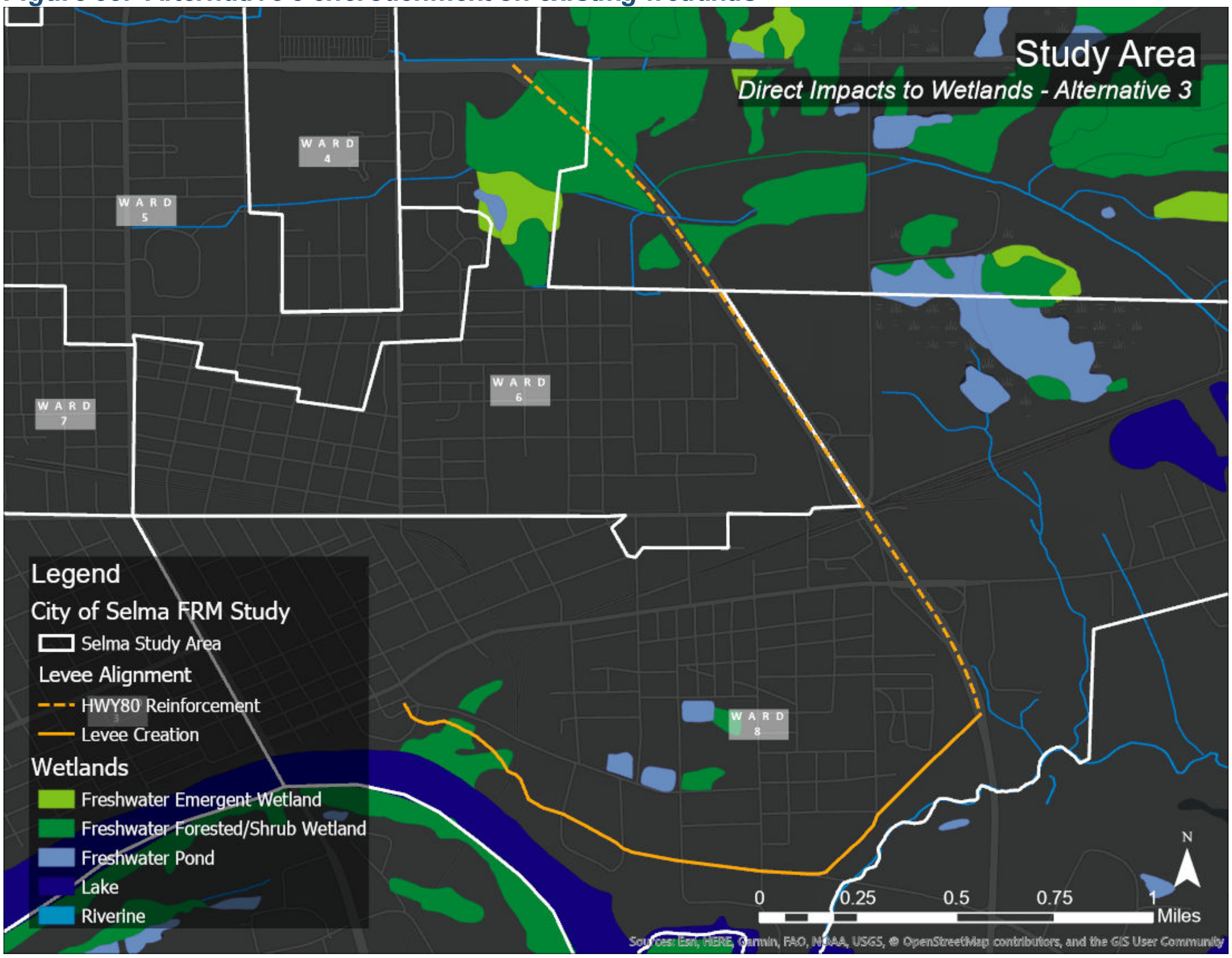
Direct Impacts: No wetland delineations have occurred; however, the likelihood of jurisdiction wetland presence within each parcel is low. Furthermore, demolition of structures would be confined within each parcel; therefore, no significant impacts to wetlands would occur.

Indirect Impacts: The alternative would demolish structures within each of the 25 parcels and have the potential to increase habitat by 170 acres. Because the buyout footprint is within the floodplain, demolition of each structure may lead to wetland conversion over a long-term period. The existing parcels contain red-clay soil used for structural foundations which are not classified as wetland soils; however, introduction of acidic soils may occur over many decades provided the parcels remain undeveloped. Consequently, the alternative may have minor benefits to wetlands.

5.1.2.4.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: As shown in **Figure 33**, the optimized levee alignment would eliminate potential wetlands within the direct footprint. Additional wetlands would be disconnected from the floodplain thus having the potential to sever hydrologic connectivity. Mitigation would be required for any impacts to jurisdictional wetlands.

Figure 33: Alternative 3 encroachment on existing wetlands



Indirect Impacts: Construction of the alternative would result in induced flooding in the City of Selmont and within isolated pockets in the City of Selma. Much of the surrounding area, including the City of Selmont, is comprised of wetlands due to the low-lying elevation of the floodplain. Because the three components of jurisdictional wetlands are comprised of vegetation, soils, and hydrology, alteration of the existing hydrologic pattern would contribute to adverse effects on wetlands. Under FWOP conditions, peak flows within the Study Area would increase by 2%; therefore, long-term compounding factors, such as induced flooding, may alter wetlands surrounding the Study Area as a result of the alternative. Mitigation requirements would require a quantitative analysis before coordination for the alternative could be complete.

5.1.2.4.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: The Soldier-Pile Wall footprint may encompass jurisdictional wetlands. The footprint will be surveyed to determine the presence of wetlands. Prior to the release of the Final Integrated FR/EA WQC would be obtained. Wetland impacts resulting from

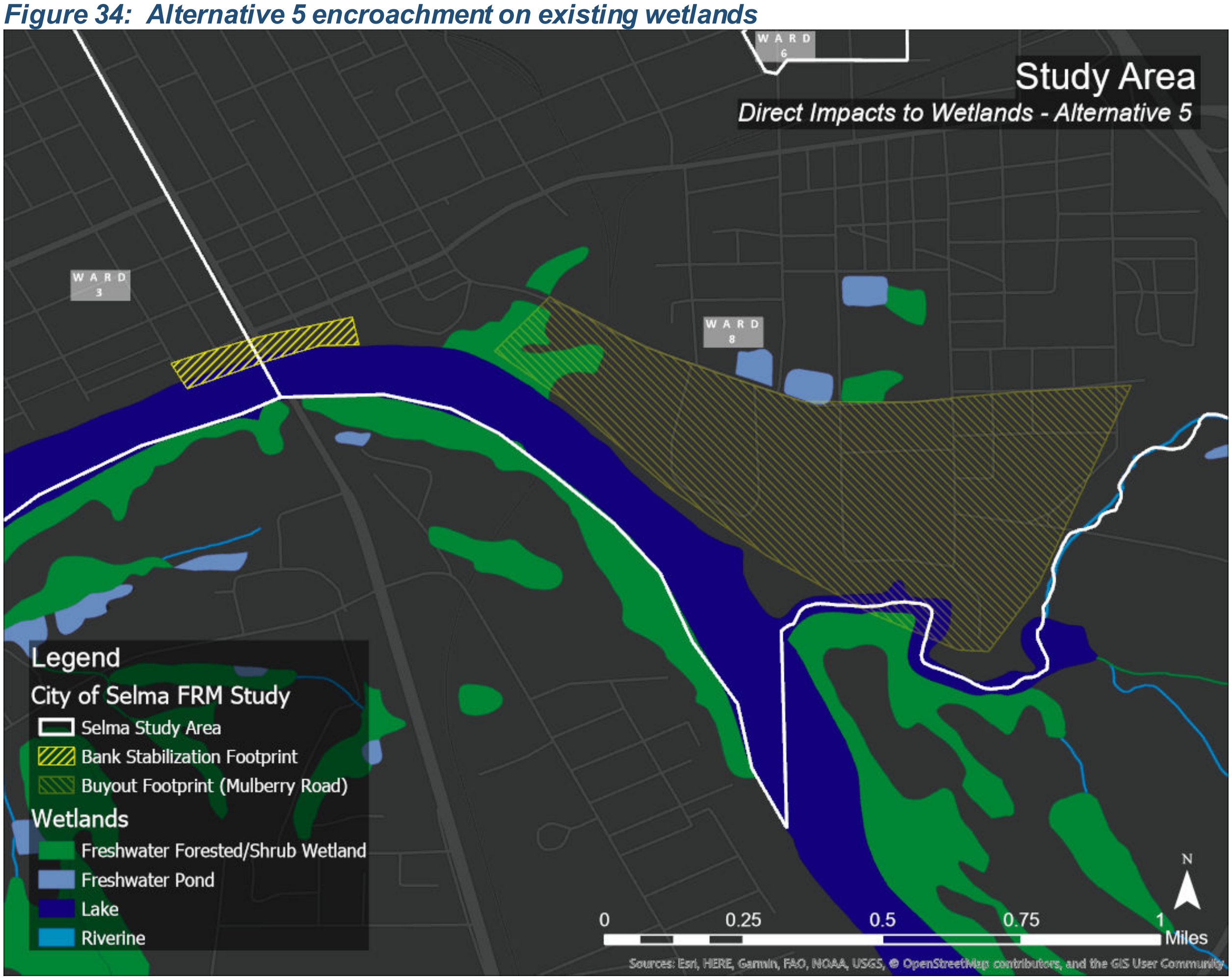
Soldier-Pile Wall construction are anticipated to be minor. No wetlands would be impacted as a result of the FMEEP.

Indirect Impacts: This alternative would not disconnect potential wetlands from the floodplain; therefore, existing wetlands within the surrounding area would maintain their hydrologic connectivity and would not be indirectly adversely impacted.

5.1.2.4.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Staging and access for Soldier-Pile Wall construction would be obtained via river. As shown in **Figure 34**, the buyout boundary may encroach on a minimal amount of potential wetlands. Activities related to the alternative include acquisition and demolition of existing structures. Staging for demolition would occur in each identified parcel. Access would be obtained using existing roads. Because each parcel lies within a highly developed area, the potential for jurisdictional wetlands is minimal. Jurisdictional wetland surveys would be required to calculate mitigation needs.

Figure 34: Alternative 5 encroachment on existing wetlands

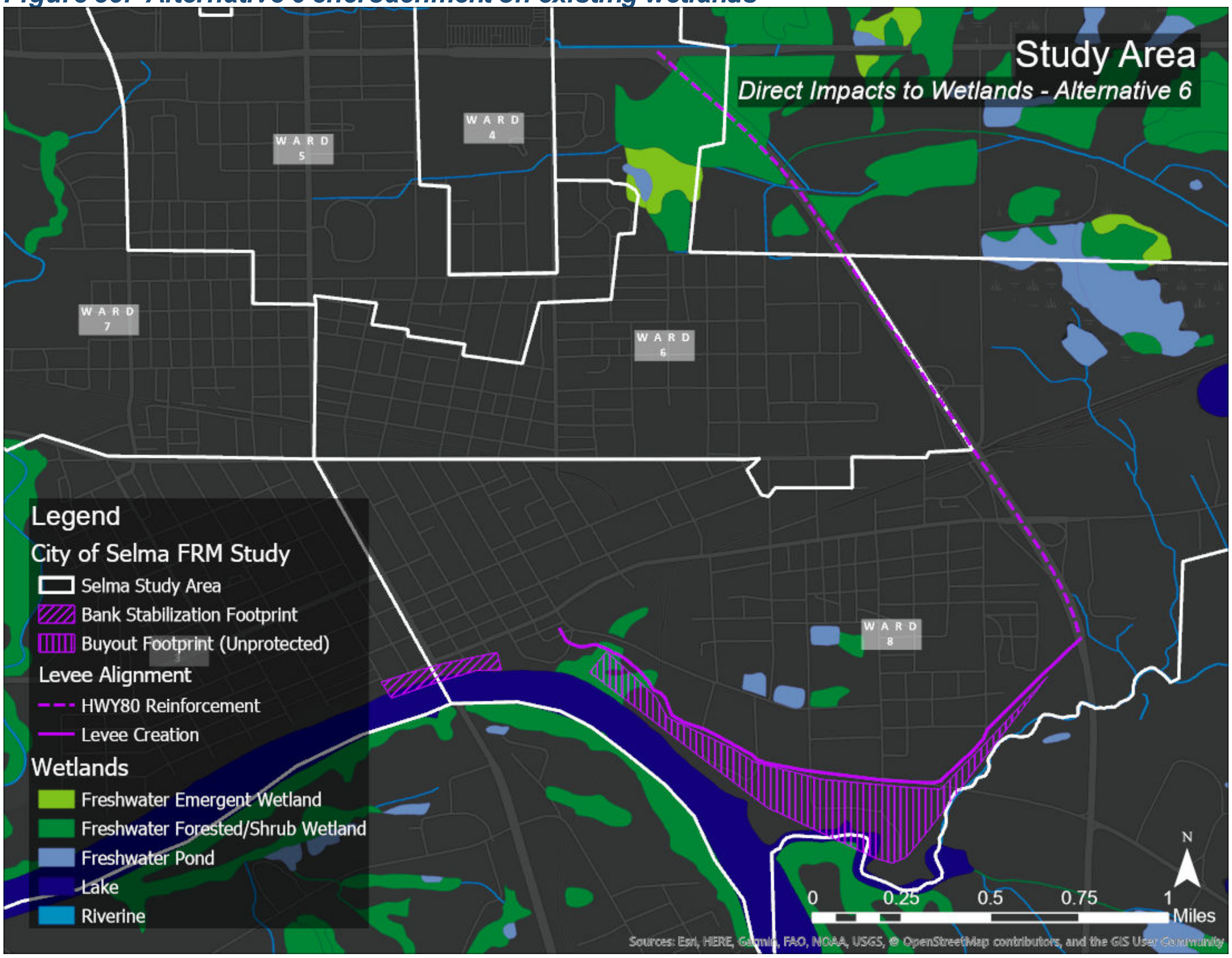


Indirect Impacts: The conversion from developed land use to floodplain habitat within Ward 8 could allow for long-term wetland conversion; however, the likelihood is minimal. Consequently, no significant impacts to wetlands are anticipated.

5.1.2.4.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: As shown in **Figure 35**, this alternative has the highest impacts to wetlands compared to all other alternatives.

Figure 35: Alternative 6 encroachment on existing wetlands



Indirect Impacts: Though Alternative 6 features demolition of structures within the 68-acre buyout footprint, these potential minor benefits would not offset the adverse impacts resulting from the floodplain disconnection within the Study Area. Additionally the optimized levee footprint may contribute to widespread indirect impacts to surrounding wetlands through induced flooding; therefore, the alternative would have adverse impacts to wetlands within the Study Area.

5.1.3. *Cultural Resources**

5.1.3.1. *Architectural**

5.1.3.1.1. *No Action Alternative Impacts**

Direct Impacts: The NAA produces negative consequences to architectural cultural resources as the degraded bankline threatens the structural integrity of Nationally Registered Historic Properties.

Indirect Impacts: Potential loss of these structures as a result of the NAA negatively consequences the viewshed of the Edmund Pettus Bridge, Water Avenue Historic District, and Civil Rights Historic Districts.

5.1.3.1.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The removal of nationally registered structures would negatively impact the Civil Rights Historic District.

Indirect Impacts: The removal of national registered structures would impact the viewshed of the Civil Rights Historic District.

5.1.3.1.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Alternative 3 would have negative impacts to structures within the footprint of the levee alignment as these would have to be removed.

Indirect Impacts: Alternative 3 would have negative impacts to the viewshed of the Civil Rights Historic District.

5.1.3.1.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Alternative 4 would have beneficial impacts to the structural integrity of structures with the bank stabilization footprint

Indirect Impacts: Alternative 4 could have negative impacts to viewshed as the viewshed of the Edmund Pettus Bridge and the Water Avenue and Civil Rights Historic Districts would be altered. These impacts can be mitigated through construction of a natural bankline and Memorandum of Agreement (MOA) among the National Park Service (NPS), the Alabama Historical Commission (AHC) State Historic Preservation Officer (SHPO), and the USACE.

5.1.3.1.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Alternative 5 would produce beneficial impacts in regards to the bank stabilization for architectural cultural resources as the stabilization alternative would protect the structural integrity of Nationally Registered Historic Properties. The buyout component of the alternative would have negative impacts due to the removal of structures from a historic district.

Indirect Impacts: Alternative 5 would have similar negative impacts to Alternatives 1 and 4.

5.1.3.1.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Alternative 6 would produce similar impacts as Alternatives 3 and 5.

Indirect Impacts: Alternative 6 would produce similar impacts as Alternatives 3 and 5

5.1.3.2. *Cultural and Archaeological Resources**

5.1.3.2.1. *No Action Alternative Impacts**

Direct Impacts: The NAA would continue to produce negative consequences to cultural and archaeological resources as known archaeological sites along the bankline are losing integrity due to the severe erosion and sloughing.

Indirect Impacts: The NAA has no foreseeable indirect consequences to archaeological resources.

5.1.3.2.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Alternative 1 could produce impacts to archaeological sites within the buyout footprint but these impacts could be mitigated through archaeological investigation.

Indirect Impacts: There are no foreseeable indirect impacts to archaeological resources.

5.1.3.2.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Alternative 3 could potentially produce negative impacts to archaeological resources as there is a highly likelihood archeological sites could lie within the optimized levee alignment. These effects could be mitigated with archaeological investigation.

Indirect Impacts: There are no foreseeable indirect impacts to archaeological resources.

5.1.3.2.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Alternative 4 would have adverse impacts to archaeological sites along the bank but these impacts could be mitigated through archeological data recovery. These efforts would be captured in a MOA among the NPS, the Alabama SHPO, and the USACE.

Indirect Impacts: There are no foreseeable indirect impacts to archaeological resources.

5.1.3.2.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Alternative 5 would have similar impacts to Alternatives 1 and 4

Indirect Impacts: Alternative 5 has no foreseeable indirect impacts to archaeological resources.

5.1.3.2.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Alternative 6 would have similar impacts as Alternatives 3 and 5.

Indirect Impacts: Alternative 6 has no foreseeable indirect impacts to archaeological resources

5.1.4. *Socioeconomics**

5.1.4.1. *Land Use**

5.1.4.1.1. *No Action Alternative Impacts**

Direct Impacts: No changes to land use within the Study Area would occur as a result of the NAA. No stream buffer zones would be implemented; therefore, no consequences would occur as a result of the NAA.

Indirect Impacts: No significant development would occur under the NAA. The Study Area and surrounding areas are not anticipated to undergo a significant growth. However continued riverbank erosion is anticipated to occur. Should no protection measures be implemented, structures along Water Avenue would continue to be condemned. No future development would occur at these condemned locations thus limiting future annual Selma Bridge Crossing Jubilee occurrences; therefore, the NAA may have adverse consequences to land use and subsequent resources.

5.1.4.1.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The buyout footprint contains 25 parcels of residential properties. Demolition of these structures would occur following relocation of occupants. These parcels would be prohibited from further development and would revert to floodplain habitat; therefore, land use within the buyout footprint would change from developed to undeveloped lands. The effects of this change would be minor.

Indirect Impacts: No protection of the vulnerable historic structures would occur under this alternative. Without bank stabilization, impacts to recreation and the regional economy would occur, which could indirectly impact land use due to the loss of revenue which supports land use development; however, these impacts would be minor overall.

5.1.4.1.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Parcels within the footprint of the alternative would be acquired to construct the optimized levee alignment. U.S. Highway 80 would remain a main thoroughfare through the Study Area.

Indirect Impacts: Parcels within the interior portion of the optimized levee alignment are predominantly residential properties. Construction of the optimized levee would allow the parcels to remain residential; however, parcels within the immediate footprint of the levee alignment would be acquired for construction of the levee. Residents within Ward 8 may desire to build new structures or rebuild existing structures. Construction of the optimized levee would not increase the economy; therefore, residents would not have an increased capacity to significantly develop Ward 8.

5.1.4.1.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Land use within the immediate footprint of the alternative is undeveloped. Construction of the Soldier-Pile Wall would convert the existing land use to low intensity development. As stated in **Section 4.3** the FMEEP would provide recommendation for addressing flood risk through responsible future development of the floodplain.

Indirect Impacts: The Soldier-Pile Wall would reduce flood induced erosion which could aid in the City's attempts to strengthen structural foundations along Water Avenue. Should bank stabilization be implemented, historical structures within the Historic

Downtown District of the City of Selma may be protected from future destruction. In addition, the annual Selma Bridge Crossing Jubilee relies heavily on the integrity of the historical path that Representative John Lewis and Dr. Martin Luther King Jr walked. Prevention of future erosion would protect this integral landmark from future destruction; therefore, this alternative would have a significant benefit to the Study Area when compared against FWOP conditions.

5.1.4.1.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Buyouts would convert approximately 170 acres from residential land to undeveloped floodplain. These parcels would be prohibited from further development.

Indirect Impacts: The Soldier-Pile Wall would stabilize the eroding riverbank which would aid in the preservation of the historic integrity of the structures atop the bluff. Maintaining the integrity of the nationally historic structures and the currently utilized land use of these structures would help to maintain the recreation and industry of the annual Selma Bridge Crossing Jubilee and Heritage Tourism; therefore, the Soldier-Pile Wall would benefit land use within the Study Area when compared against FWOP conditions.

5.1.4.1.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: The Optimized levee alignment would convert approximately 18 acres of residential land within the direct footprint of the alignment within Ward 8. Acquisition of parcels located within the levee footprint would be required. Buyouts would convert 68 acres outside the optimized levee alignment from residential land to undeveloped floodplain. Relocation assistance to displaced persons would be offered. Fee and easement interests acquired would prohibit further development.

Indirect Impacts: The Soldier-Pile Wall would reduce future erosion which could aid in the attempts to strengthen structural foundations along Water Avenue. Construction of the Soldier-Pile Wall would significantly reduce the threats to historical structures within the Water Avenue and the Civil Rights Historic Districts; therefore, through bank stabilization, land use of Water Avenue would not change and would serve to maintain existing cultural resources, recreation, and industry. Compared against FWOP conditions, the Soldier-Pile Wall would provide a benefit to the Study Area.

5.1.4.2. *Noise**

5.1.4.2.1. *No Action Alternative Impacts**

Direct Impacts: The Study Area and its surrounding are not located within a high-density metropolitan area. Metropolitan cities such as Montgomery or Birmingham experience regular elevated noise levels due to continual traffic and construction. The Study Area experiences minimal traffic during the majority of the year. Under the NAA, no construction or demolition would be implemented; therefore, there would be no consequence to noise levels.

Indirect Impacts: No indirect consequences would occur as a result of the NAA.

5.1.4.2.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Demolition within each of the 25 parcels would increase noise levels temporarily and would return to normal conditions upon completion.

Indirect Impacts: Less residential structures would result in less localized traffic, which would indirectly reduce noise levels; however, this impact would be minor.

5.1.4.2.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Construction, access, and staging would increase noise volumes within average limits; however, this disturbance would cease upon project completion.

Indirect Impacts: Residential commute timeframes may increase due to potential road realignments. An increase in commute times would increase the noise volumes; however, these increases are anticipated to be minor individually and cumulatively.

5.1.4.2.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: The Soldier-Pile Wall would take approximately 30 months to complete. This would increase noise levels in the immediate vicinity of the footprint; however, noise volumes would return to normal conditions upon completion of the project. Evacuation from areas identified within the FMEEP during flooding events would temporarily increase noise from the increased traffic; however, noise would recede once evacuation is complete.

Indirect Impacts: The Soldier-Pile Wall would be constructed to provide bank stabilization to the historic structures along the bluff. These structures are integral to the recreational traffic during the annual Selma Bridge Crossing Jubilee. Survival of these historic structures, and the associated recreational traffic would mean no change to long term noise levels. No significant increase in land use development is anticipated; therefore, no indirect impacts to noise would occur.

5.1.4.2.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Construction, access, staging, and demolition activities would increase noise volumes within average limits; however, this disturbance would cease upon project completion.

Indirect Impacts: Removal of structures within Ward 8 would decrease the amount of traffic flow; therefore, a potential decrease in noise volumes could occur as a result of the decreased traffic.

5.1.4.2.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Construction, access, staging, and demolition activities would increase noise volumes within average limits; however, this disturbance would cease upon project completion.

Indirect Impacts: Residential commute timeframes may increase due to road realignments. An increase in commute times would increase the noise volumes; however, these increases are anticipated to be minor individually and cumulatively.

5.1.4.3. *Aesthetics**

5.1.4.3.1. *No Action Alternative Impacts**

Direct Impacts: Current aesthetics of the Study Area show a naturally meandering river with eroded cliffs and perilously close structures. High development is located within the central portion of the area and less developed areas with more vegetation are located on the western portion. No construction or demolition would be implemented under the NAA; therefore, no direct modification to the aesthetics of the Study Area would occur.

Indirect Impacts: The city viewshed is historic in that many of the existing buildings are Nationally Registered Properties. Continued erosion of the riverbed under FWOP conditions would result in the destruction of these historic buildings which would permanently degrade the historic viewshed of Downtown Selma; therefore, the NAA would have adverse consequences.

5.1.4.3.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Implementation of the alternative would convert the existing aesthetics to floodplain terrain; therefore, the alternative would have direct impacts on the aesthetics of Ward 8 and the Civil Rights Historic District.

Indirect Impacts: No bank stabilization features are captured within the alternative; therefore, the riverbank would continue to degrade. Existing structures would continue to be threatened and may be condemned following bank failures. Consequently, the aesthetics of downtown Selma would be indirectly negatively impacted under the alternative.

5.1.4.3.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: The optimized levee alignment would require the acquisition of parcels within the direct footprint of the levee alignment. Structures within those parcels would be demolished. Construction of the levee would create a visual barrier for residents of Ward 8 and would have direct impacts to the aesthetics of the Civil Rights Historic District.

Indirect Impacts: There would be no significant indirect impacts to aesthetics.

5.1.4.3.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: No adverse impacts to aesthetics would occur as a result of the FMEEP. Under FWOP conditions the riverbank would continue to degrade and existing historical buildings would likely be condemned and demolished. Though the construction of a Soldier-Pile Wall and riprap encasement would permanently alter the aesthetics of the natural riverfront, the inclusion of a structure to maintain the integrity of the historical buildings would only serve to benefit the aesthetics. Additionally, the design of the Soldier-Pile Wall would be consistent with the historical background of the Study Area; therefore, compared to FWOP conditions, this alternative would benefit the aesthetics of the Study Area.

Indirect Impacts: There would be no significant indirect impacts as a result of the alternative.

5.1.4.3.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Direct impacts would occur from the Soldier-Pile Wall; however, all efforts would be made to design the wall in a beneficial manner.

Indirect Impacts: Impacts would be consistent with Alternatives 1.A and 4.

5.1.4.3.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Construction of the optimized levee would adversely impact aesthetics in the Study Area. Though the Soldier-Pile Wall would benefit aesthetics, the adverse aesthetics of the optimized levee would overshadow the overall benefits that could be achieved.

Indirect Impacts: Aesthetic impacts related to Alternative 6 would be a combination of Alternatives 3 and 5; although impacts relating to the buyout component would be reduced due to the smaller footprint.

5.1.4.4. *Recreation**

5.1.4.4.1. *No Action Alternative Impacts**

Direct Impacts: No construction, staging, or demolition would occur under the NAA; therefore, no disturbances to recreational activities or recreational traffic would occur.

Indirect Impacts: Under the NAA, no construction would occur and FWOP conditions would be realized. Without a proposed plan to strengthen and/or protect riverbank conditions, recreation could be reduced and/or eliminated. The historic viewshed of the Edmund Pettus Bridge contributes to the significant draw of the annual Selma Bridge Crossing Jubilee and Heritage Tourism within the Study Area; therefore, without a solution to stabilize the bankline a significant threat to recreation and Heritage Tourism would occur. Currently the USACE, Mobile District is conducting a Section 14 CAP project to reduce the severe erosion along the bankline of the Historic Riverfront Park, which emphasizes the necessity for bank stabilization measures. In summary, the NAA would be consistent with FWOP conditions and would have adverse consequences to recreation.

5.1.4.4.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The alternative has no recreational features and would not require the elimination of any municipal parks; therefore, no direct impacts to recreation would occur.

Indirect Impacts: Recreation within the Study Area is largely driven by the annual Selma Bridge Crossing Jubilee. Without a bank stabilization feature, the alternative may indirectly cause a decline in projected recreational use due to the likely condemnation of existing historical structures.

5.1.4.4.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Construction of the levee may disrupt local recreational traffic as local commuting routes may be realigned. Commutes may be rerouted which would increase travel time and distance which would lead to increased frustration. Access for construction would be obtained using existing roads. Staging areas would be identified and selected to be in close proximity to work-stations while considering impacts to municipal parks. Should any staging occur within a municipal park, areas would be restored to pre-project conditions following construction completion.

Indirect Impacts: The alternative does not include bank stabilization features and may lead to decreased tourism recreation for the annual Selma Bridge Crossing Jubilee as historical structures are condemned under FWOP conditions. Additionally, the levee alignment induced flooding throughout the surrounding area may impact widespread recreation. The combined negative direct effects and indirect impacts would cause a significant impact to recreation within the City and County.

5.1.4.4.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: No impacts to recreation would occur from the FMEEP. As stated in **Section 4.2.4.2.1.3**, the annual Riverfront Market Festival and Selma Bridge Crossing Jubilee contribute to recreation. These festivals occur along Water Avenue which is threatened by severe erosion. Construction of a Soldier-Pile Wall would reduce future erosion, which could maintain recreation within the Study Area. Compared to FWOP conditions this would benefit recreation.

Indirect Impacts: No significant indirect impacts to recreation would occur.

5.1.4.4.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Access for Soldier-Pile Wall construction would be obtained via river. Staging would be accomplished via barge. Construction and staging of Soldier-Pile Wall may disrupt fishing; however, anglers would be able to relocate to other areas of the river. Access, staging, and demolition activities for buyouts would not disrupt recreational events or activities since all impacts would be contained within each parcel and existing roads.

Indirect Impacts: Construction of the Soldier-Pile Wall would benefit recreation through the stabilization of the riverbank. This would limit flood induced erosion of the historical trails, structures, and town which draw thousands of spectators annually during the annual Selma Bridge Crossing Jubilee. This festival serves as a large economic driver for the region; therefore, the alternative would also have benefits to the economy as well.

5.1.4.4.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Construction of the optimized levee may disrupt local recreational traffic and activities during implementation. Long term impacts of the optimized levee alignment may cause social fragmentation and may lead to decreased recreational involvement as commutes around the levee alignment would increase local travel time and distance.

Indirect Impacts: Construction of the Soldier-Pile Wall would benefit recreation through the stabilization of the riverbank. Conversely, induced flooding would impact widespread areas not currently experiencing the extent and/or magnitude of flooding which may disrupt recreation during flooding events. Though the induced flooding impacts to recreation beyond the Study Area cannot be quantified, those impacts are anticipated to be overshadowed by the beneficial impacts of the Soldier-Pile Wall; therefore, the alternative would slightly benefit recreation.

5.1.4.5. *Industry**

5.1.4.5.1. *No Action Alternative Impacts**

Direct Impacts: No industries would be bought or relocated under the NAA.

Indirect Impacts: Flood induced erosion along the riverbank could lead to condemnation of local businesses. The City of Selma and Dallas County, Alabama are highly dependent on the annual Selma Bridge Crossing Jubilee which largely contributes to the Heritage Tourism, a significant economic driver. Heritage Tourism is reliant upon the historic viewshed of the Edmund Pettus Bridge; therefore, without any solution to stabilize the bankline a significant threat to industries, such as Heritage Tourism, would occur. Additionally, continued flooding within Ward 8 would occur, which would impact the Ziegler Plant; therefore, the consequences of the NAA would be adverse.

5.1.4.5.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The proposed alternative would not directly impact existing industries within the buyout footprint. Only residential structures would be acquired and demolished.

Indirect Impacts: Because the buyout footprint does not encompass the nearby Ziegler Plant, the industry would continue to be impacted by flooding. Additionally, the buyout footprint contains no risk-reduction solutions for the historical structures along Water Avenue. Without a proposed solution these historical structures, which are integral to the Heritage Tourism industry, would continue to be threatened from future erosion; therefore, the alternative would have adverse indirect impacts to the industries within the Study Area.

5.1.4.5.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: The optimized levee alignment would be located directly north of the Ziegler Plant which would not reduce flooding impacts to the industry. In addition, the optimized levee alignment would cause additional commute time and distance to employees as roadways are rerouted to accommodate for the levee.

Indirect Impacts: Induced flooding to the Ziegler Plant may cause temporary closures during flood events. Additionally, potential revenue losses may occur as continued erosion of the riverbank may reduce Heritage Tourism.

5.1.4.5.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: The Soldier-Pile Wall would have significant benefits to the Heritage Tourism industry by significantly reducing the threat of erosion, which leads to condemnation and demolition. As explained in the RED and OSE Appendices, this industry has an important role not only for the City of Selma but also the region. Because the Alabama River flooding is slow-rising, citizens within the City of Selma would have ample notice to evacuate as outlined in the FMEEP. Production of the Ziegler Plant may be temporarily impacted as employees evacuate; however, production would return to normal once citizens arrive home following flood events.

Indirect Impacts: The non-structural component of the TSP is the FMEEP; therefore, the Ziegler Plant within Ward 8 would continue to experience flood damages. These impacts would be minor and would not offset the benefits obtained from reducing the threat to the Heritage Tourism.

5.1.4.5.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: No buyouts or relocation of local industries would occur as a result of the alternative; however, no flood-risk reduction to the Ziegler Plant would occur.

Indirect Impacts: The Soldier-Pile Wall would benefit local and regional tourism through the increased bank stabilization.

5.1.4.5.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: The alternative would cause additional time and distance to local employees as they reroute around the optimized levee alignment.

Indirect Impacts: The Soldier-Pile Wall would benefit local and regional tourism but would produce negative impacts to local commuters. The Ziegler Plant would continue being impacted from flooding events and may experience temporary closures.

5.1.4.6. *Demographics**

5.1.4.6.1. *No Action Alternative Impacts**

Direct Impacts: No construction or demolition would occur; therefore, the social fabric of the community would not be altered.

Indirect Impacts: The NAA would not increase revenue to the local community. Under FWOP conditions the community is anticipated to remain a disenfranchised minority population.

5.1.4.6.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: The alternative would remove tenants within the 25 parcels in Ward 8. This would reduce the population within a disenfranchised community. The parcels would then be prohibited from further development. Compared to the entire Study Area parcels, this reduction would be minimal; therefore, the alternative would have a minimal direct adverse impact to the demographics.

Indirect Impacts: As shown in the OSE analysis, the additional burden on the City of Selma to carry out a buyout alternative would force the relocation of these tenants outside the Study Area due to the limited DSS housing. This would indirectly and adversely impact Community Cohesion and Social Vulnerability.

5.1.4.6.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: The optimized levee alignment would be predominantly located along U.S. Highway 80; however, approximately 1.6 mi of levee would be created within Ward 8 which could fragment the community.

Indirect Impacts: The alternative would have no indirect change on demographics. No permanent jobs or resources would be created as a result of the alternative. As such, no significant boost to citizens' livelihoods would occur.

5.1.4.6.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: No changes would occur to the Study Area population or income earnings. Construction would not contribute to permanent job creations nor would it draw a substantial population increase.

Indirect Impacts: Through construction of a Soldier-Pile Wall, however, Heritage Tourism would continue to operate as outlined in the existing conditions. The dependency on this industry cannot be overstated. Loss of this revenue could impact over 1,000 jobs which would significantly devastate the economy of the Study Area. This would trickle down to the livelihoods of individual civilians; therefore, the alternative would benefit the Study Area when compared against FWOP conditions.

5.1.4.6.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Ward 8 is composed of over 300 structures. The alternative would require acquisition of 25 parcels and relocation of tenants within Ward 8. Though Ward 8 is a severely economically depressed community, tenant dwellings are predominantly located within Ward 8 the southern portion of the Ward. Acquisition and relocation are generally favorable to home owners as monetary value can be obtained; however, tenants do not receive the same benefits and instead typically receive negative effects from mandated relocation. Due to the limited DSS housing, relocation would require tenants to be established in neighboring communities due to the inadequate availability within the City of Selma. Should citizens be relocated outside the Study Area, there is a high potential that they would be placed within an area that exceeds their financial capabilities; therefore, the alternative would permanently remove those residents from the local demographic.

Indirect Impacts: Because the Soldier-Pile Wall would reduce riverbank erosion, the local economy driven by tourism would continue to sustain the City of Selma. With the local economy sustained, no significant additional hardships would be inflicted upon the community; therefore, the social fabric of the community would continue as assumed under FWOP conditions.

5.1.4.6.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: The alternative would require the acquisition and demolition of structures outside the levee alignment within Ward 8. Residents would be relocated; however, limited comparable DSS housing is available within the City limits. Additionally, the City of Selma has marginal professional real estate capability to implement the acquisition of unprotected structures outside of levee alignment in accordance with Federal laws and regulation.

Indirect Impacts: The optimized levee alignment would fragment the local community and have an adverse impact on demographics.

5.1.4.7. *Public Safety**

5.1.4.7.1. *No Action Alternative Impacts**

Direct Impacts: No construction, staging, or demolition would occur; therefore, no direct threats and/or risks to public safety would occur under the NAA.

Indirect Impacts: No reduction in flooding extent or depth would occur under the NAA. Additionally, as stated under FWOP conditions the riverbank would continue to erode which would contribute to significant concerns for public safety from continued bank failures. As such, there would be adverse consequences from the NAA.

5.1.4.7.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Demolition activities would be barricaded to prevent members of the public from accessing a hazardous work site; therefore, no direct impacts to public safety would occur.

Indirect Impacts: Because the alternative does not incorporate bank stabilization, the public safety risk for the eroding bank and structural instability would still occur; therefore, the alternative would have indirect adverse impacts to public safety with respect to the structures and infrastructure along Water Avenue.

5.1.4.7.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Local residents would be prohibited from entering construction and staging zones. Additionally, increased flooding protection from the optimized levee alignment would reduce flood risk within Ward 8; however, flooding depths to the majority of structures within Ward 8 are below first floor elevations across a broad area; therefore, the amount of substantial risk reduction is minimal.

Indirect Impacts: Operation of flood gates could present a risk to public safety during installation and preparation of the structure during eventual flooding events. Installation of flood gates could also produce a transfer of risk as citizens may need to be evacuated during flooding events and emergency crews would have limited access to flood prone areas. Additionally, no bank stabilization would occur and increased threats to public safety in the downtown area would continue. Most importantly, the optimized levee alignment would cause induced flooding and may increase threats to public safety in a broader area during flooding events.

5.1.4.7.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: There are several factors that cause the erosion of the riverbank. Erosion of the riverbank occurs at an unpredictable rate; therefore, the USACE cannot confirm with high confidence the concerns for public safety. However, the erosion process leads to condemnation of threatened structures. Should any persons be present in the event of a spontaneous structural collapse, the concern for public safety would be paramount; therefore, the alternative would reduce the public safety concern to occupants and pedestrians along Water Avenue. Additionally, the FMEEP would identify areas at risk during flood events and would create a notification and evacuation system. This addresses the risk to life-safety during flooding events while being cost effective and efficient; therefore, the alternative would provide a benefit to the Study Area.

Indirect Impacts: Implementation of the alternative would alleviate the erosional processes occurring; however, the alternative would not remedy existing foundation issues and/or reinforce the foundation of each structure.

5.1.4.7.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: Local residents would be prohibited from entering construction, staging, and demolition zones. Removal of residents that experience first floor elevation flooding would reduce the risk to public safety. Additionally, the Soldier-Pile Wall would eliminate threats to public safety from future bank failures.

Indirect Impacts: Maintenance of the Soldier-Pile Wall may present a minor risk to public safety as persons would be required to remove encroaching vegetation; however, herbicides could be applied at a greater distance and reduce the risk to public safety.

5.1.4.7.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Local residents would be prohibited from entering construction, staging, and demolition zones. Additionally, decreased flooding risk from the levee alignment would eliminate flooding within Ward 8; however, the majority of flood depths within Ward 8 are below first floor elevations so risk reduction is minimal.

Indirect Impacts: Operation and maintenance of the flood gates and Soldier-Pile Wall may present increased risks to public safety as discussed in **Sections 5.1.4.7.3** and **5.1.4.7.4**.

5.1.4.8. *Traffic and Navigation**

5.1.4.8.1. *No Action Alternative Impacts**

Direct Impacts: No terrestrial or riverine construction, staging, or demolition would occur; therefore, no disruption to existing transportation and navigation would occur.

Indirect Impacts: Continued erosion of the riverbank under FWOP conditions would lead to additional road closures as roads would be unsafe to travel due to lost foundation material. This would have negative impacts on resources such as historic trails, structure, town, and recreation which collectively account for a large portion of traffic during the annual Selma Bridge Crossing Jubilee. A reduction of these resources would contribute to a reduction in overall traffic during a brief period of time. Likewise, continual erosion of the riverbank would accumulate in the immediate and downstream portions of the Alabama River; thereby decreasing the overall navigation channel depth. These impacts are anticipated to be minor; therefore, the consequences of the NAA are not significant.

5.1.4.8.2. *Alternative 1.A (Buyouts) Impacts**

Direct Impacts: Through the removal of residential structures within Ward 8, local traffic would be reduced; however, the amount of traffic reduction would be minimal.

Indirect Impacts: The navigational channel within the Alabama River may be negatively impacted as a result of the alternative. Without bank stabilization the riverbank would continue to erode. Although the Alabama River is a low-use system, navigational maintenance dredging is performed at varying frequencies; however, the Selma City

Marina small boat access channel is performed on an as-needed basis. Eventually sedimentation may build up with enough capacity to reduce the navigational channel, thus causing a negative impact to navigation; however, sediment accumulation to that extreme would take many decades. Consequently, these impacts to traffic and navigation are anticipated to be minor.

5.1.4.8.3. *Alternative 3 (Optimized Levee) Impacts**

Direct Impacts: Construction, access, and staging activities would block or impede traffic in the immediate vicinity of work. The alignment of the levee would permanently realign and/or remove existing roads; therefore, a substantial change to existing roadways would occur. No construction would occur in the river, however, so no disruption to navigation would occur.

Indirect Impacts: The alternative would have similar indirect impacts to that of the NAA. In addition, induced flooding would cause transportation disruption during flooding events in areas not accustomed to deeper flood depths. No change to navigation would occur as a result of the optimized levee alignment.

5.1.4.8.4. *Alternative 4 (Soldier-Pile Wall) + FMEEP Impacts**

Direct Impacts: Traffic would be temporarily impacted during evacuation as identified within the FMEEP; however, traffic would reduce to normal conditions upon completion. The alternative would also reduce the erosional processes along the riverbank which would reduce the build-up of sedimentation within the Alabama River. Though the Alabama River is designated as a low-use system, a reduction is sediment accrual would slightly benefit navigation compared to FWOP conditions.

Indirect Impacts: No indirect impacts are anticipated as a result of the alternative. The Soldier-Pile Wall would not cause a permanent change in navigational use within the Alabama River. Temporary increase would occur through implementation due to the need to construct from barge platforms; however, upon construction completion navigational use would revert to normal conditions.

5.1.4.8.5. *Alternative 5 (Soldier-Pile Wall + Buyouts) Impacts**

Direct Impacts: No roadblocks would be necessary during buyout demolition activities. Access would be gained using existing roads and staging would occur within each parcel. Traffic may be slowed due to increased activity; however, these impacts would be temporary and minor. Staging, access, and construction of the Soldier-Pile Wall would occur via river access through barges. Navigation would be directed around construction activities; however, since the Alabama River is considered low-use no significant impacts to commercial navigation is anticipated. These minor impacts to navigation would return to pre-construction conditions following project completion.

Indirect Impacts: The alternative would indirectly benefit navigation as the amount of sediment accrual would be reduced; however, this benefit would be minor.

5.1.4.8.6. *Alternative 6 (Combination) Impacts**

Direct Impacts: Construction, access, staging, and demolition for the complete alternative would impact traffic and navigation. Construction of the optimized levee alignment would cross existing roads which may be permanently realigned and/or removed to reroute around the optimized levee. Navigation impacts during construction of the Soldier-Pile Wall would return to preconstruction conditions following project completion.

Indirect Impacts: The City of Selmont would experience increased flooding depths and extents which may prevent localized traffic during flooding events. Benefits to infrastructure in the downtown area of Selma, including Water Street, would occur as a result of the Soldier-Pile Wall; therefore, no future disruption to traffic would occur as roads would not be condemned. Likewise, minor benefits to navigation would occur as sediment accrual within the channel would be reduced as a result of bank stabilization.

5.2. Cumulative Impacts*

A thorough cumulative assessment considers past, present, and future action which affect the Study Area. Historical activities to reduce riverbank erosion repairs include lining the bank with debris. Additionally, FEMA conducted emergency bank stabilization using concrete blocks along the downtown riverfront. Currently, the USACE is conducting a bank stabilization project within the City limits. The City of Selma had designed plans to develop the riverfront property to include a riverwalk and revitalization although no funding to complete the work has been allocated at this time.

Collectively, bank stabilization efforts have resulted in decreased erosion in the immediate locations; however, each effort in itself has not been substantial enough to reduce erosion throughout the entire reach of the Study Area.

5.2.1. *Physical Environment**

Two noteworthy resources to evaluate for cumulative effects are “geology and soils” and hydrology:

Geology and Soils: Though the rate of erosion has not been captured, erosion of the riverbank has been ongoing which culminated in the 2016 FEMA bank stabilization armament using riprap along the downtown riverfront. Additionally, current Federal action has been approved through a Continuing Authorities Program Section 14 Study which identified a bank stabilization alternative to address riverbank erosion upstream of Alternative 4 footprint. Over the 50-year period evaluated under FWOP conditions, continued erosion would lead to significant degradation of the riverbank and may lead to a setback significant enough to cause condemnation and demolition of the entire riverbank viewshed.

Hydrology: Though the operation of dams occurring throughout the Alabama River occurs as a “run-of-the-river” system, construction of the Claiborne Lock and Dam in 1971 lead to an overall minor increase in river stage elevation. Current hydrology shows a frequency of flooding to warrant Federal interest. Through a climate change analysis over a 50-year period, a peak flow increase of 2% was identified based on land use changes occurring within the Alabama River Basin located several miles north of the Study Area.

5.2.2. *Biological Resources**

Threatened and Endangered Species: The primary concern for biological resources with respect to this study is T&E species. The State of Alabama has one of the highest concentrations of Federally listed species in the nation. Construction of the Locks and Dams throughout the Alabama River has caused a significant strain on the aquatic species. In particular, the Alabama Sturgeon is critically imperiled and the Heavy Pigtoe is reduced to one surviving population located one mile upstream of Alternative 4. Additionally, the footprint of Alternative 4 encroaches on the stronghold of the Tulotoma Snail; however, these impacts will be reduced through Reasonable and Prudent measures identified during ESA coordination. Additionally, through a comprehensive strategy the City of Selma plans a "Downtown Revitalization" to include a riverbank walk which will run parallel with the Alabama River. (*Community* 2016). Such a structure would need to be coordinated with the appropriate agencies to obtain proper permitting and to reduce overall environmental impacts.

5.2.3. *Cultural Resources**

Architectural: A significant concern for cultural resources are the architectural structures lining the bankline of the project area. These structures are contributing buildings to two historic districts and compose the viewshed of Downtown Selma and the Edmund Pettus Bridge. Geological and Hydraulic investigations have shown significant erosion in the project area present a direct threat to the stability and integrity of these structures. Continued erosion would also lessen their integrity, structurally and historically. Without bank stabilization measures, these structures could be lost.

Archaeological: A relevant concern for cultural resources are known archaeological sites within the study and proposed project area. The City of Selma was the location of the Civil War battle, the Battle of Selma and archaeological investigations how that archaeological evidence of this event could remain in the area. Archaeological investigations also suggest that severe erosion along the northern bankline could have negatively impacted the integrity of these sites over time. Therefore, the proposed alternative could be seen as a method to reduce further erosion and thus further loss of valuable archaeological information about the Study Area.

5.2.4. *Socioeconomics**

Industry: The driving force behind this study is two-fold. The historical significance of the Study Area contributes to the City's and the Region's most recognizable tourist attraction. Each year, it is estimated that a range of 200-400 thousand citizens gather to partake in the annual Selma Bridge Crossing Jubilee. During the 2015 Annual March, upwards of 1 million people attended including President Barack Obama.

5.3. Public Laws and Executive Orders*

5.3.1. *Environmental Justice (Executive Order 12898)**

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* dated February 11, 1994 directs all Federal agencies to determine whether a "proposed action" would have a disproportionately high and adverse impact on minority and/or low-income populations. The City of Selma population as a whole is predominately poor minority persons. Additionally, the recommended TSP is the only solution to preserve the integrity of the historical structures, which play an integral role in the City's recreational, industrial, and economical sources; therefore, no disproportionate adverse impacts to minority and/or low-income populations would occur.

5.3.2. *Protection of Children (Executive Order 13045)**

Executive Order 13045, The Protection of Children from Environmental Health Risks and Safety Risks, was issued April 23, 1997. Executive Order 13045 applies to significant regulatory actions that concern an environmental health or safety risk that could disproportionately adversely affect children. Environmental health risks or safety risks refer to risks to health or to safety that are attributable to products or substances that the child is likely to come in contact with or ingest.

The recommended TSP is not anticipated to impact the health and safety of children. Barriers and other measures would be implemented during construction to ensure protection of non-project workers, including children. Conversely, the NAA may present greater risks to public safety of children as erosion is anticipated to continue at an unpredictable rate.

5.4. Other NEPA Considerations*

5.4.1. *Any Irreversible or Irretrievable Commitments of Resources Which Would Be Involved Should the Tentatively Selected Plan Be Implemented**

Any irreversible or irretrievable commitments of resources involved in the TSP have been considered and are either unanticipated at this time or have been considered and determined to present minor impacts. The recommended TSP is reversible, albeit costly. Reclamation, if needed, would include removal of the Soldier-Pile Wall and restoration of the riverbank; however, considering the degraded nature of the existing riverbank and the continual hydrological forces which contribute towards degradation, complete restoration of the riverbank may not be feasible.

5.4.2. *Adverse Environmental Effects Which Cannot Be Avoided**

Any adverse environmental effects which cannot be avoided should the recommended TSP be implemented are expected to be minor individually and cumulatively. These include riverine habitat loss and suitable habitat for Federally protected species. Additionally, relocation of the Tulotoma Snail would stress the species to a point where some mortality may occur.

5.4.3. *The Relationship Between Local Short-Term Uses of the Human Environment and Maintenance and Enhancement of Long-Term Productivity**

The TSP constitutes a short-term use of man's environment, will result in minimal environmental impacts, and is not anticipated to affect long-term productivity. The recommended TSP is compatible with surrounding uses and is the only solution to prevent additional condemnation of historical structures of national importance.

5.5. 17 Points of Environmental Quality*

As specified by Section 122 of the Rivers, Harbors & Flood Control Act of 1970 (P.L. 91-611), 17 environmental quality categories of impacts were reviewed and considered in arriving at the final determination. As laid out in **Table 21**, long-term significant adverse impacts from the TSP to these identified points are not anticipated. Temporary minor impacts from constructions activities would occur in some categories.

Table 21: Seventeen Points of Environmental Quality Effects Considered

Points of Environmental Quality	TSP Effects
Noise	Temporary and minor impacts
Displacement of people	No effect
Aesthetic values	Beneficial impacts
Community cohesion	No effect
Desirable community growth	No effect
Tax revenues	No effect
Property values	No effect
Public facilities	No effect
Public services	No effect
Desirable regional growth	Beneficial impacts
Employment	No effect
Business and industrial activity	Beneficial impact
Displacement of farms	No effect
Man-made resources	No effect
Natural resources	No significant impacts
Air	Temporary and minor impacts
Water	Temporary and minor impacts

5.6. Mitigation Considerations*

A cultural data recovery in conjunction with a UXO survey would occur prior to PED phase of the study. These surveys would occur in two phases: the first to identify target locations and the second to implement removal of any confirmed UXOs. In conjunction with this survey, proper documentation of each artifact would occur and would serve as a parallel cultural resources mitigation measure. A MOA will be included in **Appendix B** and will outline those mitigation measures.

6.0 ENVIRONMENTAL COMPLIANCE*

This Study was conducted in accordance with the USACE EOPs which were developed to ensure each mission includes totally integrated sustainable environmental practices. The seven re-energized EOPs are available at the following webpage: http://www.usace.army.mil/Missions/Environmental/Environmental-Operating-Principles/.

Federal laws and EOs applicable to the TSP, and, if applicable, their status is presented in **Table 22**. Assuming that the TSP does not expand beyond the scope described in this draft report, the TSP is in compliance with NEPA.

Table 22: Public Law Environmental Compliance Status

STATUS	PUBLIC LAW (US CODE)/EXECUTIVE ORDER
Pending	Archeological and Historic Preservation Act of 1974, as amended (54 U.S.C. 3125)
Pending	Bald and Golden Eagle Protection Act (16 U.S.C. § 668 et seq)
Pending	Clean Air Act of 1972, as amended (42 U.S.C. 7401 et seq)
Pending	Clean Water Act of 1972, As Amended (33 U.S.C. 1251 et seq)
Pending	Federal Water Pollution Control Act of 1972, as amended (33 U.S.C. 1251 et seq)
N/A	Comprehensive Environmental Response, Compensation & Liability Act of 1980 (42 U.S.C. 9601)
Pending	Endangered Species Act of 1972 (16 U.S.C. 1531)
Pending	Executive Order 11988, Floodplain Management
Pending	Executive Order 12898, Environmental Justice
Pending	Executive Order 13045, Protection of Children
Pending	Fish and Wildlife Coordination Act of 1958, as amended (16 U.S.C. 661)
N/A	Flood Control Act of 1944, as amended, Section 4 (16 U.S.C. 460b)
N/A	Historic and Archeological Data Preservation (16 U.S.C. 469)
N/A	Migratory Bird Conservation Act of 1928, as amended (16 U.S.C. 715)
Pending	Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703)
Pending	NEPA of 1969, as amended (42 U.S.C. 4321 et seq)
Pending	National Historic Preservation Act, as amended (154 U.S.C. 300101 et seq.)
N/A	Native American Religious Freedom Act of 1978 (42 U.S.C. 1996)
N/A	Native American Graves Protection and Repatriation Act (25 U.S.C. 3001)
N/A	National Trails System Act (16 U.S.C. 1241)
N/A	Noise Control Act of 1972, as amended (42 U.S.C. 4901 et seq)
N/A	Rehabilitation Act of 1973 (29 U.S.C. 794)
N/A	Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901-6987)
N/A	River and Harbor Act of 1888, Section 11 (33 U.S.C. 608)
N/A	River and Harbor Act of 1899, Sections 9, 10, 13 (33 U.S.C. 401-413)
N/A	River and Harbor and Flood Control Act of 1962, Section 207 (16 U.S.C. 460d)
Pending	River and Harbor and Flood Control Act of 1970, Sects 122, 209 and 216 (33 U.S.C. 426 et seq)
N/A	Submerged Lands Act of 1953 (43 U.S.C. 1301 et seq)
N/A	Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. 9601)
N/A	Toxic Substances Control Act of 1976 (15 U.S.C. 2601)
N/A	Wild and Scenic River Act of 1968 (16 U.S.C. 1271 et seq)

6.1. Consultation and Coordination*

In accordance with Section 1005 of the Water Resources Reform and Development Act of 2014, cooperating agency letters dated January 24, 2019 and February 12, 2019 were mailed to Federaland State agencies and are included in **Appendix B**. An Interagency Meeting was held on June 10, 2019 to gather environmental data and discuss alternatives. The Memorandum for Record of the Interagency Meeting is included in

Appendix B. Additionally, Agency Workshops with the Alabama SHPO were held on October 28, 2019 and August 4, 2020. Electronic correspondence for participation of the USACE AMM and the TSP Milestone Meetings were submitted to each agency identified in **Table 23**.

Table 23: Section 1005 Compliance with Federal and State Agencies

Agency	**Charette (October 2018)**	**COOP Agency Letters (February 2019)**	**AMM (January 2019)**	**Agency Scoping Meeting (June 2019)**	**TSP (June 2020)**
USEPA Region 4	Attended	Cooperating	✓	Attended	Accepted
FEMA Region 4	✓	✓	✓	✓	✓
Federal Highway Administration	✓	Declined	✓	✓	✓
USGS Southeast Region	✓	✓	✓	✓	✓
USFWS Southeast Region	✓	✓	✓	✓	✓
USFWS Daphne Field Office	✓	✓	✓	Attended	✓
Department of Interior Atlanta Region	✓	✓	✓	✓	✓
AHC	Attended	Cooperating	✓	Attended	Attended
Advisory Council on Historic Preservation	--	--	--	--	Attended
NPS	Attended	Participating	✓	Attended	✓
U.S. Department of Housing and Urban Development	✓	✓	✓	✓	✓
NRCS	Attended	✓	✓	✓	✓
ALDCNR	✓	✓	✓	✓	✓
ADEM	✓	✓	✓	✓	✓

Agency	Charette (October 2018)	COOP Agency Letters (February 2019)	AMM (January 2019)	Agency Scoping Meeting (June 2019)	TSP (June 2020)
Alabama Secretary of State	✓	✓	✓	✓	✓
Alabama Emergency Management Agency	Attended	Participating	✓	Attended	Attended
Alabama Department of Transportation	✓	Cooperating	✓	Attended	✓
Alabama Department of Public Health	✓	Participating	✓	✓	✓

✓=invitations were sent

6.1.1. *Fish and Wildlife Coordination Act**

According to the *Water Resources Development Under the Fish and Wildlife Coordination Act* report dated November 2004, "The FWCA [Fish and Wildlife Coordination Act] provides a basic procedural framework for the orderly consideration of fish and wildlife conservation and enhancement measures in Federally constructed, permitted, or licensed water development projects. The FWCA provides that, whenever any water body is proposed to be controlled or modified "for any purpose whatever" by a Federal agency or by any "public or private agency" under a Federal permit or license, the action agency is required first to consult with the wildlife agencies, "with a view to the conservation of fish and wildlife resources in connection with that project."

The Selma FRM Feasibility Study is considered a Federal project for the purpose of evaluating the manipulation of a body of water. The USACE coordinated closely with the USFWS Daphne Field Office regarding the study. The USFWS and the USACE agreed that the FWCA would be satisfied should FWCA language be included within a BO with the caveat that the language is clear and distinct from ESA language. This solution was agreed upon during the February 27, 2020 IPR with the Vertical Team.

6.1.1.1. *USACE Position**

[*This section intentionally left blank. Upon receipt of the draft BO, the USACE position will be summarized within.*]

6.1.2. *Public Involvement**

6.1.2.1. *Charette**

A study Charette was held in the City of Selma on October 23, 2018. Attendees included members of the Project Delivery Team (PDT), City Council Officials, as well as Federal and State Agencies such as NPS, AHC, and the USEPA. Topics discussed included flooding frequency and inundation, but more importantly the erosion issues of the downtown riverbank area.

6.1.2.2. *Public Meeting**

A public meeting was held in the City of Selma on November 7, 2018. No members of the public attended; however, one local news station conducted an interview with members of the PDT. A virtual public meeting will occur prior to the Agency Decision Milestone.

6.1.3. *Summary of Public and Agencies Comments**

[*This section intentionally left blank. Upon completion of Public and Agency Review, critical comments will be concisely summarized within this section and the entirety will be included within* **Appendix B** *of the Final Integrated FR/EA.*]

6.2. Areas of Concern

The presence of UXOs within the recommended TSP footprint present some concern; however, the removal of any UXO material would occur prior to implementation. Close coordination with UXO specialists would occur throughout geotechnical surveys to ensure worker safety. Should UXOs be removed from the riverbed, disposal of the UXO may need real estate acquisition which may be challenging due to the City’s limited professional real estate capabilities.

7.0 DESCRIPTION OF THE TENTATIVELY SELECTED PLAN

7.1. Plan Components

Plan components of the TSP include the FMEEP and a Soldier-Pile Wall. Because the FMEEP is non-structural, it will not be discussed in **Section 7.2**. Mitigation considerations include conducting a cultural data recovery in conjunction with a UXO survey.

7.2. Design and Construction Considerations

7.2.1. *Bank Stabilization*

7.2.1.1. *Threatened Structures*

Approximately 11 structures are located along the riverbank adjacent to the footprint of the Soldier-Pile Wall. As shown in **Image 1**¸ **Image 2**, and **Image 3**, most buildings appear to be within 10 ft of the top edge of the bank (where the bank line drops abruptly).

Based on the age and appearance of the buildings, it is likely that the buildings are composed of unreinforced load bearing masonry walls. More specifically, the masonry walls are most likely a mult-wythe system where the wythes are directly tied together with header bricks and are not separated by a cavity. These walls either extend down to a concrete wall footing or potentially bear upon the rock that can be seen in available photos. The load bearing masonry also may bear upon slightly wider concrete foundation walls.

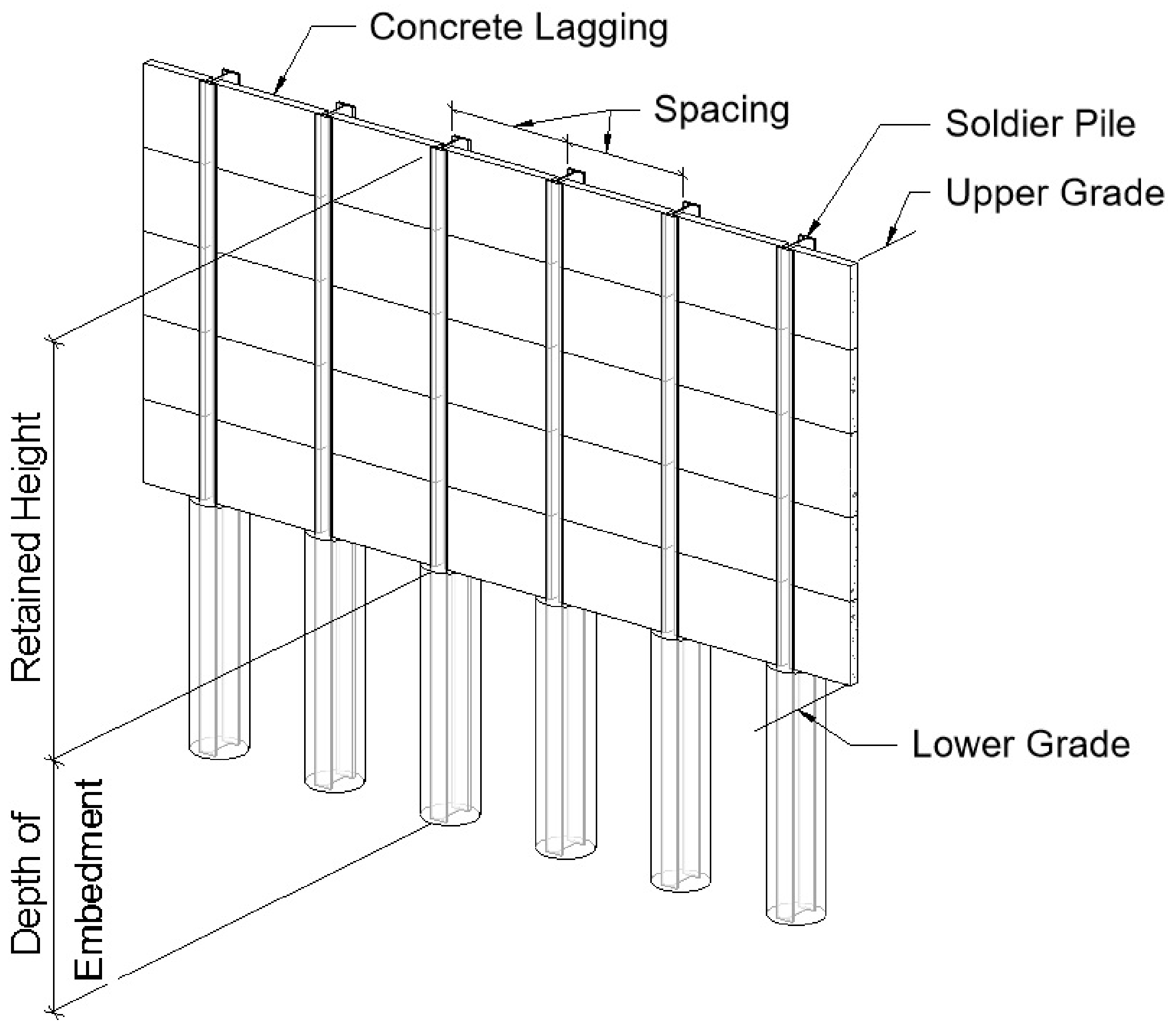
The floors and roofs are likely supported with wood framing and sheeting. From available photos, the majority of the structures appear to be in poor condition. This is difficult to assess with the available information.

7.2.1.2. *Structural Concept and Design*

The bank stabilization would be composed of a Soldier-Pile Wall. More specifically, the wall would consist of wide flange steel sections or precast concrete sections forming the "soldier" piles with precast concrete panels forming the lagging.

Due to the presence of chalk below the surface, it is expected that driving the piles would not be possible. This would, therefore, require the piles to be installed into holes which would be drilled in advance. After installing the piles into the drilled holes, lean concrete or similar material would be used to encase the piles in-place. This encasement and embedment would assist in resisting the bending moment developed from the driving forces exerted by the retained soil. The lagging spans horizontally between these piles. In this scheme the piles are cantilevered, but tie backs could potentially be used to decrease the pile embedment depth, decrease the pile size, or increase the pile spacing. The use of tie backs could especially be advantageous where walls exceed 15 ft in height. However, adequate space must be available to provide tie backs. It is expected that approximately 94 tie backs would be needed. The concept is illustrated in **Figure 36**.

Figure 36: Soldier-Pile Wall Concept



To provide a complete design of the Soldier-Pile Wall, soil properties such as density, shear strength, passive and active soil pressures, and other geotechnical recommendations must be determined. Using existing geotechnical information and assumptions, including the use of a tie back near the top of each pile, a preliminary analysis and design was performed to determine an expected configuration of Soldier-Pile size, pile spacing, and thickness of concrete lagging. The outcome of this preliminary work follows: W21x73 steel pile sections, pile spacing of 8 ft, and 8" thick concrete lagging panels. The full set of calculations can be found in **Appendix A**.

7.2.2. *Path to Design and Construction*

As stated in **Section 4.3.1** the additional tasks remaining will inform a fully developed design. Those tasks include:

1) Engineering to confirm that upcoming survey work is sufficient for design/layout of the retaining wall;
2) Execute physical purvey;

3) Engineering to develop preliminary layout/design of the retaining wall;
4) Coordinate preliminary layout/design with PDT;
5) Refine as required and coordinate with Sponsor and Cooperating Agencies such as AHC, NPS, etc.;
6) Perform UXO Survey, as required, utilizing proposed layout and coring locations;
7) Perform geotechnical investigation; and
8) Refine/Finalize bankline stabilization layout/design.

7.3. Real Estate Requirements

7.3.1. *Land, Easements, Relocations, Right of Way, and Disposal Sites (LERRDs)*

The proposed non-structural feature consists of development of a floodplain management/emergency evacuation plan that will address affected evacuation areas and necessary routes with advance notice through the utilization of nearby stream gages.

Bank Stabilization improvements have been proposed from Washington Street to a point paralleling with Lauderdale Street, divided in two roughly equal segments by the Edmund Pettis Bridge. Further Engineering design refinements are anticipated which will have bearing on the LERRDs footprint.

The City of Selma is the NFS for the proposed project. Upon receipt of the formal notice to proceed with land acquisition from the USACE, Mobile District, Real Estate Division, the NFS has the responsibility to acquire all real estate interests required for the project, in accordance with Federal law, regulations, and policy, including P.L. 91-646, the Uniform Relocation Act, as amended. The NFS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the project.

Pursuant to ER 405-1-12, Chapter 12, Paragraph 12-34, if the NFS is incapable of acquiring the required LERRDs for the project and the District has sufficient available resources to perform in a timely fashion while completing its other real estate missions, the District Commander, acting through the District Chief of Real Estate, may agree to a NFS's written request for the Government to acquire LER on behalf of that NFS, provided that all estimated project costs have been provided up front, under one or more of the following circumstances:

- the NFS lacks the professional capability to acquire LER required for the project and cannot reasonably obtain contract services from sources other than the Government; and/or
- although the NFS has sufficient general acquisition authority, it lacks legal authority to acquire particular tracts and its request to the Government is limited to acquisition of such tracts.

LERRDs credit will be determined in accordance with the terms of the Project Partnership Agreement (PPA), Office of Management and Budget Circular A-87, Chapter 12, ER 405-1-12, and applicable laws.

7.3.2. *Land Acquisition*

For the soldier pile wall features, 14 parcels are situated within the proposed construction area, and a preliminary acquisition estimate of 0.3 +/- of an acre will be required in Perpetual Bank Protection Easement (**see Appendix D**).

In addition to lands noted above, a portion of the soldier pile wall construction estimated at 0.08 +/- of an acre is situated within the City of Selma's right-of-way for Washington Street which will not pose a Real Estate issue. At the current level of Engineering design (minimal), the project footprint is not expected to extend into the State right-of-way for the U.S. Highway 80 Business/Edmund Pettis Bridge. If unidentified impacts were to occur, coordination with Alabama Department of Transportation would be required, with the most probable outcome being a license agreement for the small portion of project area within State right-of-way.

The UXO site is pending further onsite surveys to determine if real estate needs will be required.

All access and staging for construction within the Study Area is anticipated via barge on the Alabama River. Staging for barge loading will be determined during the PED phase of the project. Additional access is available via public right-of-way (Washington St and Broad St).

Reference **Appendix D** to this report for further information regarding real estate requirements for construction, operation, and maintenance of the project.

7.4. Operations, Maintenance, Repair, Rehabilitation and Replacement (OMRR&R)

The projected O&M costs for the Soldier-Pile Wall are estimated to be **$4,000** per year. Species control (e.g. herbaceous, woody, and invasive species growth) measures would be necessary, such as weeding and spraying. Intermittent inspections would be required to review structural integrity for things such as cracks, sloughing, and other signs of structural movement. Regular O&M for the FMEEP would include updating at least once every five years.

7.5. Risk and Uncertainty

The study assumptions, risks, and uncertainties have been identified in the Risk Register. Items of low and medium risk are included in the register and will be made available to the Agency Technical Review (ATR) team. Those items ranked as high risk are summarized in **Sections 7.5.1**, thru **7.5.4**.

7.5.1. *Economic Assumptions, Risks, and Uncertainties*

The NED Policy Exception allows for analysis and consideration for other system of account benefits, primarily OSE based on historic and cultural significance as determining criteria for plan selection and justification in lieu of a NED justified plan.[8]

7.5.2. *Engineering Assumptions, Risks, and Uncertainties*

[8] *Id.*

The main risks and uncertainties are associated with the bank stabilization portion, relating to the site conditions as well as the constructability of the alternative. The underwater sub-surface conditions are currently assumed to be similar to nearby existing available boring data. The uncertainty with this is assumption is that the sub-surface conditions could not be homogenous across the proposed alignment. A differing soil site condition could result in a more robust design or a re-design all together. Due to this risk, the team is recommending that the sub-surface geotechnical investigations takes place as soon as possible after the TSP Milestone Meeting.

There are uncertainties and risks associated with the implementation of the bank stabilization alternative, due to the state of the buildings and the limited site accessibility. Given that buildings have been removed in the area due to instability, it is assumed that those still present are in a vulnerable state. Vibrations from construction activities could be enough to induce further damage to the remaining structures. This risk has been minimized by the Soldier-Pile Wall that the team is recommending. This construction method minimizes the vibrations introduced into the bank, as the wall will be predominantly constructed away from the bank, then backfill added between the bank and the wall. Additionally, the vast majority of the construction shall take place from the water, therefore minimizing contact between heavy construction equipment and the bank.

Risks and Uncertainties associated with the Emergency Evacuation and Floodplain Management plan are limited to errors in topography used to map floodplain inundation. In other words, any area where the topography has not been well represented by the LiDAR flown for the study area may actually flood when no flooding has been identified though hydraulic analysis. There is also a remaining life safety risk with this plan. In theory, this plan would eliminate flood risk with respect to life safety from the areas it covers. If followed, residents would have adequate time to fully evacuate. In practice, this will greatly reduce life safety risk but not eliminate it. Even mandatory evacuations are often ignored by residents who decide to accept the risk of remaining in a flood prone location during a flood. Historically, it has been impractical to fully enforce a complete evacuation of an area. Furthermore, future floodplain management of the area will ultimately be at the discretion of the city to enforce. It will likely involve locale legislation to enforce the recommendations laid out in the Floodplain Management portion of this to prevent residential redevelopment of the floodplain. In this case residual life risk is directly correlated to degree at which this document is utilized and enforced by the city of Selma.

7.5.3. *Real Estate Assumptions, Risks, and Uncertainties*

The following assumptions, risks, and consequences are noted:

- Per the requirements of ER 405-1-12 an assessment was made of the NFS' real estate professional and legal capabilities and was endorsed by the City of Selma and countersigned by the USACE, Mobile District, Real Estate Division. Marginal Real Estate professional capability (Project-specific) was noted in the NFS Real Estate Acquisition Capability Assessment to be included in the Real Estate Plan. The REP is included in **Appendix D**. The risks include the professional capability and manpower of the Sponsor to acquire bank protection easements in the parameters of an anticipated construction schedule is assessed high. The consequence of this risk is that construction schedule may be delayed or halted.

- An assumption is made that implementation of a FMEEP would be employed utilizing existing building inspection and floodplain management ordinances currently in place by the City of Selma, in consideration of the processes for deeming structures unsafe for occupancy.
- The implementation risk for the NFS to pay total upfront costs for acquisition of Lands, Easements, Rights-of-way with subsequent Federal cost share is high. The consequence of the risk is that the Project may be rendered incomplete due to the lack of funding or otherwise halted without 100% Federal funding.
- There are unknown subsurface conditions including utility lines. The scope of Utility and/or Facility Relocations and impacts are unclear due to preliminary engineering design. The consequence for this risk could increase project costs and have schedule impacts. Real Estate agreements with Alabama Department of Transportation will be required if final design enters the right-of-way of U.S. Highway 80 Business/Edmund Pettis Bridge.
- Landowner attitudes and local support/opposition is uncertain due to lack of data regarding landowner reception to the proposed alternatives, outside of a conceptual level of analysis. The consequence to this risk would be condemnation, as a last resort, to acquire required LER for construction. No known anticipated support or opposition to the TSP has been identified in the course of this study; however, the risk is noted due to the potential to increase administrative, project costs, and schedule delays.
- There have been no preliminary UXO disposal sites identified. The risk to the study would include (1) not being able to acquire the necessary land for disposal, (2) additional cost for acquisition, (3) and potential schedule delays.

7.5.4. *Environmental Assumptions, Risks, and Uncertainties*

The USACE will not receive a FWCA Report. A solution to include the FWCA summary within a BO was agreed upon during the February 27, 2020 IPR with the caveat that FWCA language must be distinctly separated from ESA formal consultation language.

Significant impacts may occur to Federally listed species. Known populations of Federally listed species under the ESA are located within the Study Area. Risk management actions include early coordination with the USFWS, seeking design alternatives that minimize the impacts to Federally listed species, and/or implementing Reasonable and Prudent Measures which enable the USACE to avoid significant harm to the species population (i.e. relocation surveys). Consequences of not utilizing risk management actions may result in a Jeopardy Opinion from the USFWS, which would involve long-term and costly monitoring.

The USACE may not receive WQC for actions occurring within the Alabama River. Potential toxic chemicals could be present within the substrate due to foreign materials, such as UXOs, leeching into the soil. Risk management actions include testing substrate prior to seeking WQC and developing a management plan for proper disposal of hazardous material. The consequence of not receiving WQC would mean the inability to implement any proposed construction within the Alabama River.

Significant impacts to cultural resources may occur within the Study Area. Risk management involves early coordination with the State Historic Preservation Officer, early implementation of surveys, and seeking design options which minimize and/or mitigate impacts to resources. A Programmatic Agreement in accordance with 36 CFR 800.14(b)(1) will be necessary to address unanticipated discoveries if a cultural survey is not completed before Preconstruction Engineering and Design (PED) phase.

The cost of Phase III mitigation may exceed the 1% threshold. A thorough desktop review found a recent maritime survey of the impacted area showing the degraded integrity of the resources. Additionally, the majority of the cost for Phase III mitigation would be accounted for within the UXO survey by combining overlapping actions; therefore, risk management actions would include seeking a waiver for the cost of the survey should the Phase III survey be necessary and over the current estimated scope.

7.6. Plan Accomplishments

As discussed in **Section 4.3.4**, the FMEEP would reduce flood risk with respect to life safety and flood damages (by preventing redevelopment) from the areas it covers. The FMEEP would encourage the City of Selma to enforce the development restrictions within the floodplain extent which, if followed, would reduce residual damage and life safety risk in the future.

Additionally, the FMEEP would recommend that should existing structures, in the future within the floodplain, be demolished due to blight or structural unsoundness, further development would be prohibited. Prohibiting redevelopment of demolished structures in the floodplain would realize the study objectives to reduce average annual flood damages and life safety risk. Implementation of the Soldier-Pile Wall would reduce flood-induced erosion to the downtown area which would contribute towards stability improvement for historic structures along the riverbank; therefore, the TSP would accomplish all study objectives.

7.7. Plan Implementation

Because of the City of Selma's financial constraints, its historical significance to the story of the Civil Rights Movement, and its strategic location along the Alabama River, an NED Exception memo was endorsed.[9] The NFS construction cost contribution (typically 35 percent) is estimated to be valued at approximately **$9,637,950**

A standard PPA will be used to partner with the NFS for design and construction of the recommended plan. This section details the implementation and cost sharing requirements between the Federal government and the NFS.

7.7.1. *Division of Plan Responsibilities*

7.7.1.1. *Federal Responsibilities*

Federal responsibility is to provide the Federal cost sharing match, engineering service via either in-house resources or architectural engineering services to produce

[9] *Id.*

construction contract documents, award a construction contract, manage construction contract, turn over the project to the NFS, and provide an O&M manual to the NFS.

7.7.1.2. *Non-Federal Responsibilities*

The NFS responsibility is to provide all LERRDs for construction, and future O&M of the project. The NFS is required to provide for OMRR&R for the completed project without cost to the USACE, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribe by the USACE in an OMRR&R manual and in accordance with provisions of the PPA.

Additionally, the NFS is responsible for the NFS cost sharing match in accordance with the PPA. Work-in-kind is not anticipated on the project. The NFS would be responsible for reviewing, commenting, or providing input to the construction contract documents and O&M manual at key milestones of the project.

7.7.2. *Implementation Schedule*

Alternative 4 coupled with a floodplain management/emergency evacuation plan was endorsed as the TSP during the July 22, 2020 milestone meeting. The release of the Draft Integrated FR/EA for public review will occur within 60 days of the endorsement. The study activities to-date and the future activities until completion and their respective timeframes are as follows:

Scoping

1) Execute FCSA (October 9, 2018)
2) Scoping Meeting (October 23, 2018)

Alternative Evaluations and Analysis

3) Alternatives Milestone Meeting (January 16, 2019)
4) TSP Milestone (July 22, 2020)

Reviews

5) DQC/Legal Review of Draft Report (August 24, 2020 – September 4, 2020)
6) Release of Draft Report (September 17, 2020)
7) Concurrent Reviews (ATR/Public/Policy (September 17, 2020 – October 29, 2020)
8) Address/Close-Out Review Comments (October 30, 2020 – November 19, 2020)

Finalize Feasibility Analysis

9) Prepare for Agency Decision Milestone (ADM) (November 25, 2020)
10) ADM (December 11, 2020)
11) Final Integrated FR/EA Complete (April 9, 2021)
12) Chief of Planning Approval to Release Draft Report (June 28, 2021)
13) S&A Review (July 9, 2021 – August 11, 2021)
14) Chief's Report (October 7, 2021)

Table 24 shows the tasks to be completed during the PED phase of the project under the assumption that design funds would be received in the FY 22 Workplan and construction Funds would be obtained in the FY23 President's Budget. A two-year construction schedule was assumed to come up with the design/construction schedule for Selma.

Table 24: Project Schedule

Task	Schedule
Project Partnership Executed	June 2022
Initiate Design (funding dependent)	June 2022
50% Design Complete	November 2022
100% Design Complete	March 2023
Real Estate acquisition/certification of lands	September 2023
Advertise for a Construction Contract	September 2023
Award a Construction Contract	December 2023
50% Construction Complete	December 2024
100% Construction Complete	December 2025
O&M Manual and Project Turnover	April 2026
Close Project	April 2026

7.7.3. *Environmental Requirements*

Environmental compliance requirements have been met to the extent possible as part of the planning process. Several environmental compliance activities would be necessary during plan implementation.

- **NHPA, Section 106** – Construction must occur in accordance with the MOA, which will be included in **Appendix B** of the Final Integrated FR/EA.
- **ESA, Section 7** – Relocation surveys for the Tulotoma Snail must be conducted prior to implementation. Commencement of work must not occur until the survey is complete.
- **HTRW** – Prior to implementation, full UXO removal must occur.
- **CWA, Section 401/404** – Design and Construction of the plan must comply with the ADEM WQC which will be included in **Appendix B** of the Final Integrated FR/EA.
- **CWA, Section 402** – The construction contractor would be required to obtain a CWA Section 402 NPDES stormwater permit from ADEM prior to implementation.

7.7.4. *Cost Sharing*

The sponsor cost contribution (typically 35 percent) to this project is estimated to be valued at approximately **$9,637,950**. Because of the City of Selma's financial constraints, its historical significance to the story of the Civil Rights Movement, and its strategic location along the Alabama River, a NED Exception was endorsed for the Selma Alabama FRM Study.[10]

7.7.4.1. *Financial Requirements*

[10] *Id.*

Upon execution of a PPA and receipt of notice to proceed with land acquisition, the NFS must bear the upfront cost of land acquisition which is currently estimated to be $380,000.

7.7.4.1.1. *Self-Certification of Financial Capability*

Through extensive outreach and national support, the NFS is anticipated to be fully financially capable of signing a Financial Capability Agreement (FCA).

7.7.4.2. *Views of the Non-Federal Sponsor*

The study partner is the City of Selma, who has been engaged since signing the FCSA in October 2018 and participating in the Planning Charette. The City fully supports the TSP which allows for bank stabilization and development of a floodplain management plan/emergency evacuation plan for the areas that receive repetitive damages and that would not adversely impact OSE within the community.

7.8. District Engineer's Recommendation / Signature Page

I have given consideration to all significant aspects of the public interest. The aspects considered environmental, social, and economic effects; engineering feasibility; and any other elements bearing on the decision. There has been no controversy concerning this study or the proposed project and the NFS and local stakeholders are in support of the proposed action. The plan complies with all seven of the USACE Environmental Operating Principles.

Based on the analysis, Alternative 4 coupled with a FMEEP is the recommended TSP. The plan includes the bank stabilization of approximately 750 linear ft using a Soldier-Pile Wall design. The FMEEP will detail evacuation areas and routes necessary based on stream gage readings with advance notice. Archeological surveys will be conducted in the form of UXO removal during the study phase of the process. All federal coordination will be completed prior to release of the Final Integrated FR/EA.

The first project costs are $27,537,000 and $4,000 estimated O&M costs to maintain the Soldier-Pile Wall. Operating and maintaining the Soldier-Pile Wall would require regular structural inspections and vegetation prevention and removal.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

DATE:______________________________ ______________________________
Sebastien P. Joly
Colonel, U.S. Army
District Commander

8.0 PROJECT DELIVERY TEAM AND LIST OF PREPARERS

Table 25 lists the functional PDT members and does not account for supervisory personnel or Vertical Team members. Each member of the PDT co-authored the Draft Integrated FR/EA.

Table 25: Project Delivery Team Members

MEMBER	DISCIPLINE
Bass, John	Geotechnical Engineer
Black, Joseph	Engineer
Bulger, Heather	Biologist
Burks, Fred	Plan Formulator
Caldwell, Timothy Jr.	Cost Engineer
Crane, Ryan B.	Engineer
Justice, Adam	Structural Engineer
Newell, David	Project Manager
Ortiz, Juan	Structural Engineer
Phillips, Stephen	Economist
Ralph, Bradner	Geotechnical Engineer
Rooney, Katherine	Attorney
Smith, Alexandria	Anthropologist
Tetreau, John	Real Estate Specialist
Throop, Ashley	Hydraulic Engineer
Vongmony, Var	Economist

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Selma, Alabama

Flood Risk Management Study

Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX A

US Army Corps of Engineers
Mobile District

September 14, 2020

The City of Selma ALABAMA Civil War to Civil Rights and Beyond

APPENDIX-A: Engineering

Table of Contents

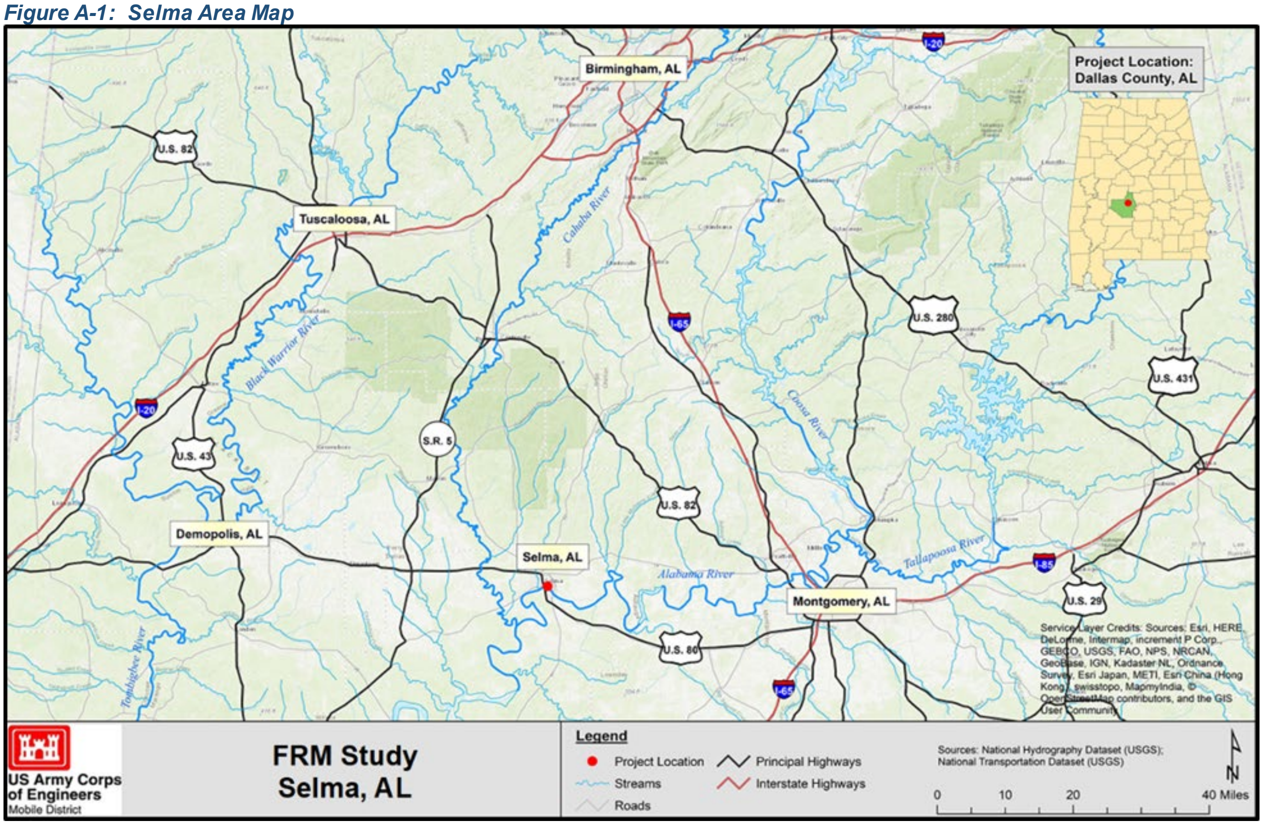
List of Figures

List of Tables

A.1. Study Area

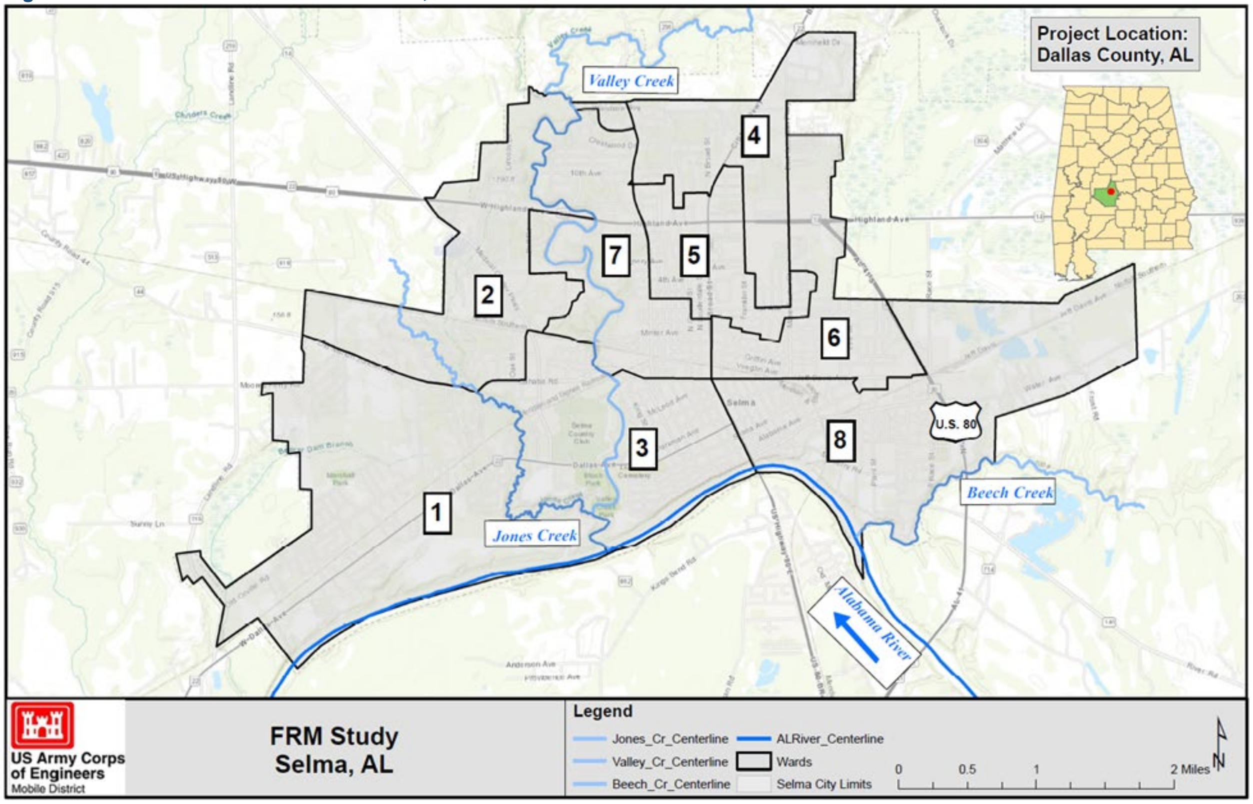
The City of Selma is located on the right bank of the Alabama River in Dallas County, in south central Alabama. The city is located on United States Highway 80, halfway between the cities of Montgomery and Demopolis, AL. Both cities are approximately 51 miles away, with Montgomery to the east and Demopolis to the west. Figure A-1 shows the location of the City of Selma with respect to the cities of Birmingham, Tuscaloosa, Montgomery, and Demopolis, Alabama.

Figure A-1: Selma Area Map



Selma consists of 8 jurisdictions known as wards and are shown on Figure A-2. Wards 1, 3, 6, and 8 are the primary areas within the City of Selma where historical flooding has occurred. The study area includes several historically significant buildings, some of which are located directly on the riverbank near Selma's downtown historic district and near the Edmund Pettus Bridge.

Figure A-2: Locations of Wards in Selma, Alabama



A.1.1. *Watershed Characteristics*

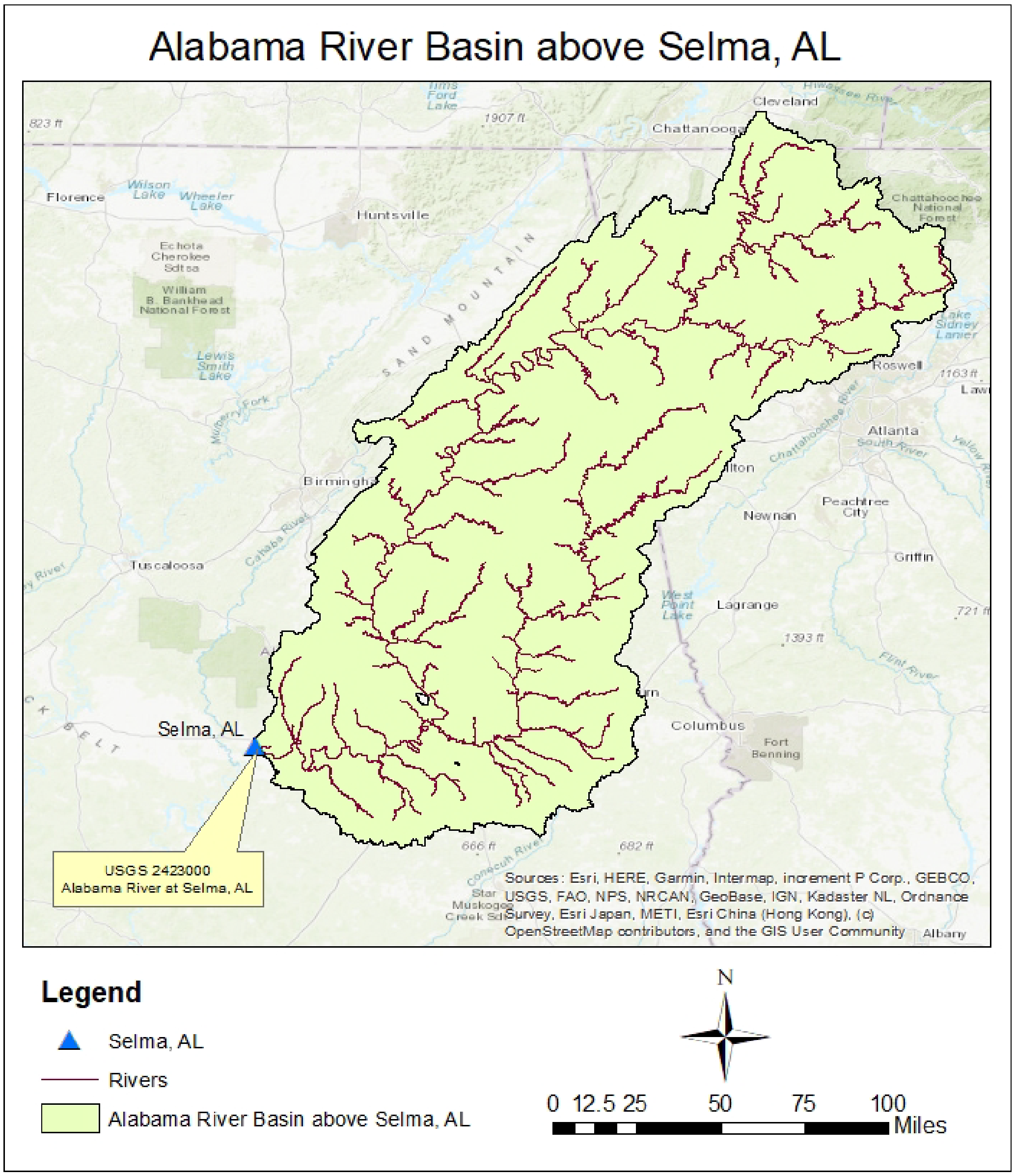
A.1.1.1. *Drainage Area Description*

The Alabama-Coosa-Tallapoosa (ACT) River System drains a small portion of Tennessee, northwestern Georgia, and northeastern and east-central Alabama. The Alabama River Basin has its source in the Blue Ridge Mountains of northwest Georgia. The main headwater tributaries are the Oostanaula and Etowah Rivers, which join near Rome, Georgia, to form the Coosa River. The Coosa River in turn joins the Tallapoosa River near Wetumpka, Alabama, approximately 14 miles above Montgomery, Alabama, to form the Alabama River.

The upper and middle ACT basin have several federal and private dams located on the main stem rivers. There are six flood risk management projects located on these systems. They are, Allatoona Dam, Carters Dam, owned and operated by USACE, and Weiss Dam, Logan Martin Dam, H.N. Henry Dam and Harris Dam, owned and operated by the Alabama Power Company. While these provide a great deal of flood protection for moderate flood events directly downstream of each structure, they provide very little peak stage and flow reduction on the Alabama River near Selma and are not intended to do so. There are also several run-of-river and navigation dams located throughout the basin. These have no impact on the Alabama River near Selma.

The City of Selma is located on the Alabama River at river mile (RM) 259.77 (above the confluence of the Tombigbee and Alabama Rivers, which form the Mobile River in southwestern Alabama). Above Selma, the Alabama River Basin has a total drainage area of 17,095 square miles (shown on Figure A-3). The study area sits in the pool of Millers Ferry Lock and Dam, located about 30 river miles downstream of the city (RM 187.35), and downstream of Robert F. Henry Lock and Dam, located about 72 river miles upstream of the city (RM 290.4) (shown on Figure A-4). The impoundment of Millers Ferry Lock and Dam (L&D) raised the river level near Selma several feet, however the operation of these projects have no further impact on the study area as they are both run-of-river navigation dams. Within the study area, there are three tributaries including Valley Creek, Jones Creek, and Beech Creek. The main cause of flooding in Selma is from backwater from the Alabama River flowing into these tributaries.

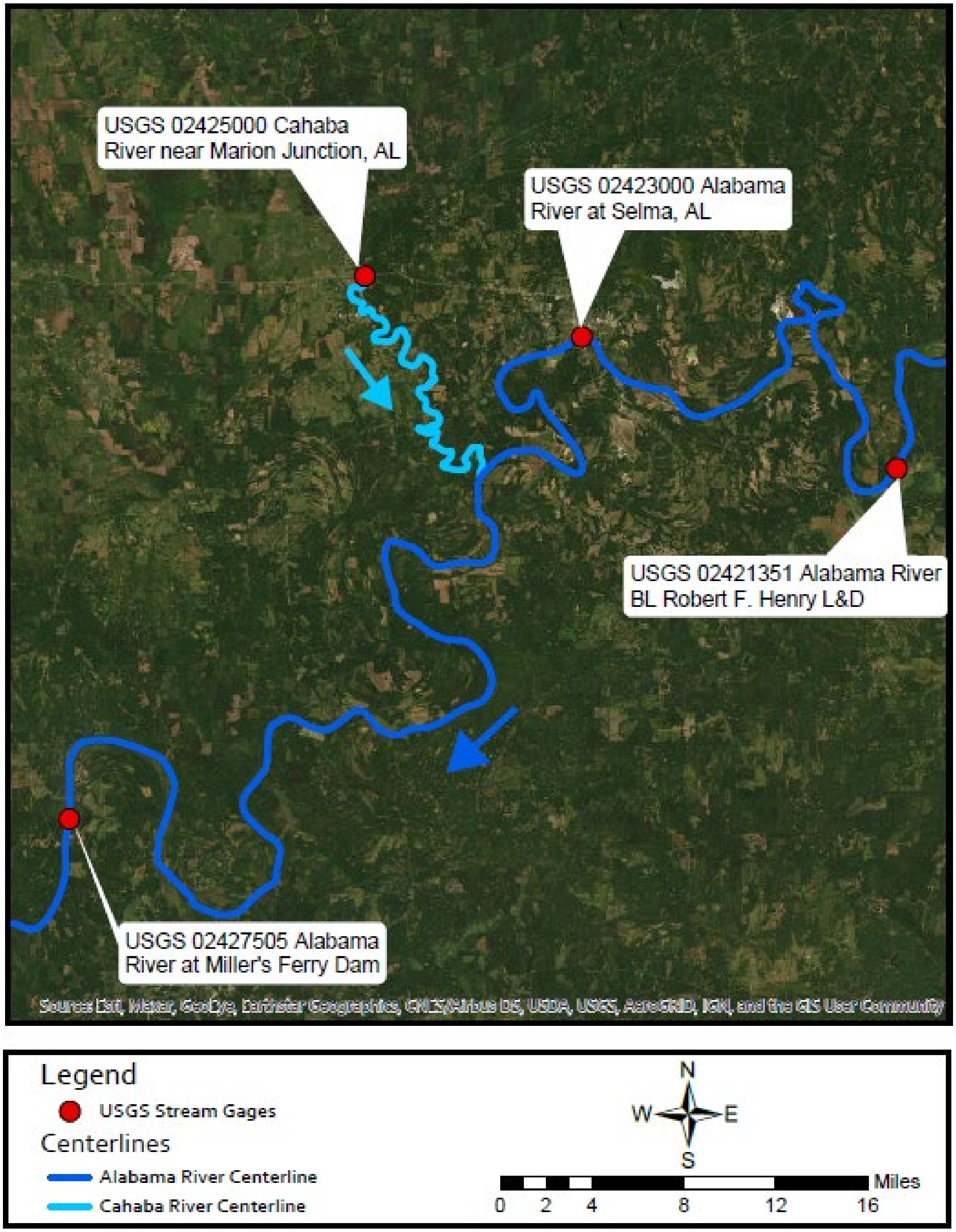
Figure A-3: Alabama River Basin map showing drainage basin upstream of Selma, AL.



A.1.1.2. *Available Data*

Four (4) United States Geological Survey (USGS) stream gages were utilized for the hydrologic and hydraulic analysis of this study. The gage locations are shown on Figure A-4 and include USGS 02421351 Alabama River BL Robert F. Henry L&D, USGS 02423000 Alabama River at Selma, AL, USGS 02425000 Cahaba River near Marion Junction, AL, and USGS 02427505 Alabama River at Miller's Ferry Dam NR Camden, AL. The USGS 02423000 gage located at Selma, AL has the longest record of the four gages, with continuous data starting in 1891. Additionally, one historic peak (1886) is attributed to the continuous record. The other three gages have mostly continuous data starting in the early/mid-1970s. In addition, the Marion Junction gage has flow data from 1939-1954. All of the USGS gages used for this study are recorded in NGVD 29 and were converted to NAVD88. The datum conversion between NAVD88 and NGVD29 is 0.102 ft (i.e., NAVD88 minus NGVD29 is equal to 0.102 ft).

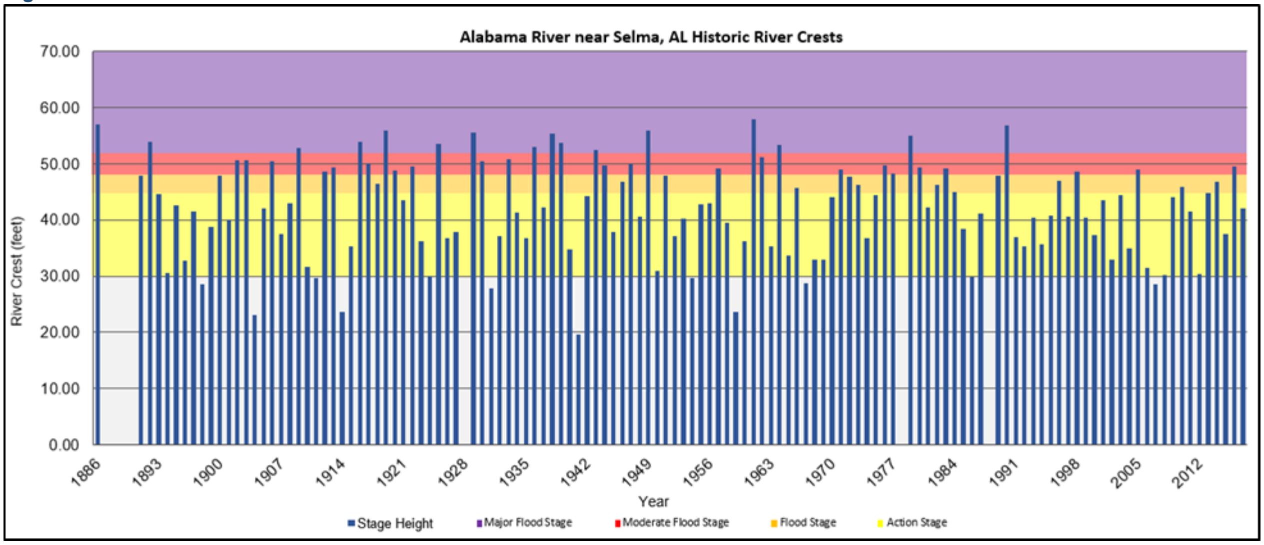
Figure A-4: Stream gages used hydrologic and hydraulic analysis.



A.1.1.3. *Flooding History*

The City of Selma has a long record of flooding based on available historical data with an observed historical event in 1886. Figure A-5 shows the annual peaks for the USGS gage 02423000 Alabama River at Selma, AL. This gage location is representative of flood conditions within the project area. There have been 16 major floods, defined by the National Weather Service as the gage height of 52 feet (113.9 feet NAVD88) or above.

Figure A-5: Annual Peaks for USGS 02423000



One of the largest floods events on record occurred in 1990. A major storm system in the spring of 1990 produced record floods on the Alabama River. On 16 March 1990, with the river still high from previous rains, the entire basin received very heavy rainfall for two days. For the two-day total, R. F. Henry reported nine inches, Millers Ferry reported 6.75 inches and Claiborne had 9.5 inches. The upper basin received an average of six to seven inches during this period. R. F. Henry passed a record breaking flow of 220,000 cfs on 20 March 1990, producing a record tailwater of 135.5 feet NAVD88. This resulted in the second largest flow on record (280,000 cfs) at the USGS gage located at Selma, AL. The largest known flood for the entire period of record is the historical flood of February-March 1961 with a peak discharge of 284,200 cfs. Another significant flood occurred on 11-16 March 1929, when 10 inches of rainfall over a period of three days was recorded in the vicinity of Auburn, Alabama. The recorded flow was 220,000 cfs at Selma. Figure A-6 shows an aerial view of the flooding in the Selma and Selmont, AL areas in this 1929 event. For the historical flood in April 1886, the peak discharge of 248,000 cfs was recorded at the Selma gage. This was the greatest flood on record for the Millers Ferry Project which is downstream of Selma.

Figure A-6: Aerial Image of Selma, AL during 1929 Flood (Source: NWS Floods in Alabama)

A.1.1.4. *Hydrology/Runoff Characteristics*

A.1.1.4.1. *Temperature*

The average daily low and high temperatures in the study area range from the mid to upper-30s to upper-50s/low-60s (in ˚F) for the winter months and the high-60s to the upper-80s/low-90s in the summer months. (Data source: https://www.usclimatedata.com/climate/selma/alabama/united-states/usal0488)

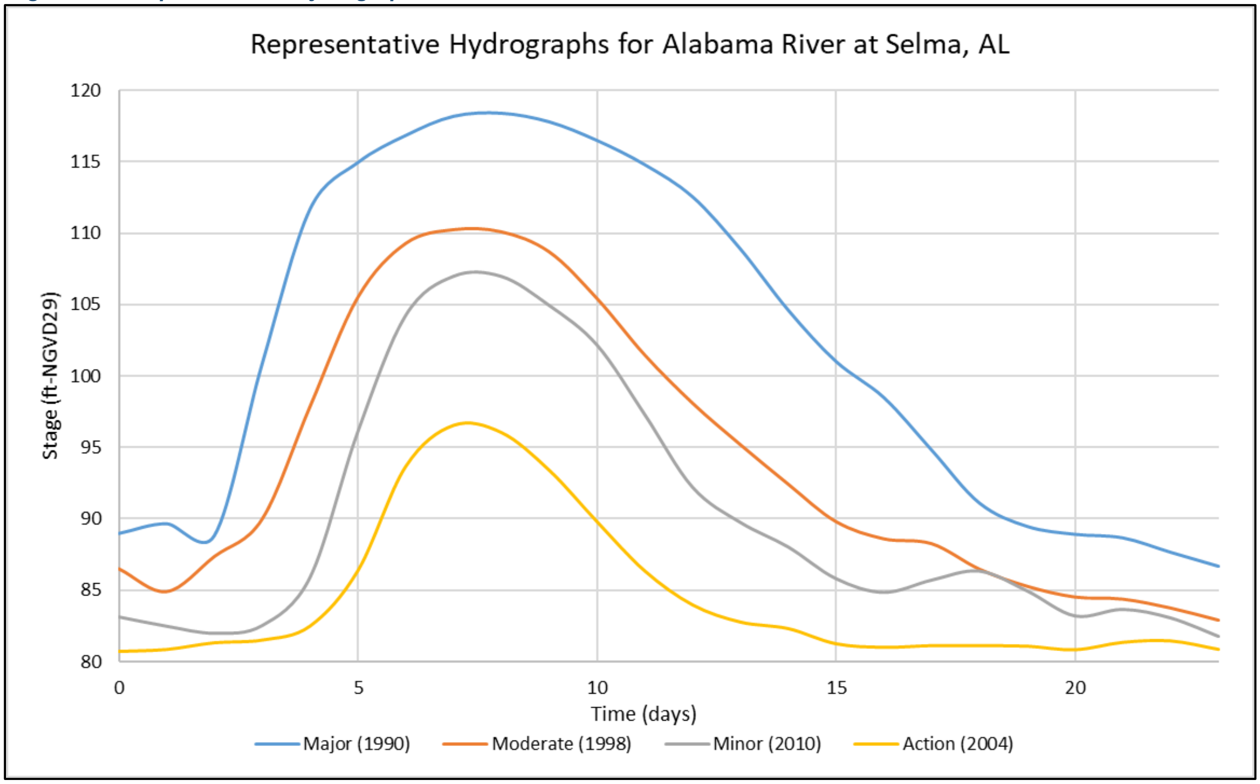
A.1.1.4.2. *Rainfall*

The average annual precipitation is approximately 55 inches, with monthly averages ranging from a low of 3.54 inches in April to a high of 6.46 inches in July (this data comes from the same source as that listed above). Synthetic rainfall data for the study area, per National Oceanic Administration (NOAA) Atlas 14, show that rainfall depths range from 0.437 inches for the 1-year, 5-minute storm to 12.4 inches for the 500-year, 24-hour storm.

A.1.1.4.3. *Hydrograph Characteristics*

The streams which constitute the Alabama River above the City of Selma exhibit wide variations in runoff characteristics, ranging from very flashy in the mountainous regions of the Coosa Basin above Rome, Georgia, to very slow rising and falling in the lower reaches, which includes the stretch of river near Selma. A typical hydrograph at Selma increases slowly over several days before reaching a peak flow, then recedes at a slower pace. Large events usually occur over several weeks, sometimes lasting over a month. Figure A-7 shows representative hydrographs of major (i.e., extensive inundation of structures and roads), moderate (i.e., some inundation of structures and roads near streams), minor (i.e., minimal or no property damage, but possibly some public threat), and action (i.e., some type of mitigation action in preparation for possible significant hydrologic activity) stage events for the Alabama River at Selma, Alabama. Major, moderate, minor, and action stage descriptions are per the National Weather Service definitions.

Figure A-7: Representative Hydrographs for Alabama River at Selma, Alabama



A.1.1.5. *Hydrologic and Hydraulic Characteristics*

The Alabama River Basin is a large, diverse basin consisting primarily of broad wooded areas in the upper basin as well as several large urban areas near and upstream of Selma, AL. Overland flow from rain events and stream conveyance in forested and wooded areas found within the upper basin will result in a slow moving flow whereas water will typically convey much faster in the urban areas due to increased land coverage of impervious areas such as asphalt parking lots and roadways.

The basin is located over two distinct topographies. The middle and norther portion of the basin is steep and mountainous with narrow floodplains, causing streamflow to be flashier with short, acute high flow events. The southern portion of the basin below Montgomery, Alabama becomes extremely flat with many sections of wide floodplain. Hydrographs in this area of the basin, including the study area, are very slow moving.

The Alabama River channel is approximately 35 feet deep in the vicinity of Selma Alabama with an approximate width of 700 feet at bank-full capacity. The river is fairly clear of debris with some vegetation on the slopes of the river. The floodplain upstream and downstream of the river ranges from cleared farmland to densely vegetated forests. Roughness coefficients (Manning's n-values) used in modeling ranged from 0.032 -0.037 for the channel section. Roughness on the overbanks and floodplain ranged from 0.05 – 0.12

Side slopes of the channel vary significantly as this channel has historically been dredged for navigation. Upstream and downstream of the city of Selma, the land is very flat on both sides of the floodplain, with a floodplain width of up to 4 miles. The downtown area of Selma sits on a high bluff on the right bank of the river.

A.1.1.6. *Land Use*

In the Alabama Basin above Selma, AL, there is a large variety of land use including impervious areas within metropolitan areas and forests throughout the basin. Figure A-8 shows the land use in the basin above Selma Alabama. The study area itself is primarily impervious areas surrounded by pastures and woody wetlands as seen on Figure A-9. There are areas of forests and crop land located sporadically outside of the city with very little inside of Selma city limits.

Figure A-8: Land Use in the Alabama River Basin and surround areas upstream of Selma, AL

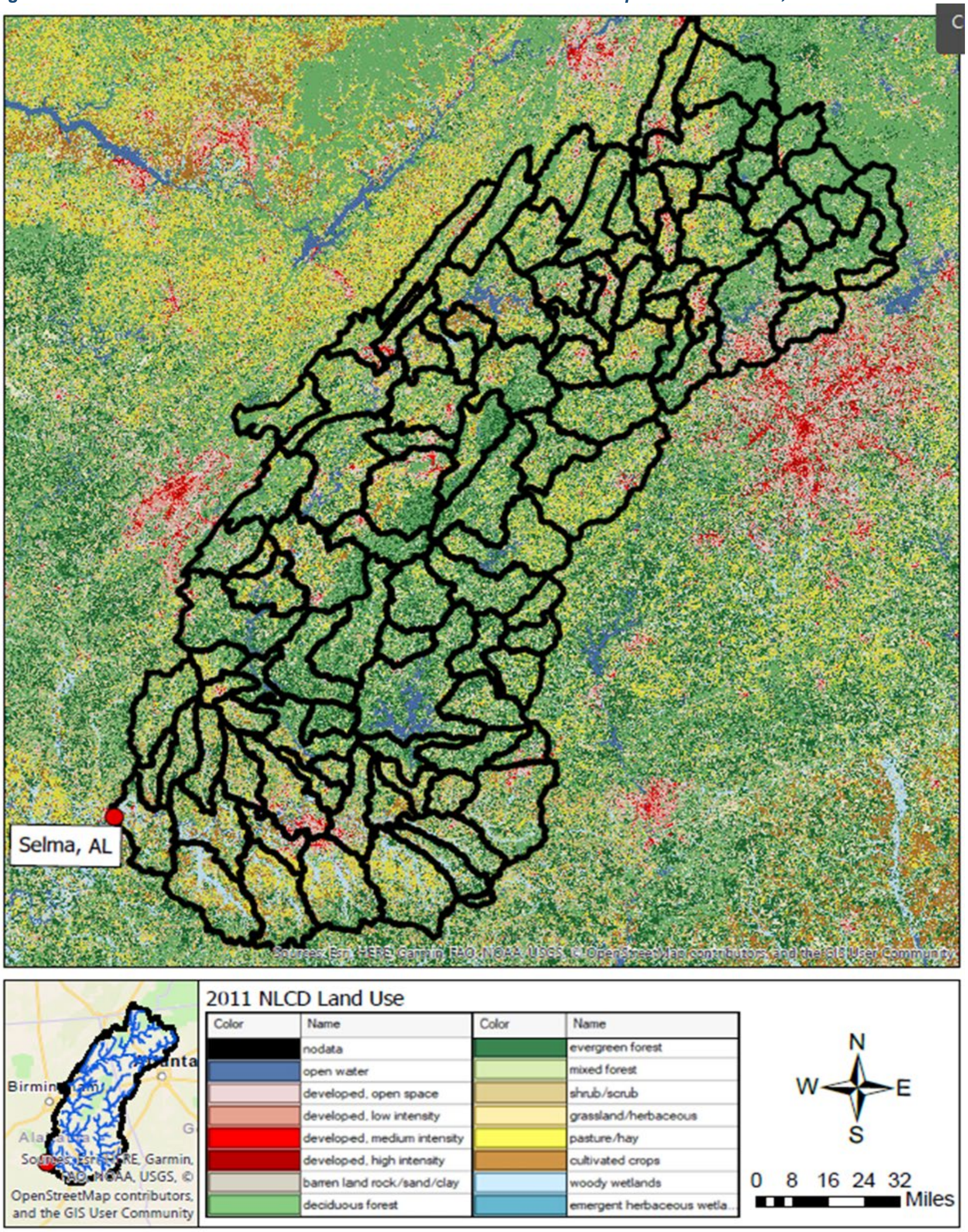
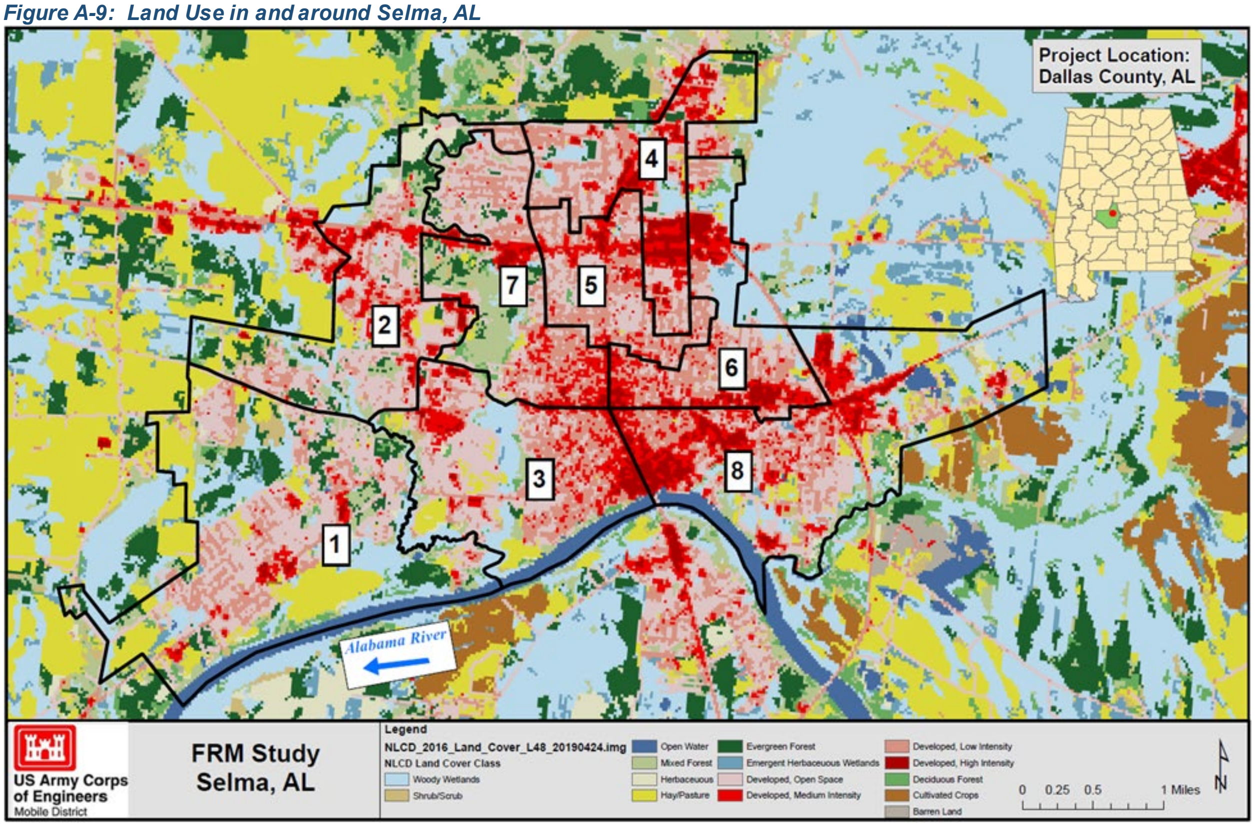


Figure A-9: Land Use in and around Selma, AL



A.1.1.7. *Alluvium and Soils*

The geology in and around the City of Selma consists of alluvial deposits, or sands, silts and clays left behind as a result of flowing water. These deposits are underlain by various formations within the Selma Group, the most prevalent of these being the Mooreville Chalk. Alluvium deposits consist of a mixture of varicolored, fine to coarse sand with clay lenses and gravel. The Mooreville Chalk is generally characterized as a yellowish-gray to olive-gray clayey chalk or chalky marl. Visual survey in the vicinity of the study area indicates that the banks are steep (1v:1.5h and steeper) and comprised of sands, silts, and clays that sit atop a layer of chalk. Historical borings from past geotechnical explorations confirm this assessment, noting that the chalk layer is dense and strong. Banks in the downtown area range in height between 30 to 50 feet (ft) above the water's surface (water surface elevation at the Edmund Pettus Bridge is about 84 ft NAVD88 in normal flow conditions). The interface of the overburden and the chalk is easily spotted from the river, and this interface appears anywhere from 5 to 20 feet above the water's surface.

A.1.1.8. *Geology and Soils*

The ACT River Basin covers an unusually wide range of geologic conditions. The location of the river basin is within parts of five physiographic provinces: the Blue Ridge Province; the Valley and Ridge Province; the Piedmont Plateau; the Cumberland Plateau; and, the Coastal Plain. Each of these physiographic sub-divisions influences drainage patterns. Rugged crystalline rocks characterize the northeastern portion of the basin in the Blue Ridge Province. Folded limestone, shale, and sandstone compose the Valley and Ridge Province. The axes of the folds that trend northeast-southwest influence the course of the streams in that they tend to flow southwestward along the alignment of the geologic structure. Like the Valley and Ridge Province -- folded, faulted, and thrusted rocks form the Cumberland Plateau -- with the deformation being less than the Valley and Ridge rocks. The east-central portions of the basin are in the Piedmont Province, characterized by sequences of metamorphic and igneous rocks. Prominent topographic features generally reflect the erosional and weathering resistance of quartzite, amphibolite, and plutonic rocks. The residual soils are predominately red sandy clays and gray silty sand derived from the weathering of the underlying crystalline rocks. The more recent sedimentary formations of the Coastal Plain underlie the entire southern portion of both river basins. The contact between the Coastal Plain on the south and the previously described physiographic provinces to the north is along a line that crosses the Cahaba River near Centreville, Alabama; the Coosa River near Wetumpka, Alabama; and the Tallapoosa River near Tallassee, Alabama. As the rivers leave the hard rocks above this line and enter the softer formations of the Coastal Plain, the erosion properties change, resulting in the formation of rapids. This line is a geological divide commonly known as the "fall line". The rocks of the Coastal Plain are typically poorly consolidated marine sediments.

The Selma area is situated near the center of the Black Prairie subdivision of the Gulf Coastal Plain physiographic province in the southern portion of the ACT Basin. The Black Prairie subdivision is a belt of low relief which crosses the state in and east-west direction. In the Selma area, it is about 20 miles wide and consists of flat to gently undulating prairie land. The major drainage of the area is by the entrenched and meandering Alabama River which crosses the prairie belt in a southwesterly direction. The Black Prairies correspond in length and width to the weathered outcrop of the Selma Group of late Cretaceous age which is a chalky to argillaceous limestone formation with a maximum known thickness of about 900 ft. The general dip of the strata in the Selma area is about 30 ft per mile to the south.

A.2. Climate Change

A.2.1. *Introduction*

In 2016, USACE issued Engineering and Construction Bulletin No. 2016-25 (hereafter, ECB 2016-25) which mandated climate change be considered for all federally funded projects in planning stages (USACE, 2016). This guidance was updated with ECB 2018-14 (USACE, 2018), which mandates a qualitative analysis of historical climate trends and assessment of future projects. Even if climate change does not appear to be an impact for a particular region of interest, the formal analyses outlined in the guidance, result in better-informed planning and engineering decisions.

A.2.2. *Literature Review*

A literature review was performed to summarize climate change literature and highlight both observed and projected assessments of climate change variables relevant to the study area. Since this is a flood risk management project, the primary variable that is relevant is streamflow. However, this variable is also affected by precipitation and air temperature. Therefore, this review focuses on observed and projected changes in precipitation, air temperature, and hydrology.

A.2.2.1. *Temperature*

A.2.2.1.1. *Observed Temperature*

The Fourth National Climate Assessment (USGCRP, 2017) states that observed temperatures in the United States have increased up to 1.9 degrees Fahrenheit since 1895, with an acceleration in increasing temperatures since the 1970s. Warming is projected for all parts of the United States (USGCRP, 2017).

The USACE Institute for Water Resources (IWR) conducted a review in 2015 which summarized the available literature on climate change for the South Atlantic-Gulf Region, including the study area (USACE, 2015). In general, studies have shown that over the last century, a period of warming in the region has been observed since a transition point in the 1970s. This transition period was precluded by an observed cooling period (see Patterson et al., 2012; Laseter et al., 2012; and Dai et al., 2011). The overall warming trend is fairly inconsistent for the region over the last century. The IWR report indicates only mild increases in annual temperature for the region with significant variability. However, there is a clear consensus in general warming since the early 1970s (USACE, 2015).

For the project area, there are a few NOAA gages in proximity of Selma with records longer than thirty years. The NOAA gage located in Selma, AL (beginning in 1895) was going to be analyzed, however, the dataset has large gaps for the more recent years. The trend from this data shows a decreasing trend, which is inconsistent with the national and regional reports. Therefore, the NOAA gage located in Marion Junction, AL with a record from 1951 - 2017 (continuous record 1955 – 2017) was used to analyze temperature trends in the area.

A statistical analysis was performed on the entire dataset from Marion Junction, AL seen in Figure A-10 with the associated p-value. The alternative hypothesis of an apparent trend is accepted to be true at the 0.05 significance level, meaning that p-values less than 0.05 are indicative of statistical significance. This is a threshold commonly adopted within statistical references, but consideration should also be given to trends whose p-values are close to this reference threshold. In this case, the period of record data produces a high p-value of 0.444272; therefore, it is not considered to have a significant increasing or decreasing trend.

However, performing the same test of average annual temperatures from 1970 - 2017 (shown on Figure A-11) produces a p-value of 0.0000216. This would be considered very indicative of a statistically significant upward trend in temperatures. The temperature gage located in Rome, GA was also analyzed (shown in Figure A-12). The p-value for the entire period of record is 0.000482, which indicates the downward trend is statistically significant. However, there is a cooling period that occurred in the 1970s that may be skewing the data. Figure A-13 shows the Rome, GA gage temperature data from 1970 - 2018.

Both gages show a statistically significant upward trend from 1970 – 2018. Visually, there appears to be an oscillating pattern with the annual average temperature. The temperatures prior to the cooling period (1970s) look similar to temperatures in the early and mid-1900s. Without longer periods of record to compare with, it is difficult to come up with a conclusion.

Figure A-10: Annual average temperature and p-value from 1951 - 2017 for Marion Junction, Alabama gage

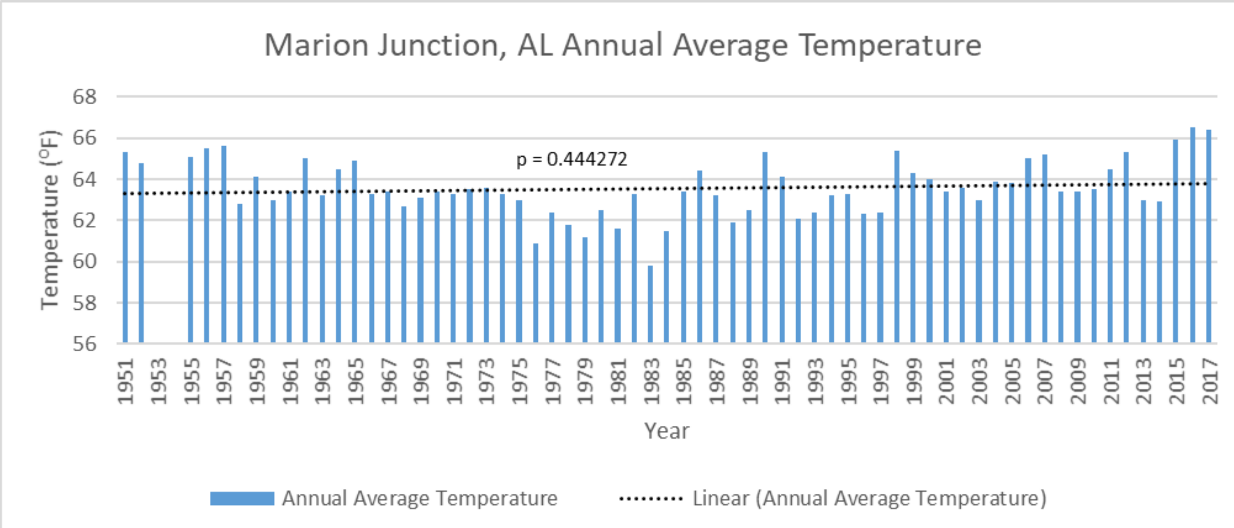


Figure A-11: Annual average temperature and p-value from 1970 - 2017 for Marion Junction, Alabama gage

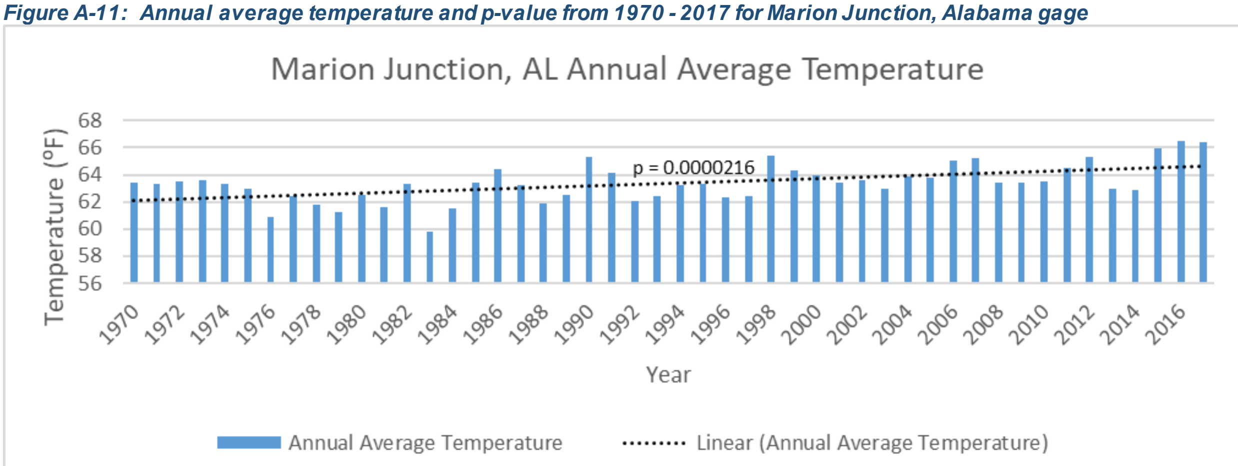


Figure A-12: Annual average temperature and p-value from 1902 - 2018 for Rome, GA gage.

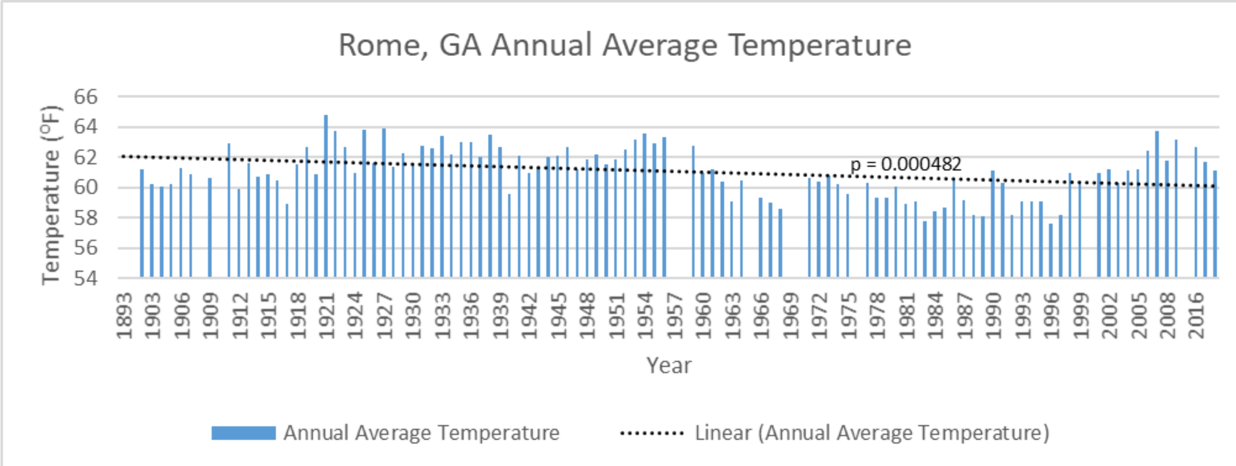
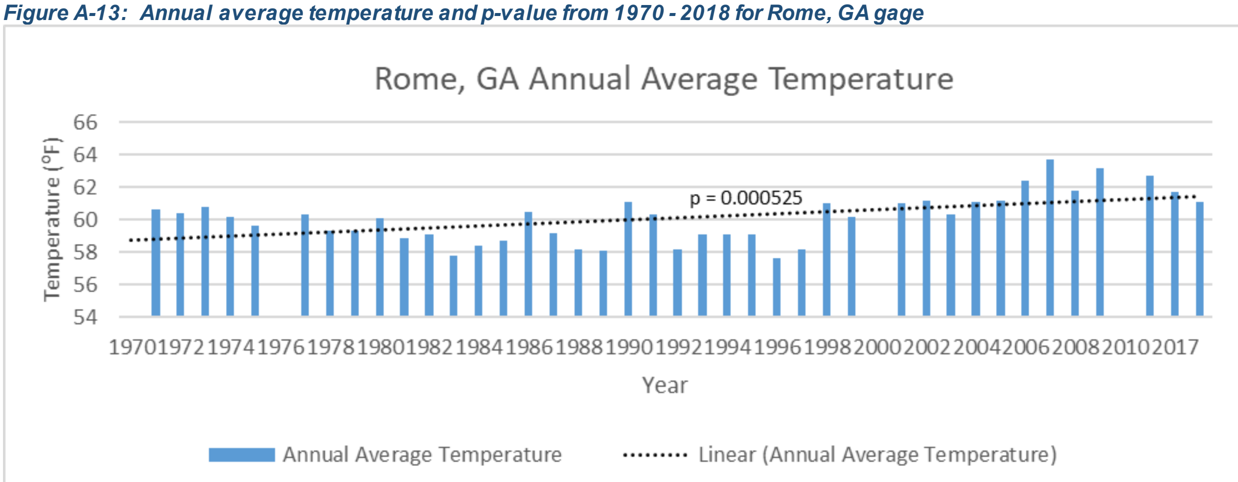


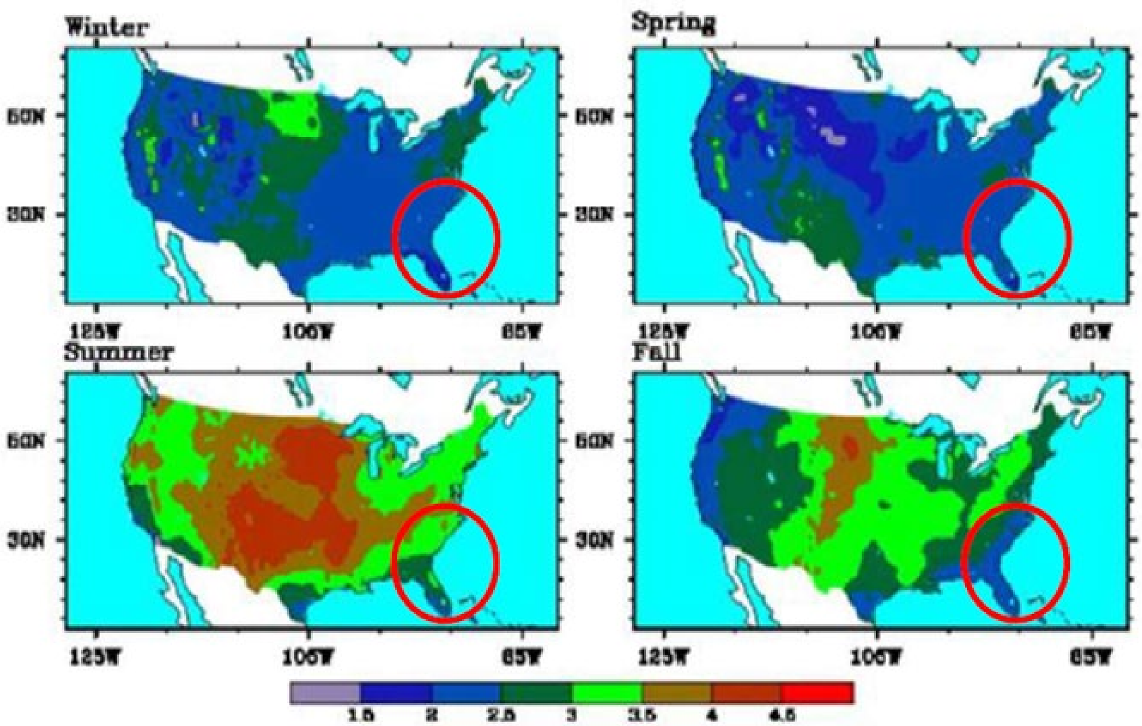
Figure A-13: Annual average temperature and p-value from 1970 - 2018 for Rome, GA gage



A.2.2.1.2. *Projected Temperature*

Global Circulation/Climate Models (GCMs) have been used to project future climate conditions in the U.S. including the southeast regions. Results show a significant warming trend at a national and regional scale. Figure A-14 shows the projected changes in seasonal maximum air temperatures from Liu et al. (2013), which is based on a "worst case" greenhouse gas emissions scenario. This shows that, overall, there is a projected warming trend of 2 to almost 4 degrees by 2070.

Figure A-14: Projected changes in seasonal maximum air temperature, ºC, 2041 – 2070 vs. 1971 – 2000. The South Atlantic-Gulf Region is within the red oval (Liu et al., 2013; reprinted from USACE, 2015)



A.2.2.2. *Precipitation*

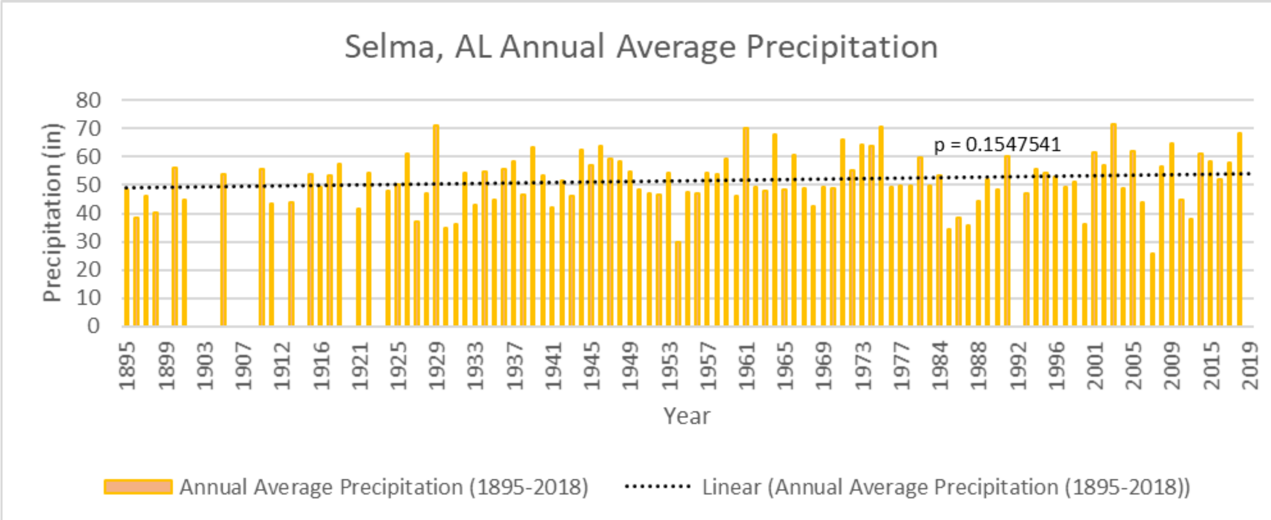
A.2.2.2.1. *Observed Precipitation*

The IWR report (USACE, 2015) shows there is a general increase in precipitation for the southeast region; however, it is highly variable for the region. Analysis of gridded data spanning years 1950-2000 showed that winter precipitation has consistently increased over the last century (Wang et al., 2009). Other seasons have shown high variability including increases, decreases, and little change in precipitation across the region.

A study by Patterson et al. (2012) did not identify any patterns of precipitation change using monthly and annual trend analysis for a number of climate and streamflow stations within the South Atlantic-Gulf Region (data included 1934 - 2005). However, the study found that more sites exhibited mild increases in precipitation than those that exhibited decreases.

Similar results were seen at the NOAA gage in Selma. The gage has a large record for precipitation spanning from 1895 – 2018, however, the p-value is 0.1547541 which means there is no statistical significance (see Figure A-15). Visually, the dataset seems to be consistent with high and low values being similar throughout the entire record. It appears that there are more low values for precipitation in recent years, even though the trend appears to increase overall.

Figure A-15: Annual total precipitation and p-value from 1895 - 2018 for Selma, Alabama gage

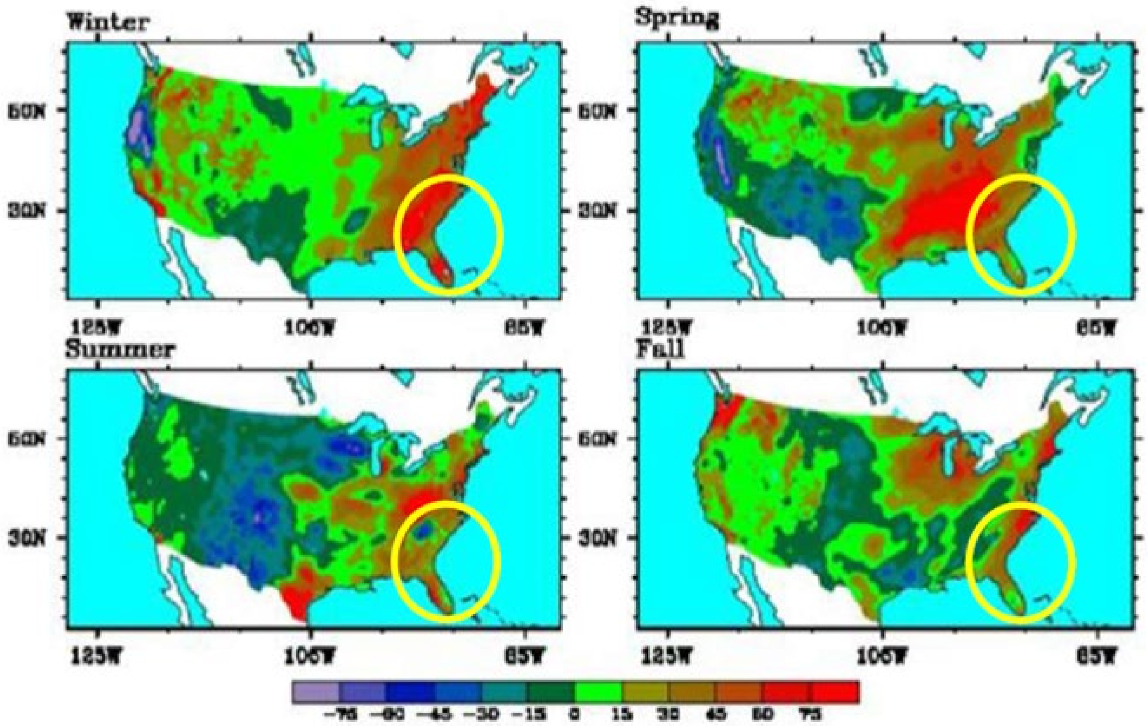


Most studies analyzed by the IWR (USACE, 2015) suggests significance in increasing precipitation severity and frequency trends in observed storms are not definitive. Some of the analyzed literature shows mild increasing trends in these parameters. For instance, Li et al. (2011) investigated anomalous precipitation (based on deviation from the mean) in summer months in the southeastern U.S. and found a greater number of climate stations within the region did not exhibit increasing trends in the frequency of occurrence of heavy rainfall. Increases were also shown by Wang and Killick (2013), who found that 20% sites analyzed, within 56 southeastern watersheds, exhibited increasing trends for the 90th quantile precipitation months. Though there is not a strong consensus regarding trends in extreme precipitation events, it is important to remain mindful of the identified increasing trends in intensity and frequency of rainfall within the region.

A.2.2.2.2. *Projected Precipitation*

Projected of future changes in precipitation for the southeast region are variable and lack consensus. Liu et al. (2013) quantified significant increases in winter and spring precipitation associated with a 2055 future condition for the South Atlantic Region. However, other seasons showed almost no increase or a slight decrease in precipitation. Figure A-16 illustrates the projected change in seasonal precipitation. The authors also project increases in the severity of future droughts for the region, leading to projected temperature and evapotranspiration impacts that outweigh the increases in precipitation.

Figure A-16: Projected changes in seasonal precipitation, 2055 vs. 1985, mm. The South Atlantic-Gulf Region is within the yellow oval (Liu et al., 2013; reprinted from USACE, 2015)



A.2.2.3. *Hydrology*

A.2.2.3.1. *Observed Streamflow*

Generalized observations of streamflow trends in the southeast lack a clear consensus, with some models showing positive trends in some areas and others showing negative. Generally, most studies in the southeast showed no trend in streamflow or a negative trend. Most notably, studies have shown that the negative trend in streamflow being more consistent for the region since the 1970s (Kalra et al., 2008; and Patterson et al., 2012).

For the study area, there is a noticeable decreasing trend for streamflow in the Alabama River. At the gage upstream of the study area (USGS 02420000 near Montgomery, AL), the p-value is 0.004737 which indicates the trend is statistically significant (Figure A-17). At USGS 02428400, Alabama River at Claiborne L&D near Monroeville, there is a decreasing trend as well; however, it is not considered statistically significant (p-value of 0.236750; Figure A-18). The gages indicate that there is decreasing trends in stream flow for the Alabama Basin based on the observed data. This could be the result from flood control projects in the upper portions of the basin. Some of the larger projects were built prior to 1976, therefore the notably decreasing trend in streamflow may not be as apparent compared to the Montgomery, AL stream gage.

Figure A-17: Annual Peak Streamflow USGS 02420000 Alabama River near Montgomery, AL

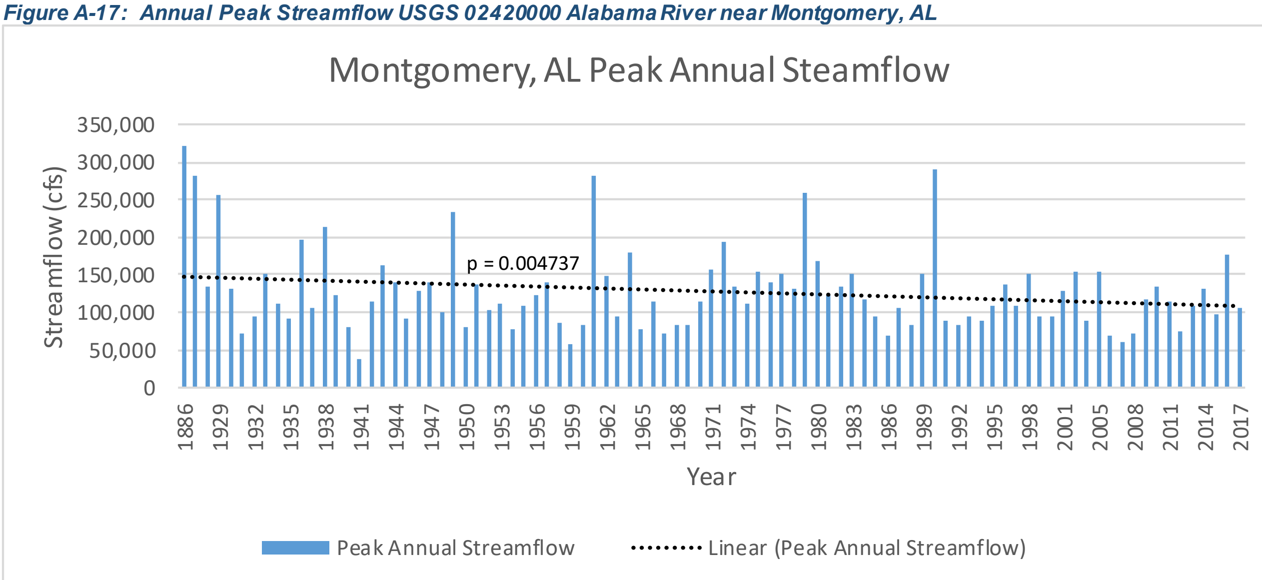
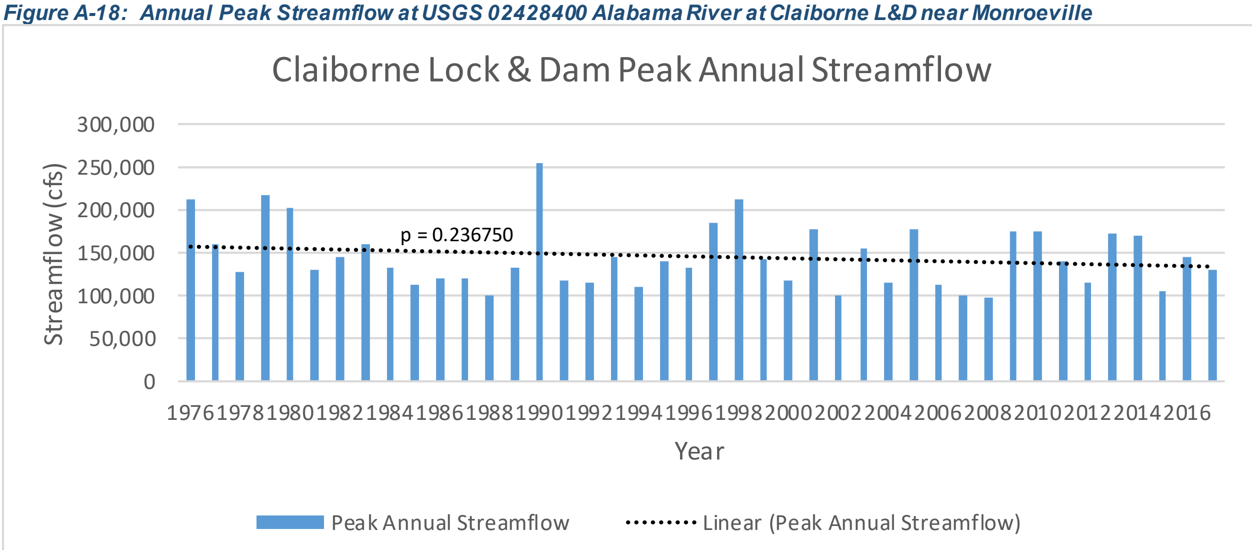


Figure A-18: Annual Peak Streamflow at USGS 02428400 Alabama River at Claiborne L&D near Monroeville



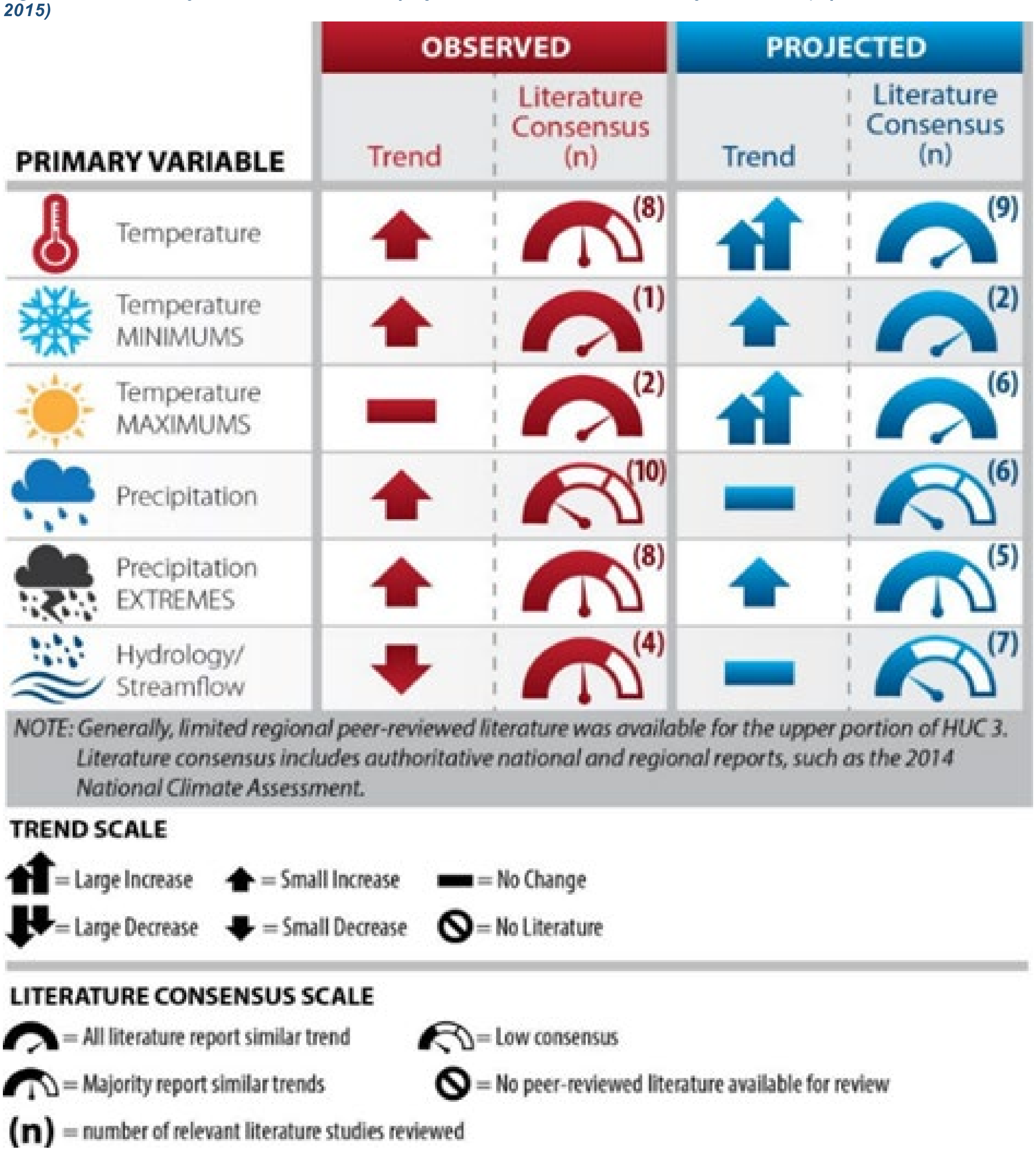
A.2.2.3.2. *Projected Streamflow*

Review of projected hydrology for the southeast region show that there is very low consensus in projected changes. This is due to the additional uncertainties that are added when coupling climate models to hydrologic models, both of which carry their own uncertainties. Overall, there are little indications of an increasing or decreasing trend in hydrology based on the reviewed literature presented in IWR report (USACE, 2015).

A.2.2.4. *Summary*

Figure A-19 shows the discussed variables and their overall consensus in trends for both observed and projected scenarios based on the findings of the 2015 USACE IWR literature synthesis. There is evidence that supports an increasing temperature trend from the observed data and less supporting evidence for trends in precipitation or streamflow for a majority of the region. However, there is some evidence that precipitation is increasing, while streamflow appears to be decreasing in some areas within the region.

Figure A-19: Summary matrix of observed and projected climate trends and literary consensus (reprinted from USACE, 2015)



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 the 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 not a consensus regarding the directionality of trends in observed streamflow. 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.

A.2.3. *Non-Stationarity Assessment*

In accordance with ECB 2018-14, a stationarity analysis was performed to determine if there are long-term changes in peak streamflow statistics within the study area and its vicinity. Assessing trends in peak streamflow is considered appropriate as opposed to a focus on precipitation and temperature as one of the primary purposes of this feasibility study is to assess and reduce flooding in the study area. However, trends in these should also be considered as they are both drivers in hydrology.

The USACE Non-Stationarity Tool was used to assess possible trends and change points in peak streamflow in the region. USGS 02420000 and USGS 0228400 were used for this analysis. The first gage used in this analysis, USGS 02420000, is located 83 miles upstream of Selma on the Alabama River near Montgomery, AL. The gage has a long and nearly continuous record from 1928-2018, includes two historical events, but is missing one year (2003). Figure A-20 shows the time series of Annual Peak Streamflow (APF) for the gage located near Montgomery, AL. Figure A-20

The second gage used in this analysis was located at Claiborne Lock and Dam, which is located approximately 79 miles downstream from Selma. This gage has a continuous record from 1976 to present. Figure A-21 shows the time series of Annual Peak Streamflow (APF) for the gage located at Claiborne Lock and Dam. In order to run the non-stationarity tool, it is recommended to have at least 30 continuous years of record. Both of these gages meet that requirement.

Figure A-20: APF at USGS 02420000 Alabama River near Montgomery, AL.

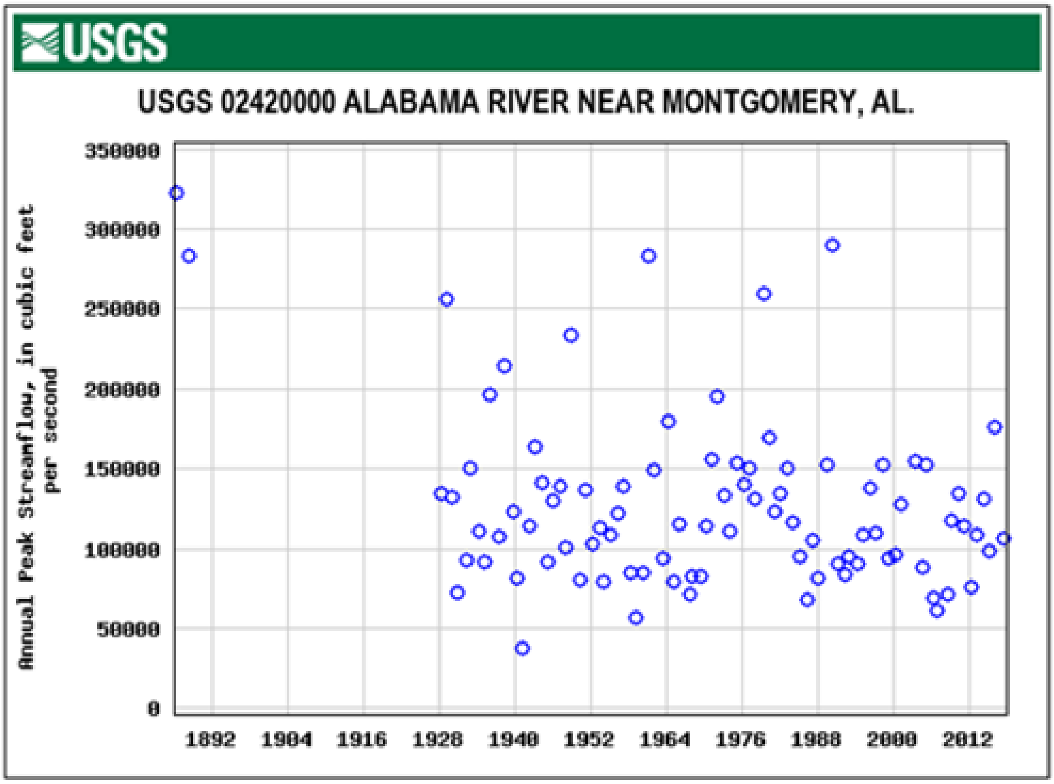
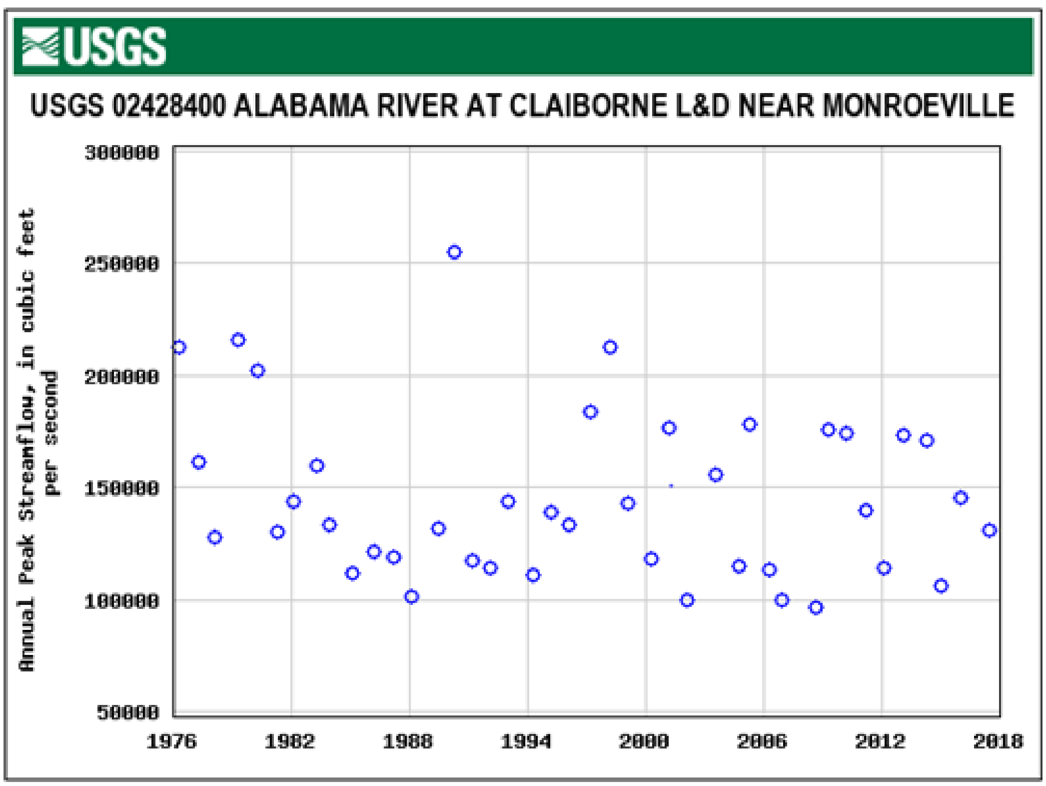
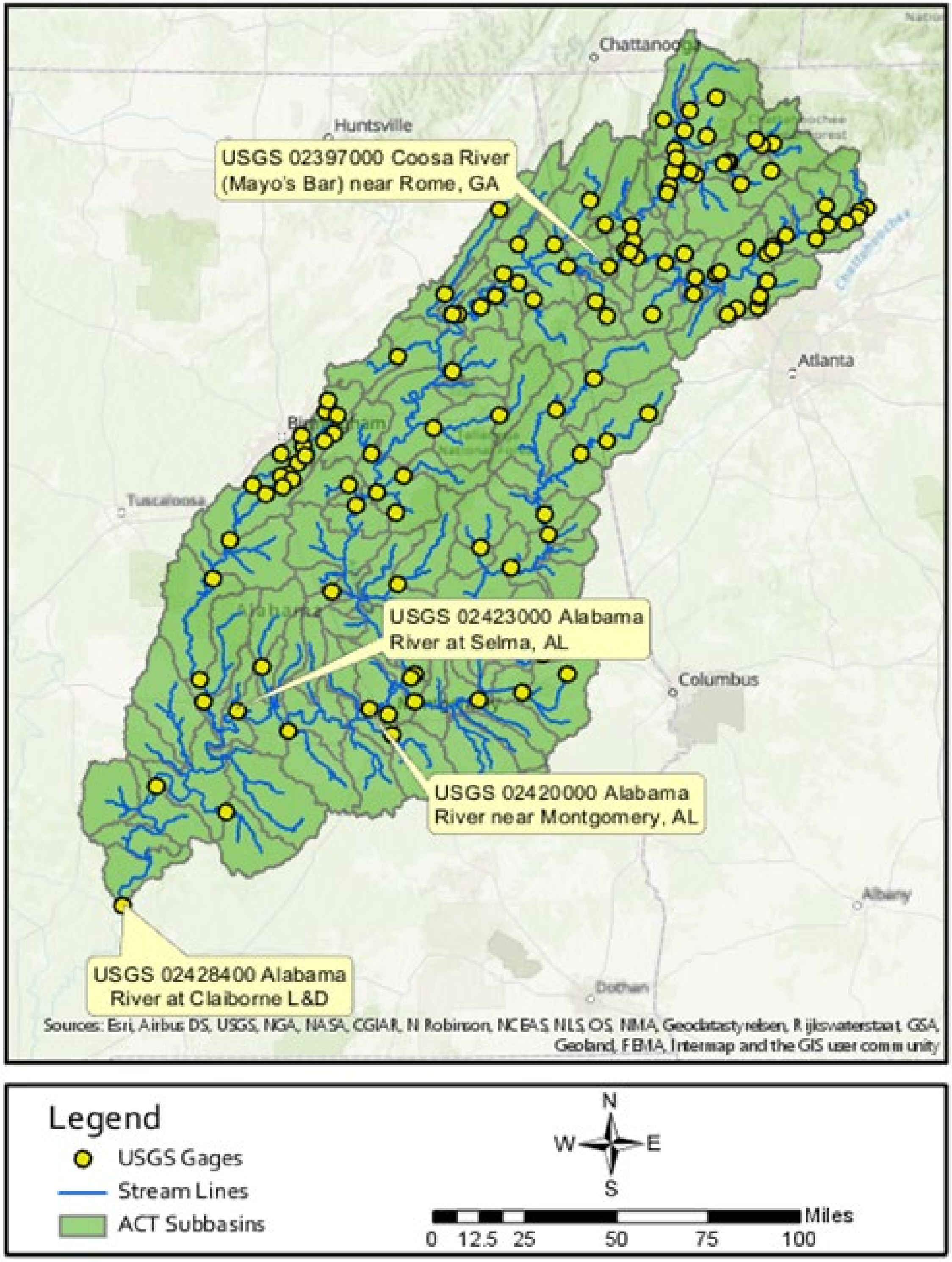


Figure A-21: APF at USGS 02428400 Alabama River at Claiborne L&D near Monroeville



In Figure A-22 the green area encompasses the entire drainage area delineated from Claiborne Lock and Dam and shows the location of the Selma, Alabama gage relative to the two gages used for this analysis.

Figure A-22: Study area and locations of the Montgomery, AL gage, Claiborne Lock and Dam gage, Selma, AL gage, and Rome, GA gage used in this analysis



The following 16 statistical tests were conducted on the APF time series shown on In accordance with ECB 2018-14, a stationarity analysis was performed to determine if there are long-term changes in peak streamflow statistics within the study area and its vicinity. Assessing trends in peak streamflow is considered appropriate as opposed to a focus on precipitation and temperature as one of the primary purposes of this feasibility study is to assess and reduce flooding in the study area. However, trends in these should also be considered as they are both drivers in hydrology.

The USACE Non-Stationarity Tool was used to assess possible trends and change points in peak streamflow in the region. USGS 02420000 and USGS 0228400 were used for this analysis. The first gage used in this analysis, USGS 02420000, is located 83 miles upstream of Selma on the Alabama River near Montgomery, AL. The gage has a long and nearly continuous record from 1928-2018, includes two historical events, but is missing one year (2003). Figure A-20 shows the time series of Annual Peak Streamflow (APF) for the gage located near Montgomery, AL. Figure A-20

The second gage used in this analysis was located at Claiborne Lock and Dam, which is located approximately 79 miles downstream from Selma. This gage has a continuous record from 1976 to present. Figure A-21 shows the time series of Annual Peak Streamflow (APF) for the gage located at Claiborne Lock and Dam. In order to run the non-stationarity tool, it is recommended to have at least 30 continuous years of record. Both of these gages meet that requirement.

Figure A-20 and Figure A-21 using the Non-Stationarity Tool:

1. Cramer-von-Mises distribution
2. Kolmogorov-Smirnov distribution
3. LePage distribution
4. Energy Divisive distribution
5. Lombard (Wilcoxon) abrupt mean
6. Pettitt mean
7. Mann-Whitney mean
8. Bayesian mean
9. Lombard (Mood) abrupt variance
10. Mood variance
11. Lombard (Wilcoxon) smooth mean
12. Lombard (Mood) smooth variance
13. Mann-Kendall trend
14. Spearman rank trend
15. Parametric trend
16. Sen's slope trend

Tests 1-12 are used to detect change points in the distribution, mean, and/or variance of the time series. These non-stationarity tests can be useful in detecting changes in annual instantaneous streamflow peaks driven by natural and human driven changes in the climate, addition/removal of water control structures, changes in land cover, and any other drivers of non-stationarity. Meanwhile, tests 13-16 are used to analyze monotonic trends.

The variety of tests is essential for increasing confidence in the overall stationarity analysis. Significant findings in one or two tests are generally not enough to declare non-stationarity.

For this analysis, the continuous period of water years 1976-2014 for the gage located at Claiborne Lock and Dam and water years 1928-2002 for the gage located near Montgomery, AL were used. All sensitivity parameters were left in their default positions. For both gages, there were no non-stationarities detected, as seen on Figure A-23 and Figure A-24. The Alabama River is a regulated system with multiple run of river projects and flood control projects. This may be the reason why non-stationarities were not detected. The monotonic trend test indicates that there are no trends for the entire record (not including historical peaks) for both gages, Figure A-25 and Figure A-26.

Figure A-23: Non-Stationarity Tool result for USGS 2420000 located near Montgomery, Alabama

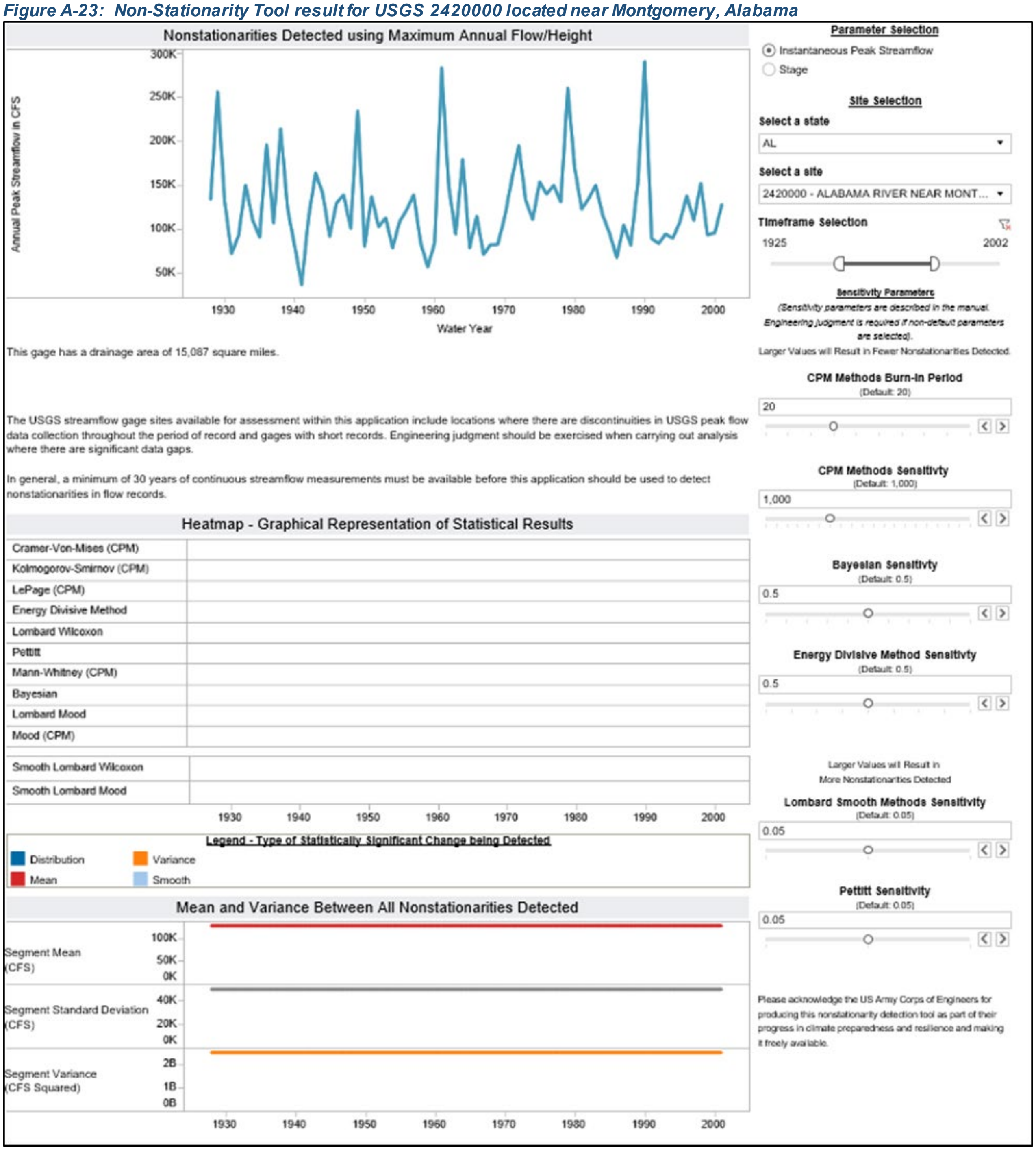


Figure A-24: Non-Stationarity Tool result for USGS 2428400 located at Claiborne Lock and Dam

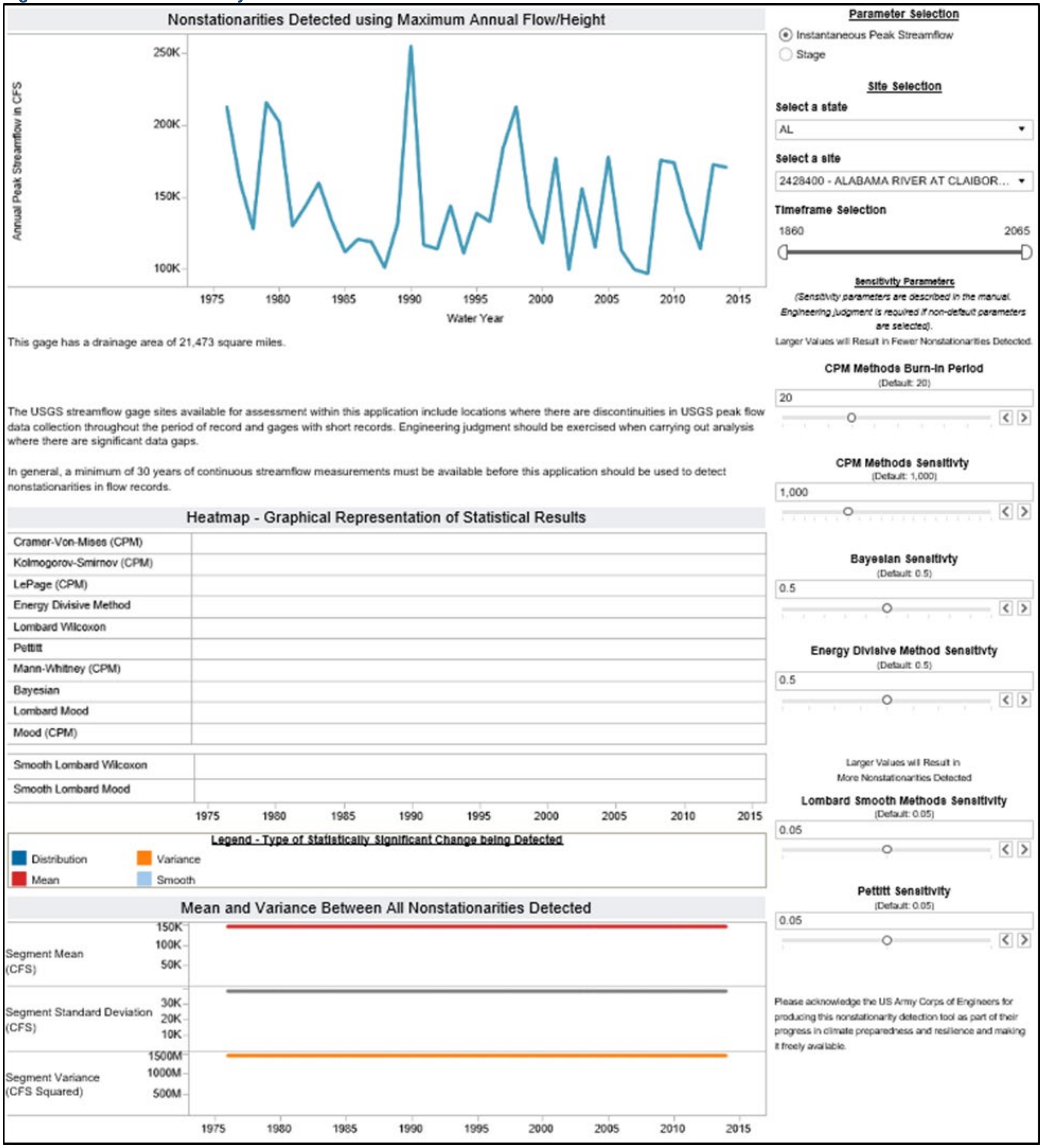
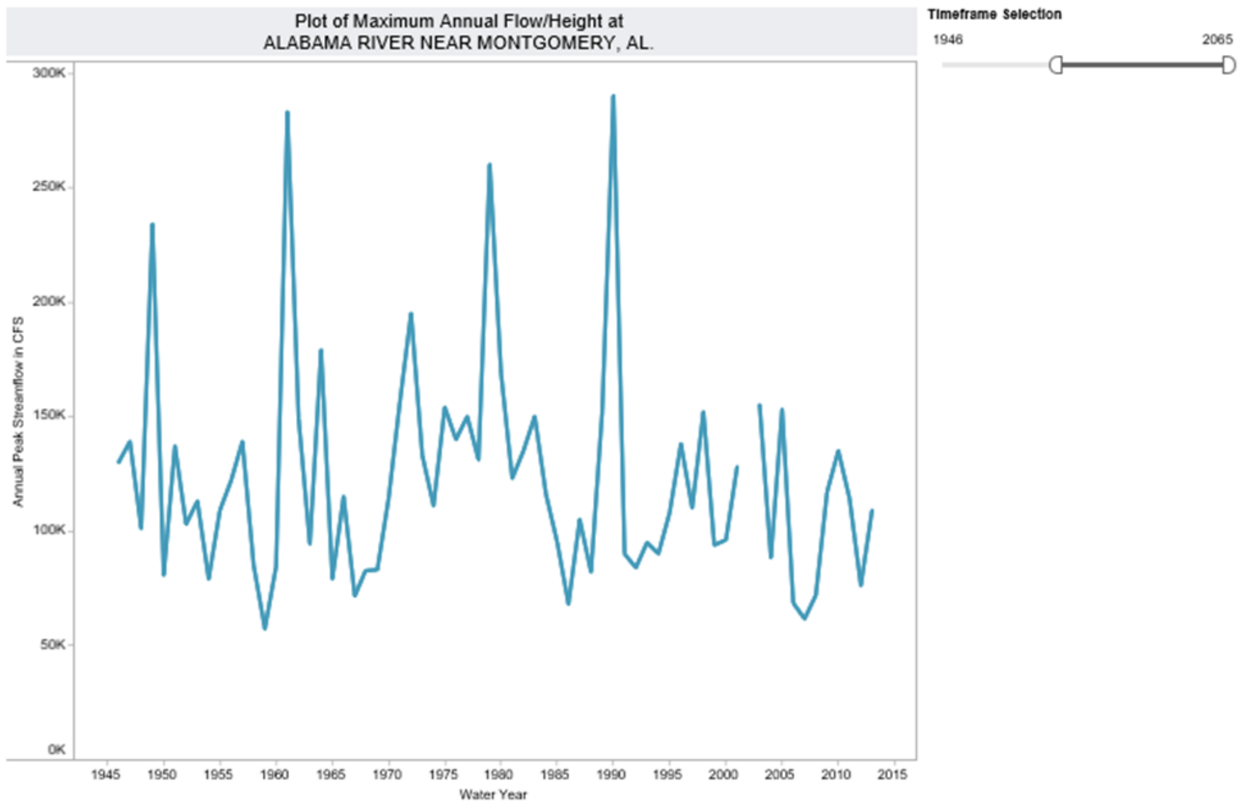


Figure A-25: Monotonic trend analysis for USGS 2420000 located near Montgomery, Alabama



WARNING: The period of record selected has missing data points. There are potential issues with the trends detected.

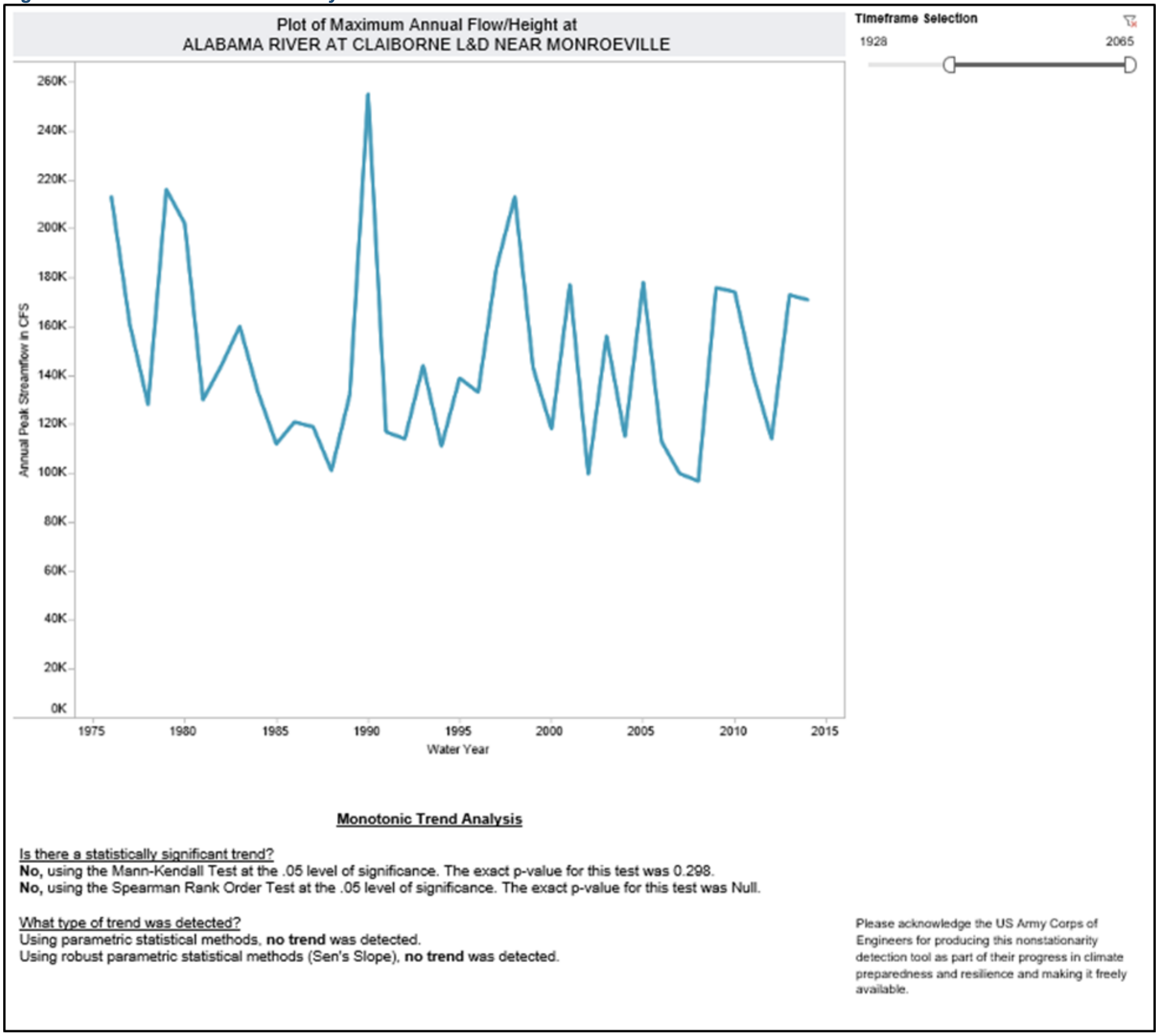
Monotonic Trend Analysis

Is there a statistically significant trend?
No, using the Mann-Kendall Test at the .05 level of significance. The exact p-value for this test was 0.458.
No, using the Spearman Rank Order Test at the .05 level of significance. The exact p-value for this test was 0.432.

What type of trend was detected?
Using parametric statistical methods, **no trend** was detected.
Using robust parametric statistical methods (Sen's Slope), **no trend** was detected.

Please acknowledge the US Army Corps of Engineers for producing this nonstationarity detection tool as part of their progress in climate preparedness and resilience and making it freely available.

Figure A-26: Monotonic trend analysis for USGS 2428400 located at Claiborne Lock and Dam



USGS water year summaries where checked and do not reveal any information that would indicate gage errors or issue with flow recording. For the gage located near Montgomery, AL, the two extremes recorded prior to the period of record were estimated based on high water marks and an extended rating curve. These two extremes were excluded from the non-stationarity analysis.

A.2.4. *Climate Hydrology Assessment Tool*

In addition to the stationarity assessment, the USACE Climate Hydrology Assessment Tool (CHAT) was used to assist in the determination of future streamflow conditions. For this assessment, three gages were analyzed within the Alabama Basin. Figure A-27 shows the CHAT output for USGS 02428400 located at Claiborne Lock and Dam and Figure A-28 shows the CHAT output for USGS 02420000 located near Montgomery, AL. The p-values for these gages are 0.380259 and 0.275589, respectively. Neither of them are considered statistically significant. For USGS 02397000 Coosa River near Roma, GA, the p-value is 0.0006056 (Figure A-29). This indicates that this downward trend is statistically significant. However, this gage is farther upstream from the study area compared to the other two gages, which are within 100 miles upstream and downstream of the Selma area. The decrease in streamflow at this gage most likely is due to the flood control projects built upstream of the gage, which was discussed in the streamflow section above

Figure A-27: CHAT output for USGS 02428400 Alabama River at Claiborne Lock and Dam

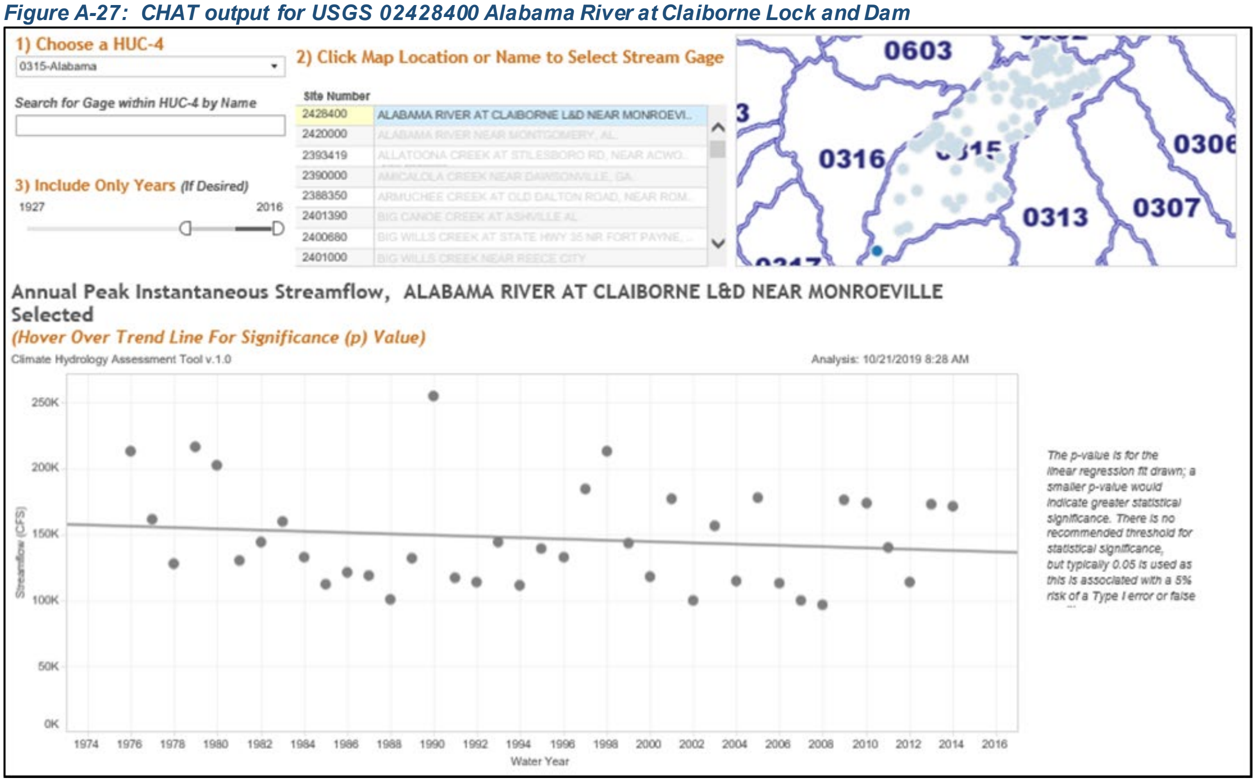


Figure A-28: CHAT output for USGS 02420000 Alabama River near Montgomery, Alabama

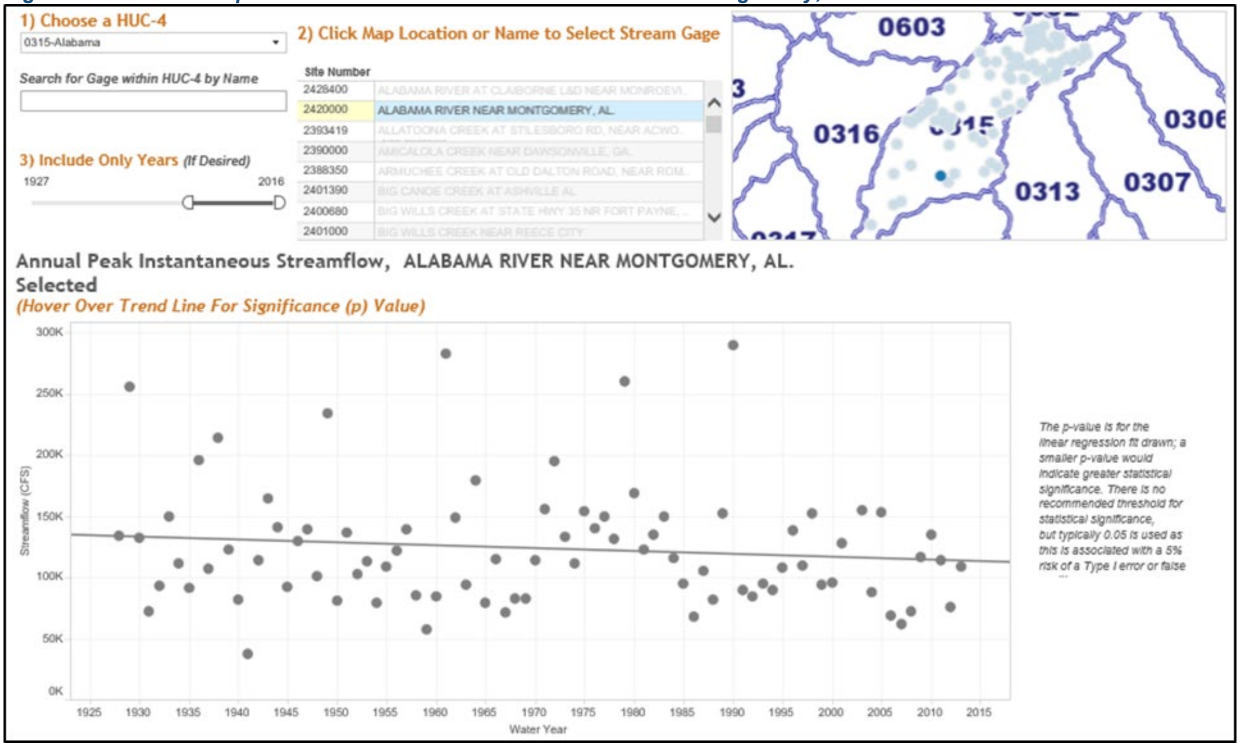
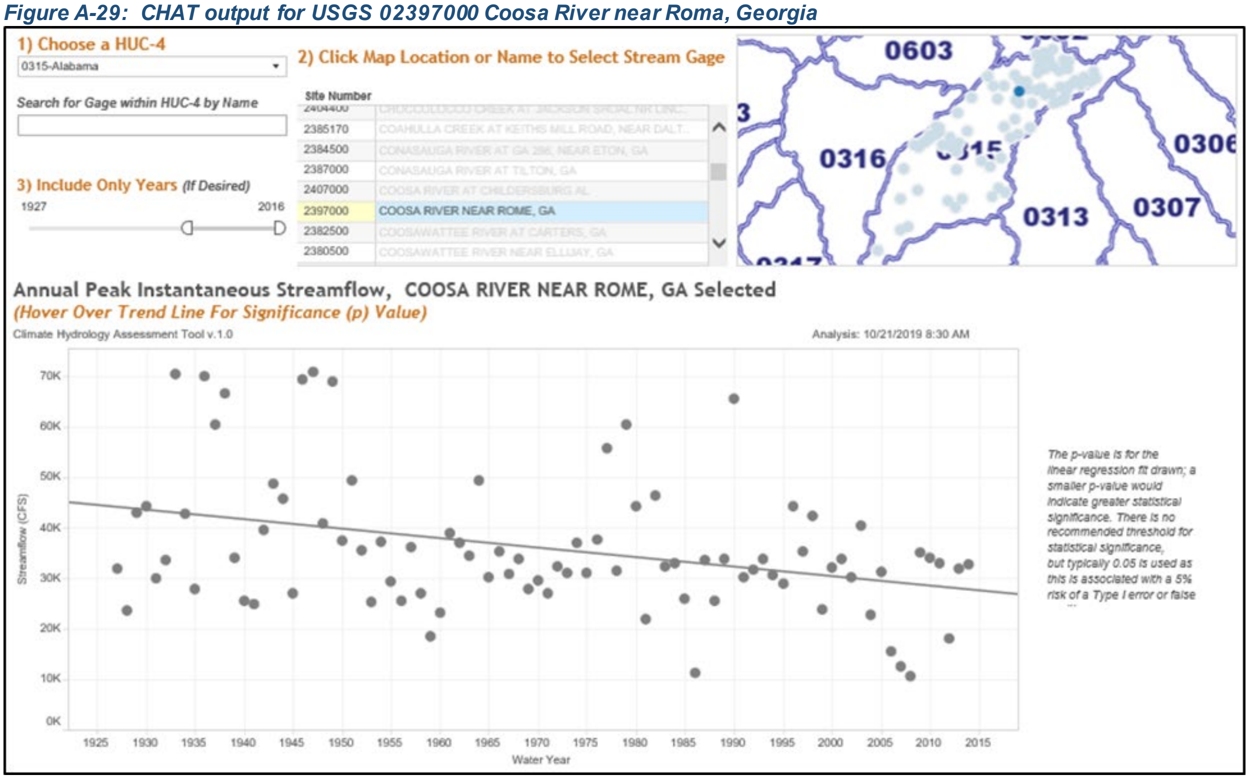


Figure A-29: CHAT output for USGS 02397000 Coosa River near Roma, Georgia



A Hydrologic Unit Code 4 (HUC-4) level analysis of mean projected annual maximum monthly streamflow was also performed. The trends in mean projected annual maximum monthly streamflow presented in this analysis represent outputs from the Global Climate

Models (GCMs) using different representative concentration pathways (RCPs) of greenhouse gasses that are then translated into a hydrologic response using the United States Bureau of Reclamation (USBR) Variable Infiltration Capacity (VIC) model. The VIC model, forced with GCM meteorological outputs is used to produce a streamflow response for both the hindcast period (1950-1999) and the future period (2000-2099). This dataset is unregulated and does not account for the many flood control structures located on the mainstem rivers within this HUC-4 basin.

The analysis indicates an upward trend in mean projected annual maximum monthly streamflow for the Alabama Basin, as shown in Figure A-30. The forecast visually indicates an upward trend in projected streamflow from years 2000 to 2099 within the basin and is considered statistically significant with a p-value of 0.01442. The hindcast data shows no statistically significant trend from 1950 to 1999 (p-value: 0.795219).

Figure A-30: Mean projected annual maximum monthly streamflow for the Alabama HUC-4

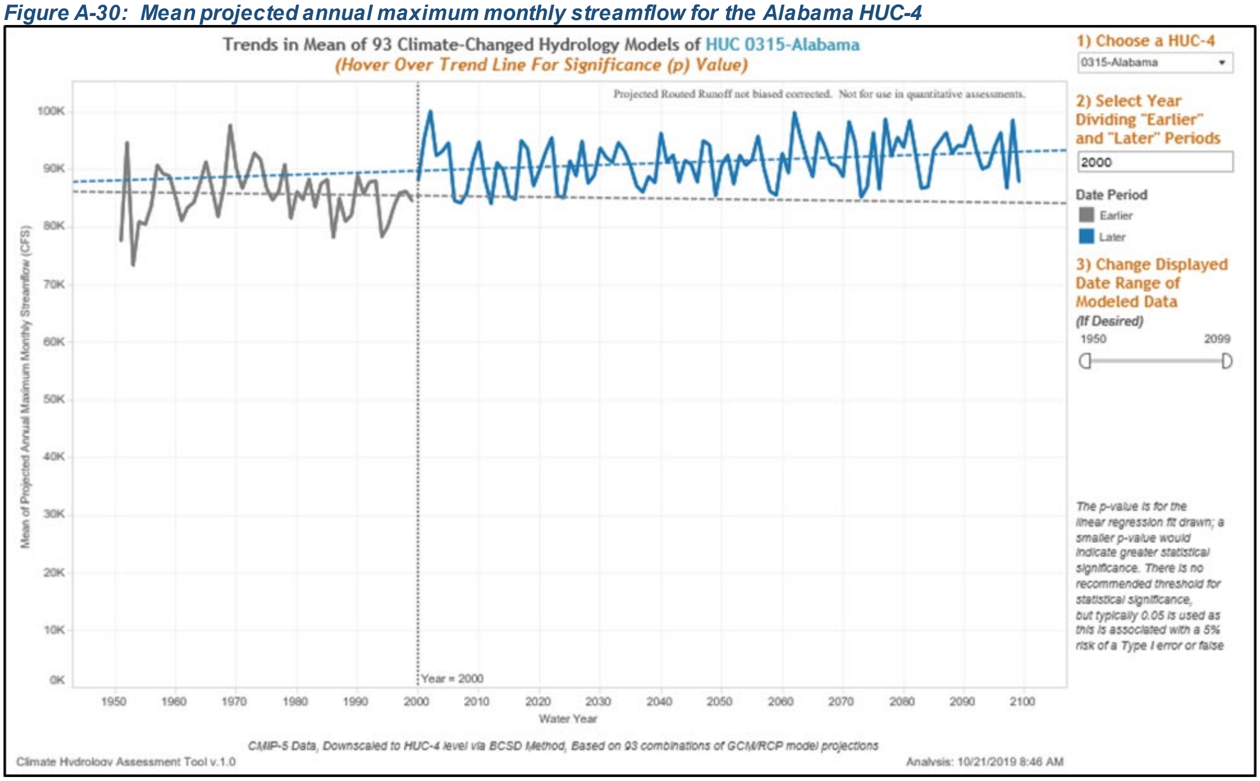
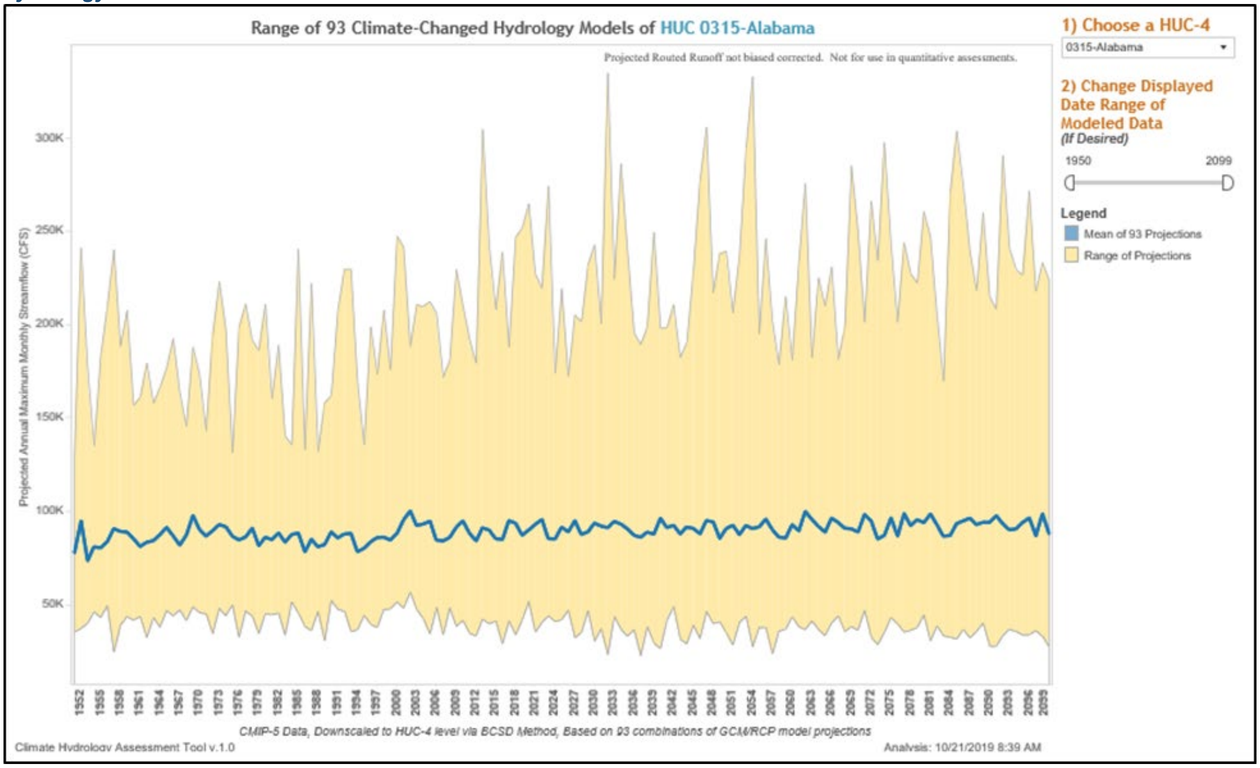


Figure A-31 provides the mean value of the 93 projections of future, streamflow projections considered through water year 2099, as well as the range of projected streamflow values produced for the watershed. The variability of the spread is fairly consistent for the projected portion of the record: 2000 to 2099.

Figure A-31: Projected hydrology for the Alabama HUC-4 based on the output from 93 projections of climate-changed hydrology



It can be seen on Figure A-31 above that there is significant uncertainty in projections of future streamflow. The yellow shaded area is indicative of the spread in the data produced. It is important to understand that this uncertainty comes from each of the model sources that are used to develop the projected streamflow datasets. GCMs have uncertainty in the bounds of their atmospheric input such as the RCPs. Downscaling the output of these models to a smaller region may not account for some regional effects.

Changes in future conditions that drive the hydrologic model are also a major source of uncertainty. An example of this uncertainty is land use changes, such as increased impervious areas, which can have a major effect on peak streamflow. There are many different land use projections for this region from many sources. Other uncertainties such as changes in temperature extremes and the seasonality of the extreme precipitation can also have a significant effect on the rainfall/runoff transformation. For these reasons, this quantitative analysis should be used with caution, with an understanding that this data should only be considered within the large uncertainly bounds of the analysis.

A.2.5. *Vulnerability Assessment*

To understand potential climate change effects and to increase resilience/decrease vulnerability of flood risk management alternatives to climate change, the relative vulnerability of the basin to such factors was analyzed. In accordance with ECB 2018-14, the USACE Watershed Climate Vulnerability Assessment tool was used to identify vulnerabilities to climate change on a HUC-4 watershed scale relative to other HUC-4 basins across the nation. As this study is an assessment of flood risk management alternatives, vulnerability with respect to the Flood Risk Reduction business line is presented in this analysis.

To address vulnerabilities due to climate change, the Vulnerability Assessment tool utilizes two 30-year epochs centered on 2050 (2035-2064) and 2085 (2070-2099) as well as a base epoch. These epochs, while arbitrary, line up well with other national climate change assessments. For each epoch, the tool utilizes the results of 100 combinations of Global Circulation/Climate Models (GCM) run using different Representative Concentration Pathways of greenhouse gas emission to produce 100 traces per epoch for a given watershed. The results of the GCMs are translated into flow and are then sorted by cumulative runoff projections. Traces of the highest 50% of cumulative runoff are categorized as wet and traces with the lowest 50% of cumulative runoff are categorized as dry. This provides two scenarios (wet and dry) for each of the two epochs, excluding the base epoch. Consideration of both wet and dry scenarios reveals some of the uncertainties associated with the results produced using the climate-changed hydrology and meteorology used as inputs to the vulnerability tool.

The tool uses specific indicators of vulnerability relative to the business line being considered. There is a total of 27 indicators in the tool, 5 of which are used to derive the vulnerability score in the Alabama HUC 4 with respect to the Flood Damage Reduction business line. Table A-1 lists the indicators and their descriptions.

Table A-1: Indicator Variables used to derive the flood risk management Vulnerability score for the Alabama Basin as determined by the Vulnerability Assessment tool

Indicator Short Name	Indicator Full Name	Description
175C_Annual_COV	Annual CV of unregulated runoff (cumulative)	Long term variability in hydrology: ratio of the standard deviation of annual runoff to the annual runoff mean. Includes upstream freshwater inputs (cumulative).
277_RUNOFF_PRECIP	% change in runoff divided by % change in precipitation	Median of: deviation of runoff from monthly mean times average monthly runoff divided by deviation of precipitation from monthly mean times average monthly precipitation.
568L_FLOOD_MAGNIFICATION	Flood magnification factor (local)	Change in flood runoff: Ratio of indicator 571L (monthly runoff exceeded 10% of the time, excluding

Indicator Short Name	Indicator Full Name	Description
		upstream freshwater inputs) to 571L in base period.
568C_FLOOD_MAGNIFICATION	Flood magnification factor (cumulative)	Change in flood runoff: ratio of indicator 571C (monthly runoff exceeded 1-% of the time, including upstream freshwater inputs) to 571C in base period.
590_URBAN)500YRFLOODPLAIN	Acres of urban area within 500-year floodplain	Acres of urban area within the 500-year floodplain.

Figure A-32 and Figure A-33 shows a comparison of WOWA scores for the flood risk reduction business line for HUC-4 watersheds nationally, and for the South Atlantic Division only, for the wet and dry scenarios as well as the 2050 and 2085 epochs, respectively. This shows that the WOWA score for the Alabama HUC-4 Basin (highlighted in yellow) is not relatively vulnerable to climate change impacts for the flood risk management business line. Within the wet subset of traces for the South Atlantic Division, there are only two HUC04 watersheds for both epochs. For the dry subset of traces, there are only three HUC04 watersheds that are considered relatively vulnerable to climate change for the Flood Risk Reduction business line. All three watersheds in question are in Florida. This further reinforces that the Alabama basin is does not have significant vulnerabilities to the Flood Risk Reduction business line with respect to other watersheds in the United States, or the region.

Figure A-32: Comparison of national vulnerability scores for CONUS HUC-4s

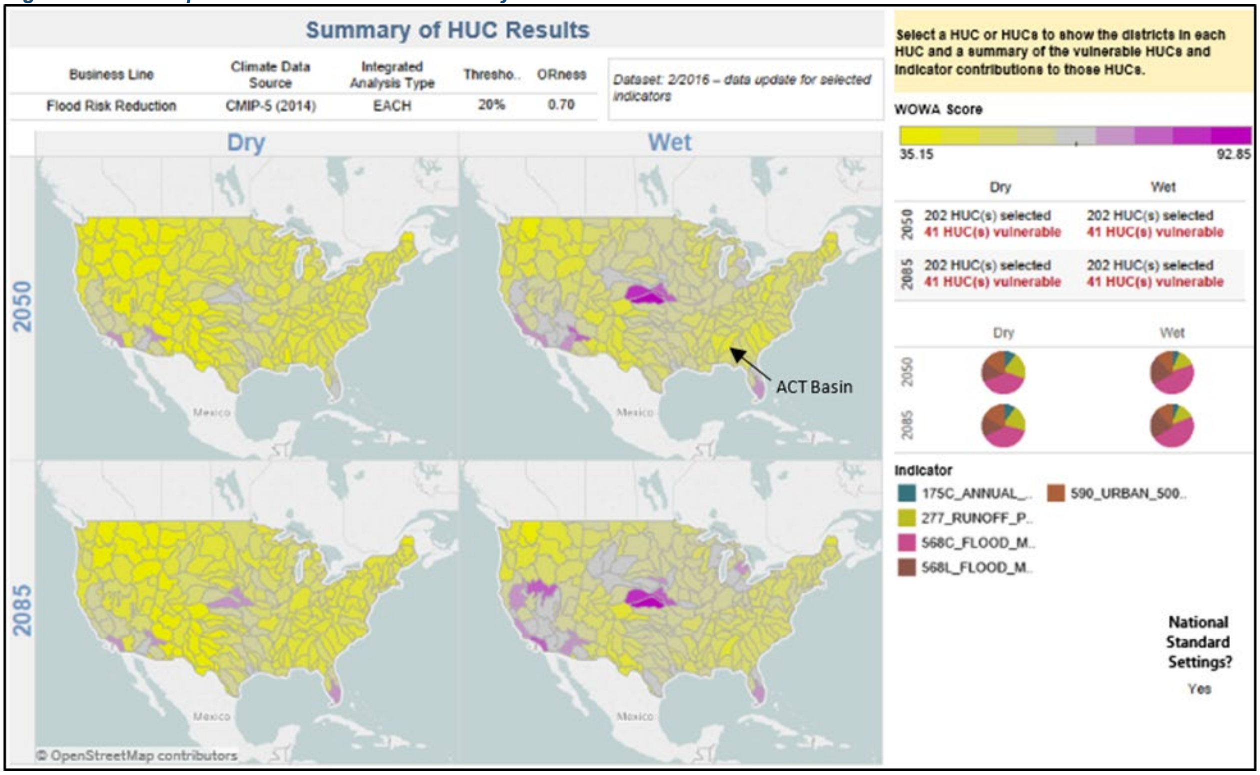
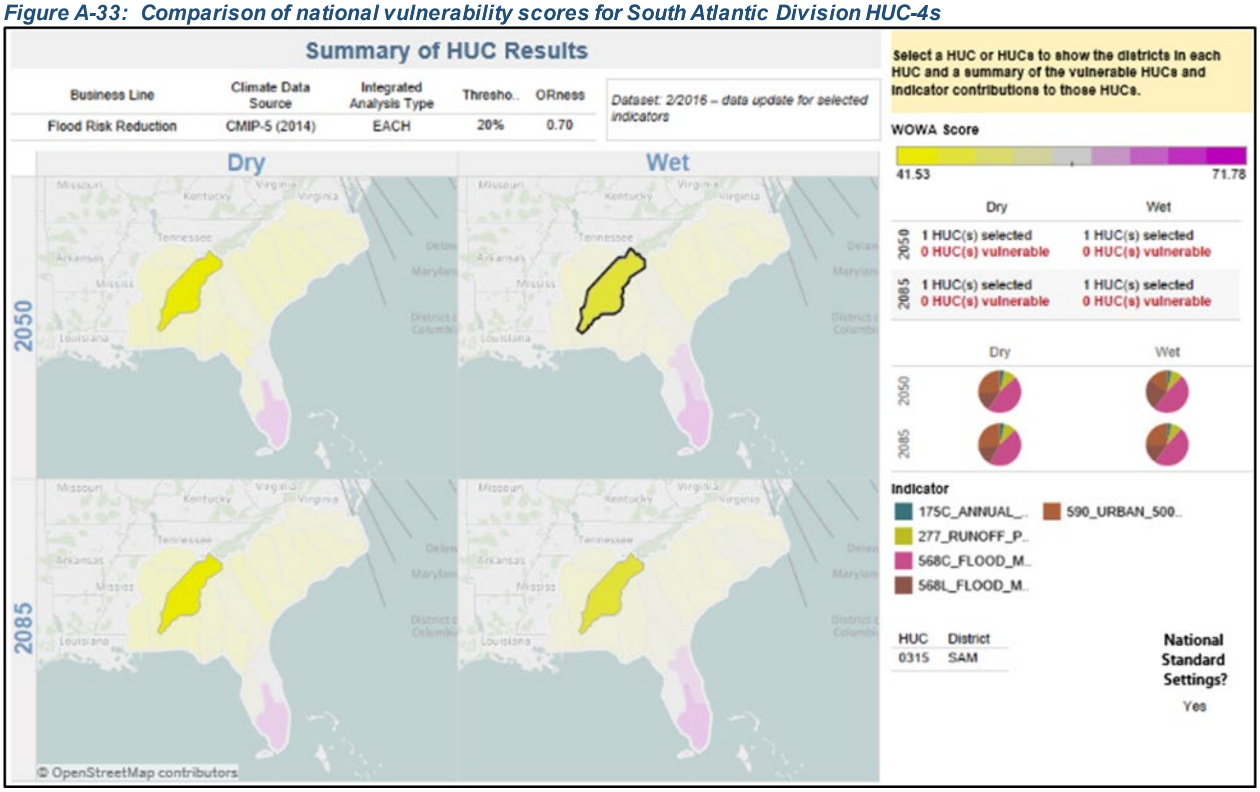


Figure A-33: Comparison of national vulnerability scores for South Atlantic Division HUC-4s



It is important to note that the vulnerability assessment only indicates vulnerability relative to the rest of the nation. It does not state that the basin itself is invulnerable to impacts of climate change on the Flood Risk Reduction business line. Therefore, it is beneficial to understand the composition of the relevant HUC 04's (Alabama Basin) vulnerability score, in terms of how much each flood risk reduction indicator variable contributes to the vulnerability score for each subset of traces, and for both epochs of time. Figure A-34 and Figure A-35 below show the dominant indicators relative to flood risk reduction and that cumulative flood magnification is the prevailing indicator variable driving the flood damage reduction vulnerability score, followed by local flood magnification for both the dry and wet scenarios, respectively. This aligns with the literature review that indicates the potential for more frequent and more severe storms in the southeast.

Figure A-34: Dominate indicators for the Flood Risk Reduction Business Line for the Dry Scenario

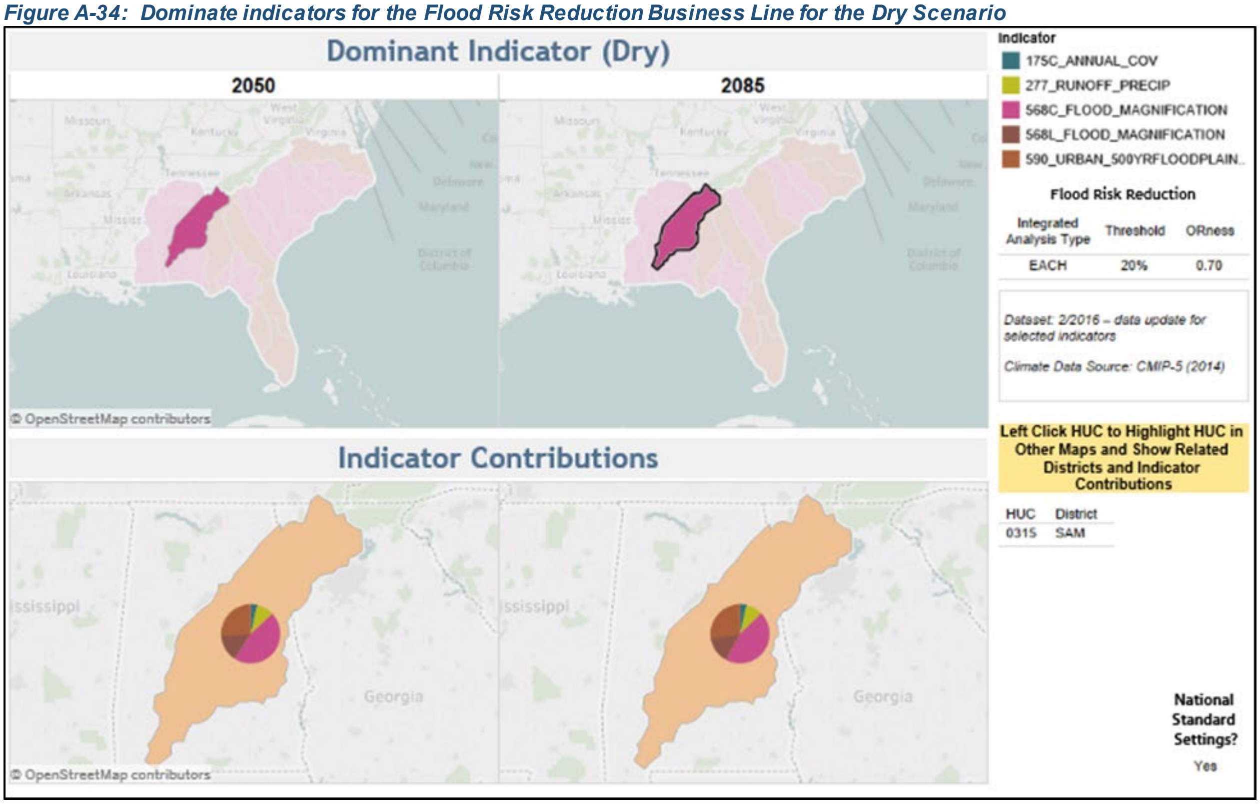
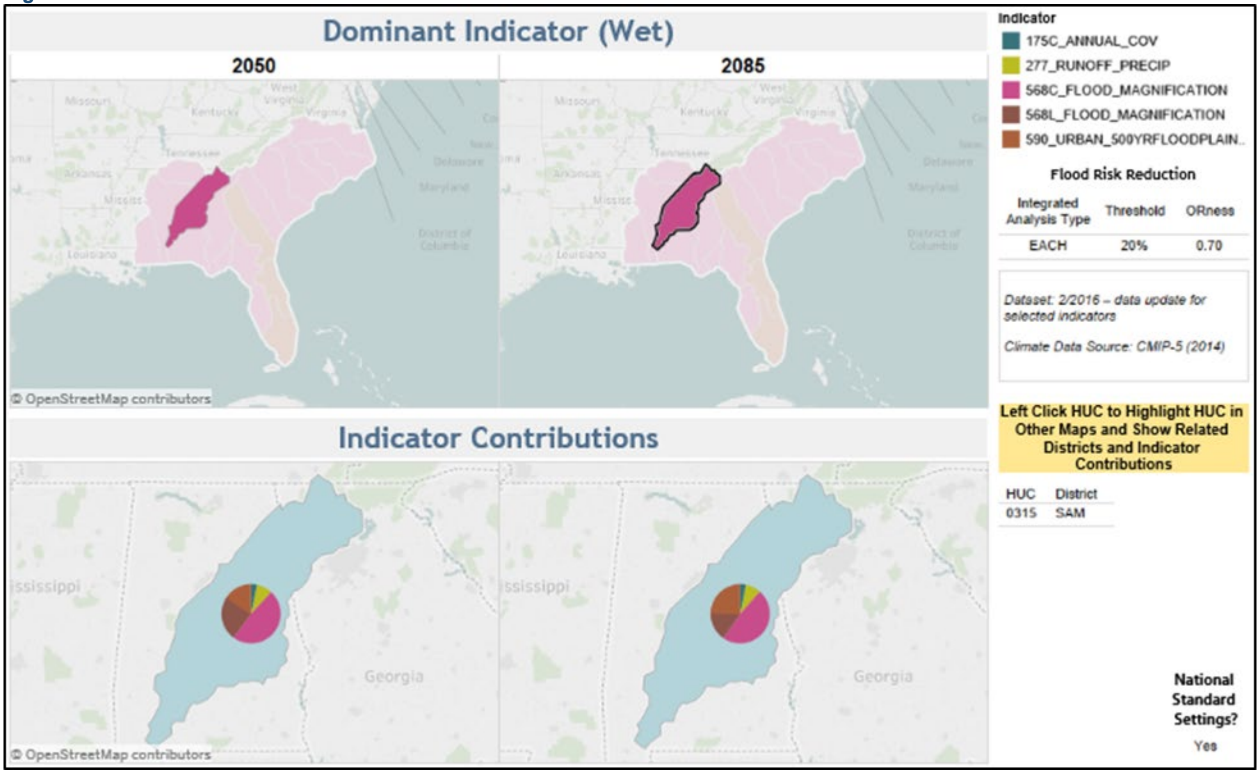


Figure A-35: Dominate indicators for the Flood Risk Reduction Business Line for the Wet Scenario



A.2.6. *Climate Change and Impacts on TSP*

The TSP for this study includes a solider pile wall to protect and stabilize the streambank in downtown Selma, and an Emergency Evacuation and Floodplain Management Plan for the city.

Table A-2: Risk assessment results of each measure in the Tentatively Selected Plan

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
Bankline Stabilization-Solider Pile Wall	Increase in frequency and magnitude of extreme storms	Peak elevations during floods could increase	Damage to soldier pile wall and the foundations of structures behind the wall	Highly Unlikely
Emergency Evacuation and Floodplain Management Plan	Increase in frequency and magnitude of			

An increase in the magnitude of extreme storms could cause the peak elevations of floods to increase for the same frequency storm. This hazard however is very unlikely to lead to damage of the solider pile wall, or any negative effect. The wall is being designed for overtopping and submergence. An increase in flood depth would have no effect on the performance or integrity of the wall. Therefore, it can be said that it is highly unlikely that there would be a negative effect on this measure.

When considering this same trigger and hazard applied to the Emergency Evacuation and Floodplain Management Plan there is the possibility that areas previously unaffected by flooding become inundated. This however will not lead to the plan not accounting for any flooding based on an increase in flow. This is because the plan will be tied to certain elevations near the city of Selma based on forecast gage locations, and not a flow-frequency event. If flows are to increase on the Alabama River, stages will increase as well; however, the inundation for a stage or elevation will not change. Therefore, the plan will still be applicable as hydrology changes.

A.2.7. *Conclusions*

Based on the literature review of relevant climate data, there is some consensus that there will be mild increases in the severity and frequency of storms in the region. However, there is no consensus on future changes in hydrology. Observed data from gages near the study area show temperatures have been gradually rising since the 1970s, after a cooling period in the middle part of the century. From these data, it is difficult to come to a conclusion on whether temperature is increasing, or if this is a reoccurring pattern. Annual precipitation seems to be variable for the region. It appears there may be more extremes occurring in recent years, such as extreme low annual precipitation values. However, the overall trends appear to be constant or increasing slightly. There is some consensus on peak streamflow for the region decreasing since the middle of the century, however, the literature lacks a clear consensus. For the Alabama Basin, this decreasing streamflow could be related to the increase in flood control projects within the region since the late 1940s.

The non-stationarity assessment on the Alabama River Basin was performed using two gages (USGS 02420000 Alabama River near Montgomery, AL and USGS 02428400 Alabama River at Claiborne Lock and Dam). Neither gage displayed non-stationarities, nor were monotonic trends detected. However, the USGS gage located near Rome, GA (Coosa River) displayed four non-stationarities, which occurred in the years 1951, 1952, 1983, and 2005. Non-stationarities in the years 1951 and 1952 can be attributed to projects, such as dams, built upstream of the gage. One of the largest projects built upstream was the Allatoona Dam, which was completed and began filling in December 1949. There appears to be a large drop in streamflow from the early 1980s to mid-1980s. This could have triggered a non-stationarity. Similarly, for the change point in 2005, there was a large decrease in streamflow. This may be the result of the 2005 drought that occurred in the northern part of the Alabama Basin.

The USACE CHAT tool indicates that there are no statistically significant trends in the two streamflow datasets for USGS 02420000 Alabama River near Montgomery, AL and USGS 02428400 Alabama River at Claiborne Lock and Dam. However, the CHAT tool was used to detect any changes in streamflow further upstream in the Alabama Basin at USGS 02397000 Coosa River near Roma, GA. The tool indicates that there is a statistically significant decrease in streamflow. This gage had several flood risk management dams built upstream since the 1940s, which most likely a key contributor to the decrease in flow. The further downstream, it appears that this significant trend is not as noticeable since this basin is large.

Furthermore, the HUC-4 analysis on streamflow on the Alabama basin only shows an increasing trend in projected streamflow based on GCM model output translated into a hydrologic response. These analyses provide some indication that there will be significant increases in peak annual streamflow in the future as a result of climate change. However, the projections seem to oppose the trend in observed flow. Caution should be used in making any definitive statements on potential future hydrology as there is substantial uncertainty in both the climate and hydrologic models that drive these analyses. The vulnerability assessment helps to further reinforce a lack of evidence in increasing flood risk. Findings of the vulnerability assessment show that the Alabama HUC-4 basin is not considered vulnerable to increased flood risk as a result of climate change, with respect to other HUC-4s in the nation.

A.3. Existing Conditions - Hydrologic and Hydraulic Modeling

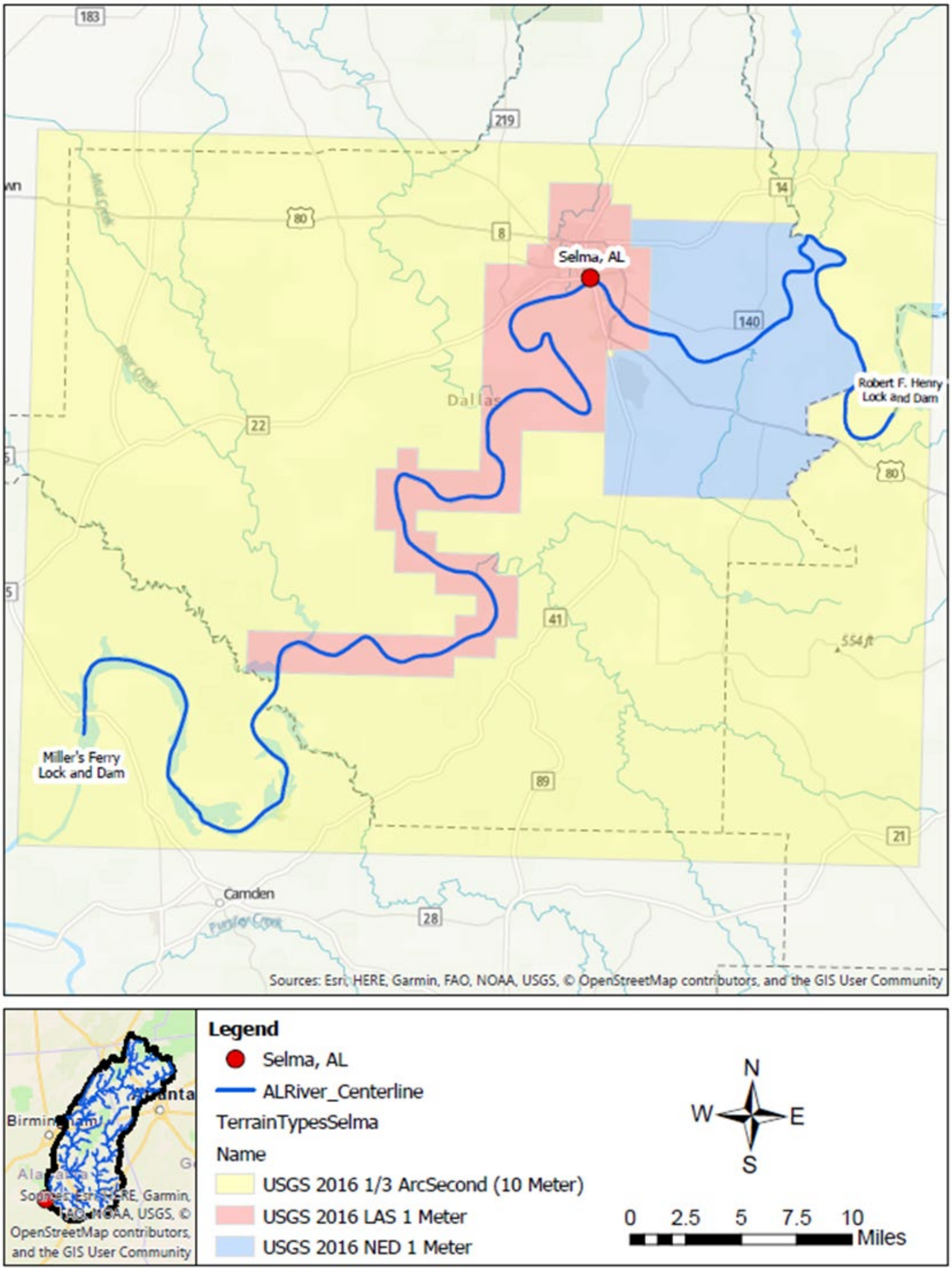
Hydrologic analysis and Hydraulic modeling were performed on the Alabama River near Selma to support the intermediate evaluation of the initial and focused array of alternatives as well as detailed modeling to support the determination of economic damages and damages reduced for the final array of alternatives. The goal of modeling the existing conditions of the study area was to establish a baseline for developing future without project conditions by which all flood risk management alternatives were evaluated.

A.3.1. *Terrain and Geometric Data*

A.3.1.1. *Digital Terrain Development*

The terrain used for modeling the area in HEC-RAS was updated to use more recent LiDAR of the area. The terrain was developed using the USGS National Elevation Dataset (NED) and USGS LiDAR Point Cloud datasets from the USGS 3DEP site (Figure A-36). For the majority of the Alabama River and overbanks stretching from Robert F. Henry Lock and Dam to Miller’s Ferry Lock and Dam, the terrain is a 1-meter resolution. The entire areas of Selma and Selmont, AL are also a 1-meter resolution. The remaining portions of the terrain have a horizontal resolution of 10 meters. The horizontal projection for the terrain file was NAD 1983 2011 UTM zone 16N. Within the study area, HEC-RAS was utilized to burn out sections where small bridges reduced conveyance of channelized areas. Bathymetry of the river was provided by the Operations Division site office in Tuscaloosa, Alabama. These bathymetry data were acquired in early 2019. Figure A-36 shows the various data sources and their extents in the study area.

Figure A-36: Data source locations and corresponding extents utilized for the Selma FRM project



A.3.1.2. *Field Reconnaissance and Survey Data*

To date, only a bathymetric survey of the Alabama River between Millers Ferry and Robert F. Henry has been completed. Bridge data used within the model was obtained directly from the FEMA Flood Insurance Study HEC-RAS modeling effort. The FIS Report states that bridge geometry was determined from field surveys, as-built plans and field verification. Pier spacing and deck/roadway elevations were surveyed for each bridge, except for the railroad bridge which was determined using as-built drawings. (FEMA, 2014)

A.3.2. *Hydrologic Model*

The hydrology of the Alabama River and upstream drainage area is extremely complex. The drainage area consists of over 17,000 square miles above Selma, 5 flood risk management projects and several other navigation dams on upstream rivers. It was initially planned to include an HEC-HMS hydrologic model to support flow input to the HEC-RAS model. This would have consisted of a heavily modified version of the Corps Water Management System (CWMS) HEC-HMS model for the ACT basin as well as modeling complex Reservoir Operations in HEC-ResSim. This was determined to be an unnecessary level of detail for the hydrologic needs of the study as well as a high risk to budget and schedule expectations.

The development of synthetic or balanced hydrographs was also considered as the input hydrology. This would consist of scaling observed flow hydrographs at locations with gaging along the Alabama River to match peak flow and volume of frequency events determined by a flow-frequency and volume-frequency analysis. One of the major drawbacks to this is the inaccuracy of recorded data at the upstream location of Robert F. Henry. The only available flow data at this location is computed using gate opening tables in the water control manual for this project. These tables have been historically inaccurate in determining the dam's releases.

The engineering team decided it would be acceptable to use peak flows from a statistical analysis of gages as input into the hydraulic model. This was deemed acceptable for several reasons. First as a steady flow approach would be acceptable to capture the flow-stage relationship on the Alabama River as the duration of flood events is very long with peak stages maintained for several days. Also, as will be discussed later, levees were the only structural alternative carried forward to modeling, making storage and timing effects far less important to alternative screening. In the event that detailed modeling of floodwave timing would be needed to support an assessment of life risk behind the levee, the model could be modified to include flow hydrographs.

A.3.2.1. *Flow Frequency Analysis*

The Alabama River Basin has several gages throughout, however, only two flow gages were utilized for this analysis. The gage located upstream of Selma is USGS 02421530 Alabama River at Robert F. Henry Lock and Dam and has a record starting in 1970 until present. Flow shown at this gage is computed based on releases using a gate operating schedule from the project's Water Control Manual (reference, e.g. USACE, 19.). The second gage used in the analysis is the USGS gage 2423000 located at Selma, AL with a record of 99 events. The record begins in 1886, ends at 1990, and has missing years of 1887-1890, 1978, and 1988. Most of the peak flows at this location are the result of field measurements and therefore are considered to be highly accurate.

The U.S. Army Corps of Engineers (USACE) Statistical Software Package (HEC-SSP) was used to calculate the frequency flows for both of these gages. Table A-3 shows the 100-year peak discharges derived from a Bulletin 17C (see England et al., 2017) flow frequency analysis in HEC-SSP. Table A-4 shows a full range frequency flows calculated for both gages. These flows where utilized for development of the design storm events in the hydraulic model. Figure A-37 shows a comparison of frequency events computed for the study area.

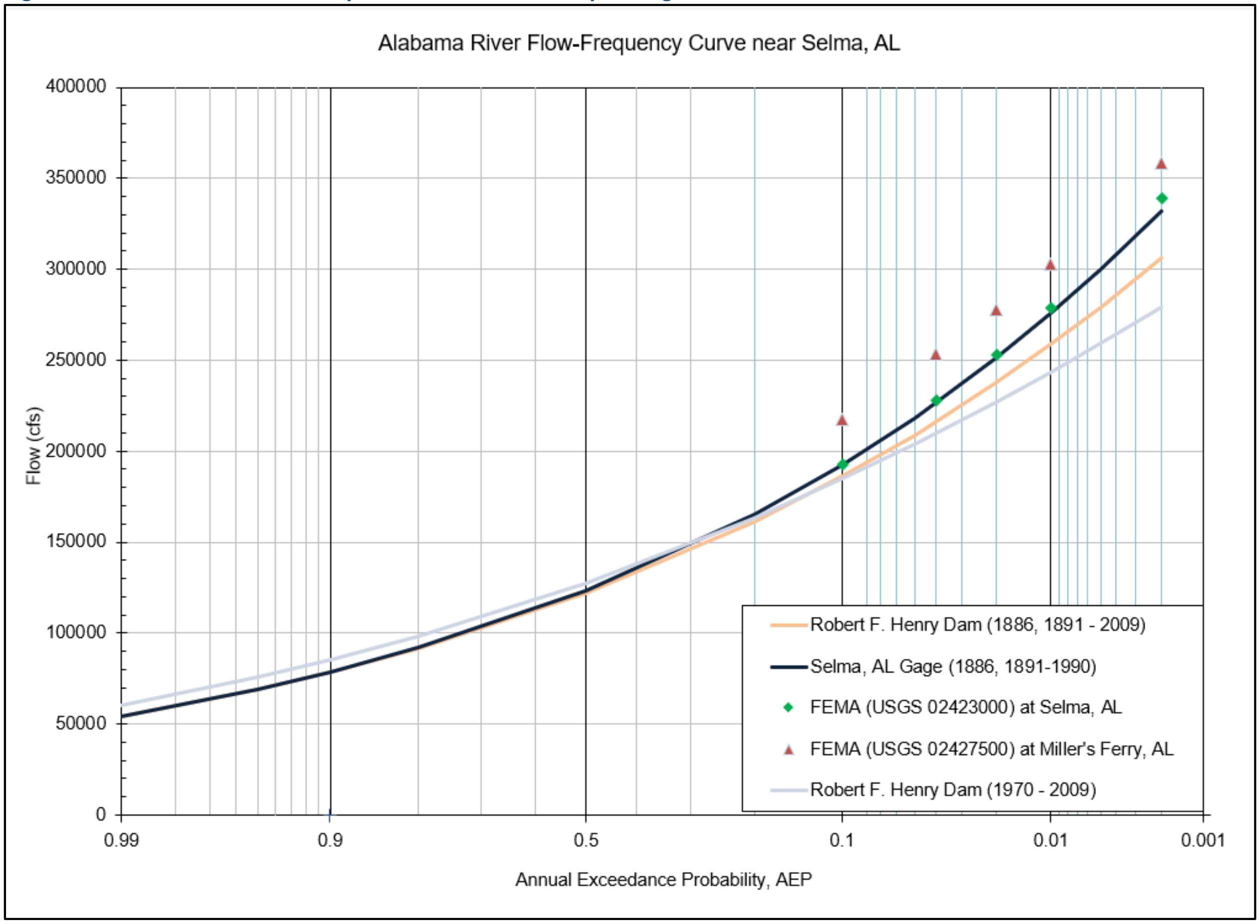
Table A-3: 100-Year Frequency Flows using Bulletin 17C

Location	Program		Skew	Period	Years of Record	# of Events	Historical Events	1% Flows (cfs)
Robert F. Henry Lock and Dam	HEC-SSP	Bulletin 17C	Station	1886, 1891-2009	124	118	1	259,000
Selma, AL	HEC-SSP	Bulletin 17C	Station	1886, 1891-1990	105	99	1	272,000

Table A-4: Gage Estimate Flows at USGS Gages 02423000 and 02421350 in frequency (cfs)

Site Location	0.5 AEP	0.2 AEP	0.1 AEP	0.04 AEP	0.02 AEP	0.01 AEP	0.005 AEP	0.002 AEP
Robert F. Henry Lock and Dam	122,000	161,000	186,000	216,000	238,000	259,000	279,000	306,000
(02421351)	124,000	166,000	193,000	226,000	251,000	276,000	300,000	332,000

Figure A-37: Annual exceedance probabilities and corresponding flow rates for Alabama River near Selma, Alabama



A.3.3. *Hydraulic Modeling Approach*

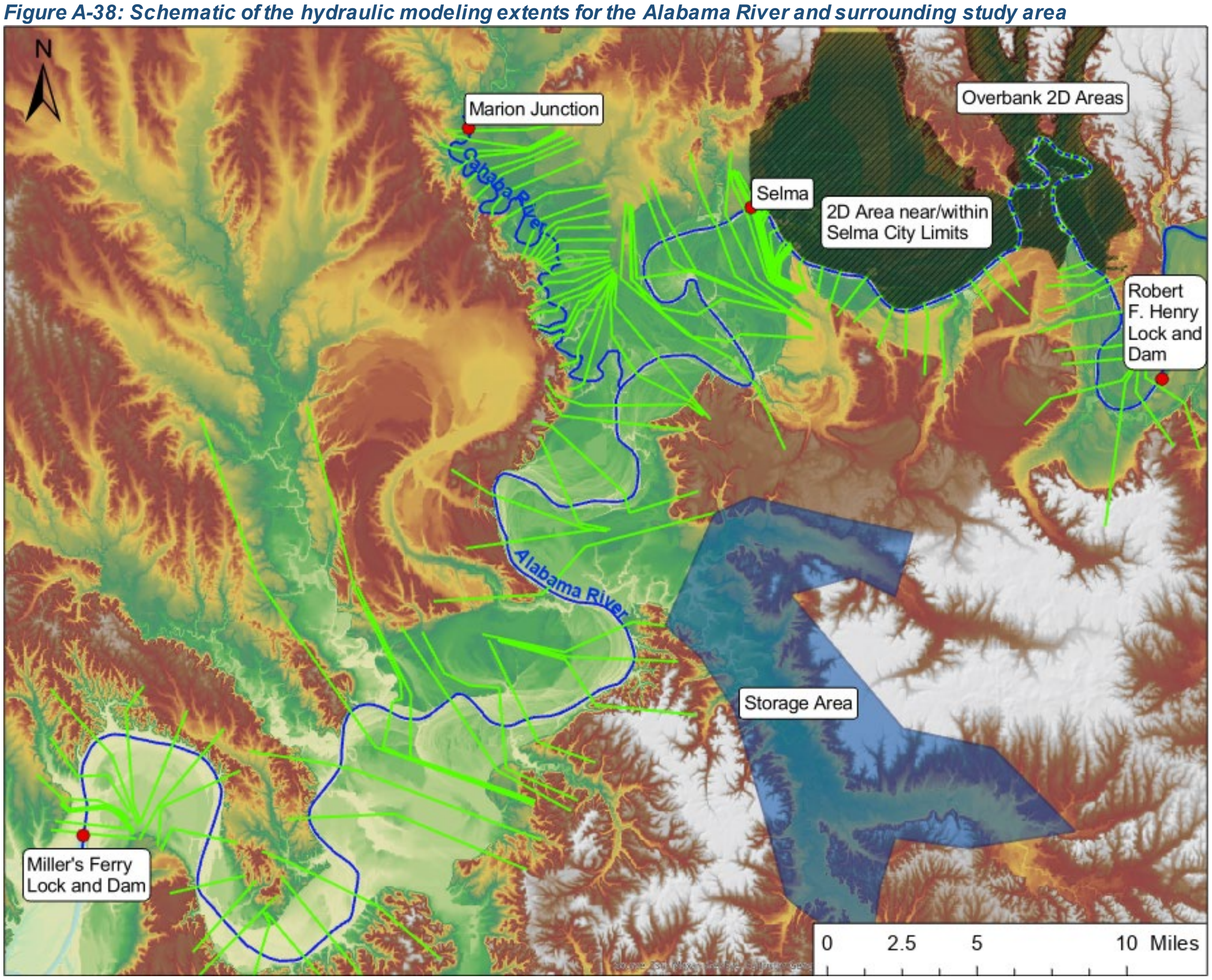
A FEMA developed HEC-RAS model utilized in the 0.01 AEP flood plain mapping was used to create an updated model. The HEC-RAS version 5.0.5 steady state model was converted to a version 5.0.7 unsteady 1D/2D Model and heavily modified. The model covered 102 river miles along the Alabama River in-between the projects Miller's Ferry Lock and Dam and Robert F. Henry Lock and Dam. The Cahaba River was included to better model the inflows from the Cahaba into the Alabama River along with any backwater effects on either system. The stretch of the Cahaba River included 22 miles from the confluence up to Marion Junction, AL. It was determined that the 2D mesh was needed in several locations within the floodplain of the study area. Reasons supporting 2D modeling included the following:

- The terrain in the area is extremely flat, meaning water flows in multiple directions as it enters the floodplain.
- Sharp meanders in the river cause the direction of flow to change sharply as flow escapes the river.
- The modeling of ring levees, as was anticipated for this effort, would be difficult and less accurate in 1D. It is more straight forward to input oddly shaped hydraulic structures within a 2D mesh.

The previously described terrain model was utilized in supporting all hydraulic modeling efforts. The frequency flows used for this analysis were based off the HEC-SSP Bulletin 17C analysis described above for USGS Gages 02423000 Alabama River at Selma, AL and 02421350 at Robert F. Henry Lock and Dam.

For the Cahaba River reach, two 2D areas and one storage area were added to the original model to account for backwater effects up the Cahaba River and other small tributaries. The first 2D area was added halfway between Robert F. Henry Lock and Dam and Selma, AL. The high degree of sinuosity in the upstream extent of the model presents challenges to a 1D approach, especially in modeling of out-of-bank stages. The second 2D area was added just upstream Selma, AL where several woody wetlands are located. This area is very flat and appears to be where the Alabama River may have once flowed, leaving oxbow landmarks in the earth (visible via aerial photography and in digital elevation models). Flow in this area is primarily two-dimensional for large, low frequency events.

Figure A-38: Schematic of the hydraulic modeling extents for the Alabama River and surrounding study area



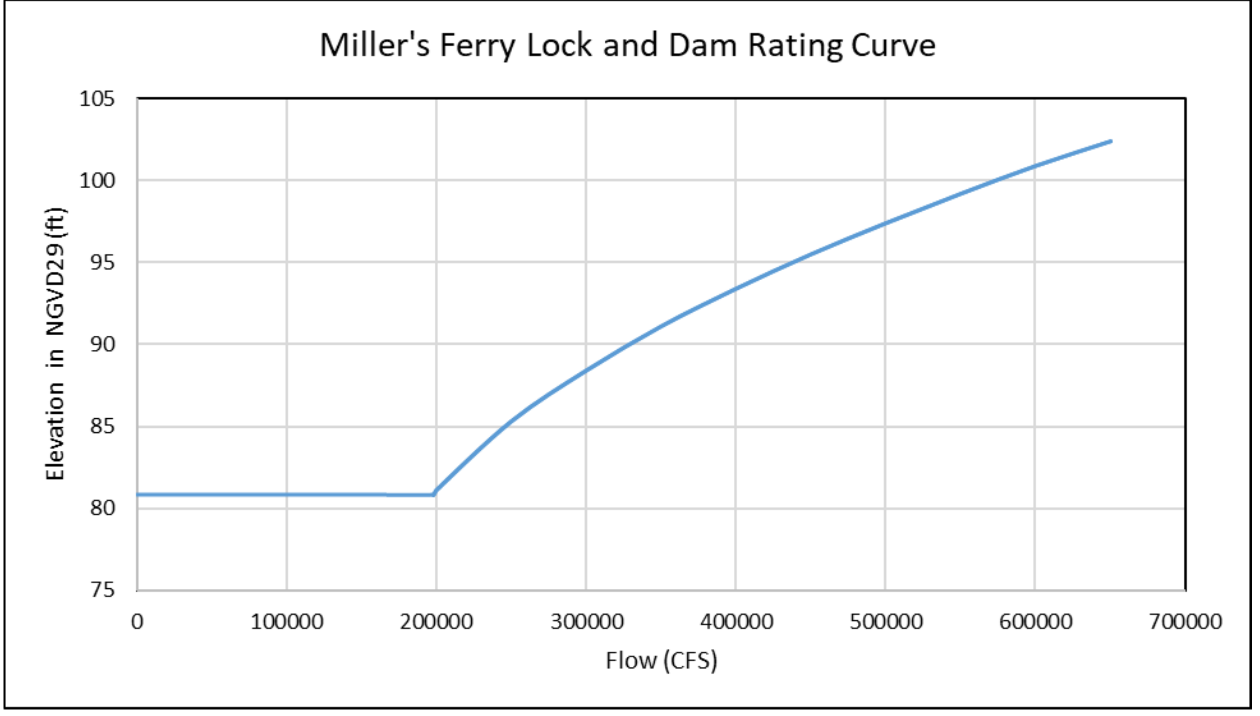
The hydrologic flow change locations in the model are located downstream of Robert F. Henry Lock and Dam, upstream of Selma, AL, and midway between Selma and Miller's

Ferry Lock and Dam (Downstream of Cahaba River (D.A. 1824), Cedar Creek (D.A. 461), Bogue Chitto Creek (D.A. 364)) to account for flow from the Cahaba River, a major tributary to the Alabama River downstream of the study area.

A.3.3.1. *Boundary Conditions and Tie-ins*

The downstream boundary condition for the model was the headwater rating curve for Miller's Ferry Lock and Dam in Wilcox County, Alabama. Miller's Ferry Lock and Dam is the next available gage location downstream of Selma, AL and gives a more accurate downstream boundary condition for modeling the backwater effect the pool has on the Alabama River system. The curve was obtained from the current water control manual (USACE, 2015) for the project, and is shown on Figure A-39. The Cahaba River ties into the Alabama River downstream of Selma, Alabama and has an upstream boundary condition at USGS Gage 02425000 near Marion Junction, AL. The purpose of this tie-in is to account for any effect the Cahaba River may have on the Alabama River system. The gage located at Marion Junction, AL is the next upstream gage located on the Cahaba River and would account for any backwater effect the Alabama River has on the Cahaba. The upstream boundary condition for the Alabama River is below Robert F. Henry Lock and Dam.

Figure A-39: Miller's Ferry Headwater Rating Curve (USACE, 2015)



A.3.3.2. *Structures*

There are four bridges in the model extents that cross the Alabama River including the US Highway 80 Bridge, Edmund Pettus Bridge, US Highway 28 Bridge, and Railroad Bridge directly upstream of the Edmund Pettus Bridge. Three bridges are located at Selma, AL and one is located near Miller's Ferry Lock and Dam. Upstream and downstream river cross sections are shown for each bridge on Figure A-40, Figure A-41, Figure A-42, and Figure A-43, respectively.

The bridges were modeled using 1D instead of 2D due to the current capabilities for modeling hydraulic structures within HEC-RAS. It was determined that 1D would better represent the bridge hydraulics. The contraction and expansion coefficients of 0.3 and 0.5, respectively, were used for two cross sections upstream and one cross section downstream of a hydraulic structure. All other contraction and expansion values were kept at default values.

Figure A-40: Upstream and downstream cross-sections of the Alabama River at US Highway 80 Bridge

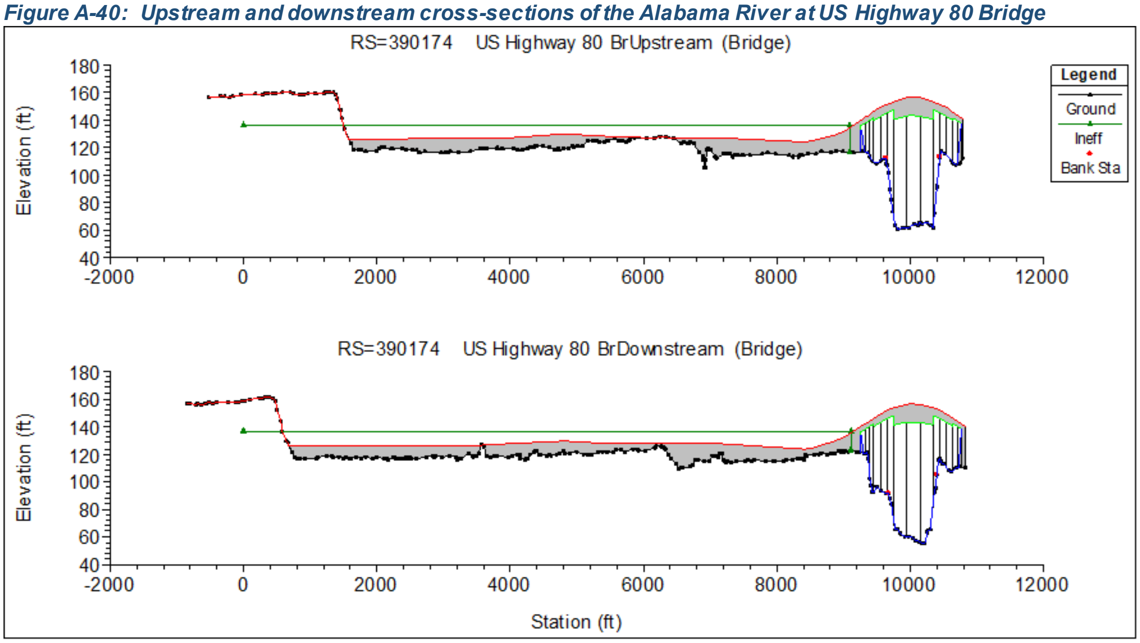


Figure A-41: Upstream and downstream cross-sections of the Alabama River at Edmund Pettus Bridge

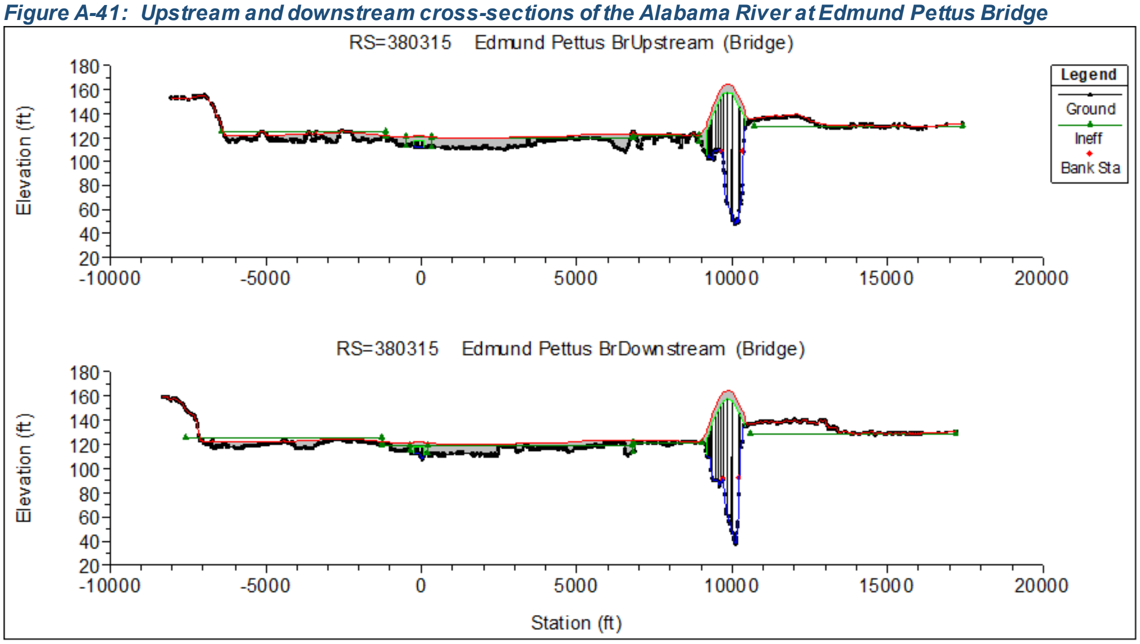


Figure A-42: Upstream and downstream cross-sections of the Alabama River at US Highway 28

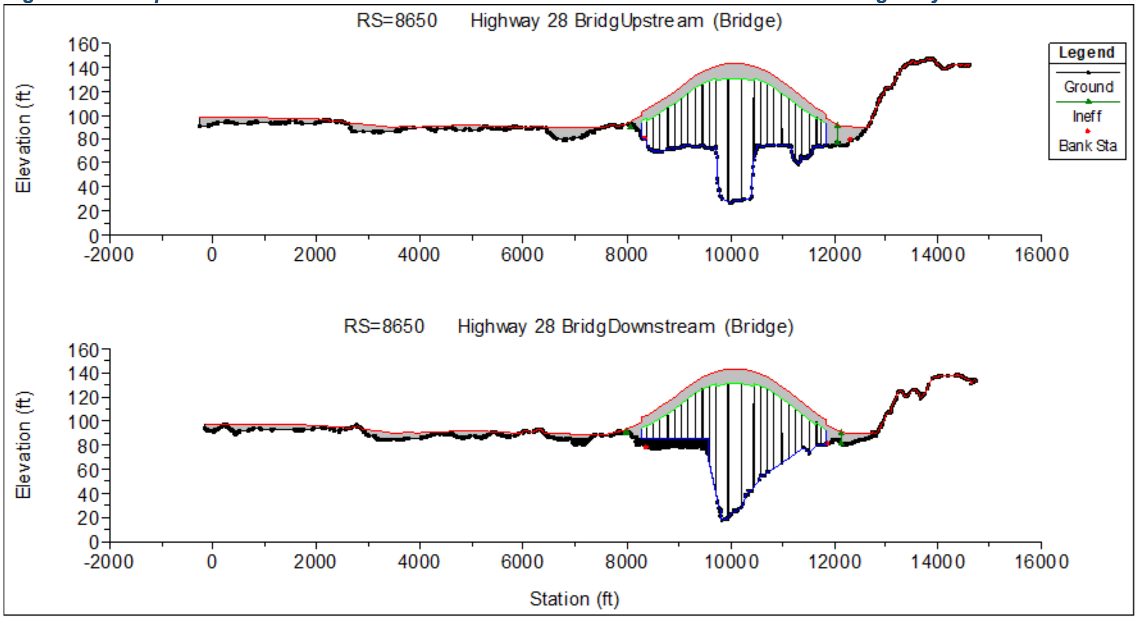
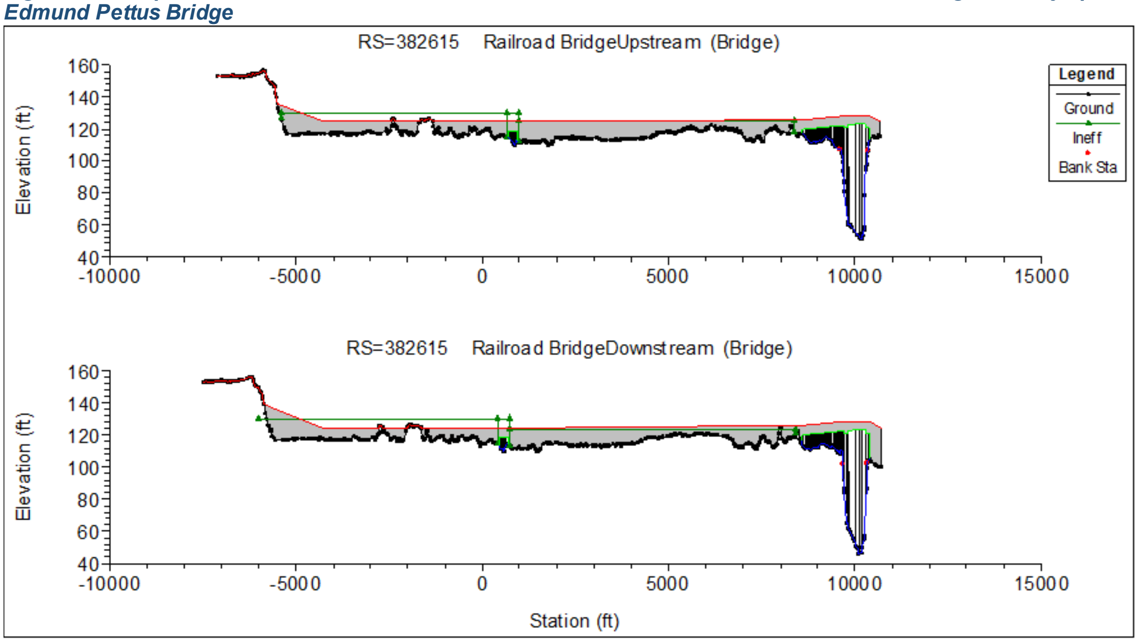


Figure A-43: Upstream and downstream cross-sections of the Alabama River at Railroad Bridge directly upstream of the Edmund Pettus Bridge



A.3.3.3. *Ineffective Flow Areas*

The reduced conveyance due to expansion and contraction at structures is reflected in the HEC-RAS model by defining ineffective flow areas for the cross sections immediately upstream and downstream of the structures. The station and elevation of the ineffective flow areas were located based on the HEC-RAS Hydraulic Reference Manual (USACE, 2016).

In addition to the application of the ineffective flow areas upstream and downstream of the structures, the ineffective flow areas were also applied to the cross sections in the areas where the topography indicates that the flows may not be fully effective. These are generally the areas where the floodplain expands and contracts suddenly or where there is divided flow. Stationing of the ineffective flow areas was defined using the same flow contraction and expansion rule applied to the structures.

A.3.3.4. *Channel Roughness Values*

Manning's roughness coefficients (Manning's "n-values") were established using guidance from the HEC-RAS *Hydraulic Reference Manual* (Reference 22). Manning's n-values used in the hydraulic computations were chose based on engineering judgment from field observations of the streams and floodplain areas and utilizing the 2011 NLCD Land Use Dataset. Roughness values used for the study streams varied from 0.030 to 0.040 for the channel and 0.04 to 0.12 for the overbank areas. The lowest value for the overbank areas was for open fields that were mostly flat, downstream of Selma, AL. The higher values for the overbank areas represented the heavily wooded and forested areas. Figure A-44 below contains the Manning's n-values associated with the NLCD Dataset imported into HEC-RAS.

Figure A-44: Manning's n Value assigned for 2011 NLCD Land Use Dataset

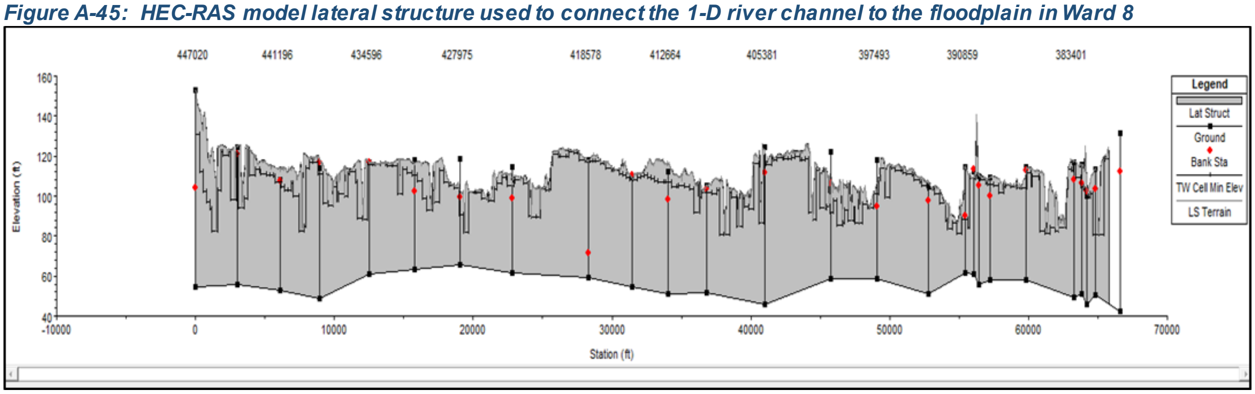
Color	Value	Name	Default Manning's n
	0	nodata	
	11	open water	0.01
	21	developed, open space	0.025
	22	developed, low intensity	0.05
	23	developed, medium intensity	0.06
	24	developed, high intensity	0.06
	31	barren land rock/sand/clay	0.06
	41	deciduous forest	0.1
	42	evergreen forest	0.09
	43	mixed forest	0.08
	52	shrub/scrub	0.08
	71	grassland/herbaceous	0.07
	81	pasture/hay	0.07
	82	cultivated crops	0.07
	90	woody wetlands	0.08
	95	emergent herbaceous wetla...	0.07

The values from this figure were used for the 2D area and were cross referenced with the existing Manning's n-values for 1D cross-sections. Override regions were utilized for tying in the values within the existing 1D model to the 2D area based on the land use type defined in the 2011 NLCD Land Use Dataset.

A.3.3.5. *Lateral Structures*

As discussed above, the overbank areas upstream of Selma, AL were modeled using a 2D area to better represent flow within the overbanks. Lateral structures were used to connect the 1D cross sections to the 2D overbank area. The lateral structure represents the ground elevation at the interface between the river channel and the overbanks. Modeling the lateral structure as a weir provided the most stability in the model. The hydraulic structures in the model were set as zero height weirs with a weir coefficient of 0.2. The weir coefficients were chosen based on Lateral Weir Coefficients within the HEC-RAS 2D Modeling User's Manual (USACE, 2016). Figure A-45 shows the HEC-RAS modeled lateral structure used to connect the 1-D river channel to the floodplain in Ward 8.

Figure A-45: HEC-RAS model lateral structure used to connect the 1-D river channel to the floodplain in Ward 8



A.3.3.6. *HEC-RAS Results and Calibration*

To ensure that the model is a good representation of the Alabama River near Selma, calibration to three large observed flood events was performed. Typically, a series of flow hydrographs would be run through the hydraulic model, however, as discussed in the report above, there was significant difficulty in developing these. Therefore steady, continuous peak flows where run through the model to match peak stages observed at the Selma USGS gage.

Three events were utilized to support the Existing Conditions hydraulic model calibration. The events occurred in 1979, 1987, and 1990 with discharges of 250,000, 110,000, and 280,000 cubic feet per second, respectively (Table A-5). All of these events were chosen due to construction of Miller's Ferry Lock and Dam and Robert F. Henry Lock and Dam in the Late 1960s and were run through the HEC-RAS model as continuous flow. Flow change locations where modeled as lateral inflows at the described locations.

In addition to the calibration simulations, two additional runs where made to ensure the composite parameters used reasonably represented peak flood stages. It is worth noting that in these two validation events of March of 2001 and April of 2005, the hydraulic model underestimates the stage by about 1 and 2 feet, respectively. However, this is well within the uncertainty in the peak flow measured for these events and deemed adequate.

Table A-5: Flood events from 1979, 1987, and 1990 used for model calibration

Flood Event	Calibration/Validation	Peak Discharge in Selma (cfs) at Gage 02423000	Estimated Peak Flood Recurrence Interval & Magnitude	Model Peak Stage	Actual Peak Stage
April 18, 1979	Calibration	250,000	>2%; 251,000 cfs	117.85	116.82
March 2, 1987	Calibration	110,000	>50%; 124,000 cfs	102.59	102.91
March 21, 1990	Calibration	279,000	<1%; 276,000 cfs	118.87	118.60
March 23, 2001	Validation	127,000	<50%; 124,000 cfs	106.25	105.26
April 3, 2005	Validation	186,000	<20%; 166,000 cfs	112.86	110.77

Using the validated hydraulic model and flows from the flow-frequency analysis as inputs to the model, the frequency simulations were run. The 0.50, 0.20, 0.10, 0.04, 0.02, 0.01, 0.005, and 0.002 annual exceedance probability (AEP) events. Table A-6 shows the existing conditions inflows by frequency for all inflow locations in the hydraulic model.

Table A-6: Flow rates (cfs) at stream gages within the study area for various flood events and annual exceedance probabilities with existing conditions

Event	AEP	Cross Section: 539014 (Alabama River Below RE Henry Lock and Dam)	Cross Section: 400732 (Alabama River upstream of Selma, AL)	Cross Section: 143555 (Between Bogue Chitto Creek and Chilachee Creek)	Cross Section: 10275 (Upstream of Highway 28 Bridge and Miller's Ferry Lock and Dam)	Cross Section: 113041 (Cahaba River near Marion Junction)
0.50 AEP	0.5	122000	1000	7000	4000	14600
0.20 AEP	0.2	161000	4000	9500	5800	19600
0.10 AEP	0.1	186000	5000	11000	6700	22700
0.04 AEP	0.04	216000	1000	12500	7500	25800
0.02 AEP	0.02	238000	11000	14300	8600	29600
0.01 AEP	0.01	259000	13000	15600	9500	32400
0.005 AEP	0.005	279000	17000	17000	10300	35200
0.002 AEP	0.002	306000	22000	18800	11400	39000

A.3.4. *Future Without-Project Conditions*

As conditions in the basin above Selma are expected to change over the 50-year planning period, a future without project conditions scenario was developed based on the existing conditions model. The two primary drivers to changes in hydrology for this area were determined to be climate change and changes to land use. The climate change assessment presented in Section 4 of this appendix states that there is not enough evidence to support an adjustment to the hydrology as a result of climate change. Changes in land use however can be estimated for the 17,000 square mile basin above the project.

The future conditions were determined by utilizing the existing Corps Water Management System (CWMS) hydrology model for the subbasins upstream of Selma, AL and land use changes from the 2070 Integrated Climate and Land Use Scenario (ICLUS) dataset. This dataset utilizes population projections through the end of the century, reflecting different assumptions about fertility, mortality, and immigration to determine the demand for new homes, and estimates the amount of impervious surface that can be expected. The majority of projected development was observed far upstream of Selma, AL, in areas such as near Montgomery, AL and Birmingham, AL.

Impervious projections were utilized for each subbasin in the CWMS hydrology model where adjusted from existing conditions. The model was then run with a series of precipitation inputs ranging from small 0.1 AEP floods to large 0.002 AEP floods. In every case considered, peak flows where increased by approximately 2 percent with a variability of about 0.15 percent per event. It was decided that an increase in peak flows of 2 percent would be a reasonable adjustment to hydrology to account for future development.

It is important to note that upstream regulation was not considered when running these scenarios to determine the future without project condition. Upstream flood operations are currently being considered for modification and in some cases, reduction of flood pools. It was the decision of the PDTs engineering team that a 2 percent increase in flows provided a practical and reasonably conservative change in peak flows based on land use changes for the future without project conditions. Table A-7 shows the updated flows used as inputs to the hydraulic model for the future without project condition. Table A-8 and Table A-9 show the comparison of stages at the Selma, Alabama USGS gage resulting from the hydraulic model runs for the Existing Condition to the Future Without Project Condition. Additional model results of water surface profiles for existing conditions and future without project conditions can be found in Section A.8 Subpart 1 and Subpart 2, respectively.

Table A-7: Flow rates (cfs) at model flow-change locations corresponding with stream gages and flow change locations from the FEMA FIS model within the study area for various flood events and annual exceedance probabilities (AEP) with respect to future without project conditions

Event	AEP	Cross Section: 539014 (Alabama River Below RE Henry Lock and Dam)	Cross Section: 400732 (Alabama River upstream of Selma, AL)	Cross Section: 143555 (Between Bogue Chitto Creek and Chilachee Creek)	Cross Section: 10275 (Upstream of Highway 28 Bridge and Miller's Ferry Lock and Dam)	Cross Section: 113041 (Cahaba River near Marion Junction)
2 year	0.5	12440	1020	7242	4386	14892
5 year	0.2	164220	4080	9690	5916	19992
10 year	0.1	189720	5100	11220	6834	23154
25 year	0.04	220320	1020	12750	7752	26316
50 year	0.02	242760	11220	14586	8874	30600
100 year	0.01	264080	13260	15912	9690	33048
200 year	0.005	284580	17340	17340	10506	35904
500 year	0.002	312120	22440	19176	11628	39780

Table A-8: Water surface elevations and river stages associated with various flood events and annual exceedance probabilities (AEP) at Selma, Alabama showing Existing Conditions

Year	AEP	Elevation (ft) (NAVD88)	Stage (ft)
2	0.5	104.94	43.14
5	0.2	110.24	48.44
10	0.1	113.36	51.56
25	0.04	115.53	53.73
50	0.02	117.69	55.89
100	0.01	119.05	57.25
200	0.005	120.44	58.64
500	0.002	122.52	60.72

Table A-9: Water surface elevations and river stages associated with various flood events and annual exceedance probabilities (AEP) at Selma, Alabama showing future without project (FWOP) conditions with uniform 2% increases

Year	AEP	Elevation (ft) (NAVD88)	Stage (ft)
2	0.5	105.21	43.41
5	0.2	110.83	49.03
10	0.1	113.63	51.83
25	0.04	115.91	54.11
50	0.02	118.01	56.21
100	0.01	119.33	57.53
200	0.005	120.89	59.09
500	0.002	122.85	61.05

A.4. Formulation of Alternatives

Plan formulation is the process of building alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. With the problems and objectives in mind, the project delivery team first identified measures which were used to develop an array of alternatives. These measures along with the initial array of alternatives were presented at the Alternative Milestone Meeting held January 16, 2019.

This study includes consideration of atypical flood risk management measures such as streambank stabilization to prevent structural foundation failures for buildings located along the river bank. When analyzing plan alternatives, no additional hydraulic modeling was completed for the streambank stabilization measures considered as no damages were derived through an HEC-FDA model. Additional information regarding the consideration of these specific measures are included in the plan formulation section of the main report as well as in the Appendix E – Economics.

A.4.1. *Problems and Opportunities*

A.4.1.1. *Problem Identification*

There are several problems related to flooding in the basin. While there are some small local flooding issues, the large scale issues are the result of flooding from the Alabama River. The Alabama River basin above Selma, AL is a nearly 17,000 square mile drainage area. This basin has multiple flood control projects however, these are not targeted or capable of providing meaningful flood reduction from the Alabama River near Selma. The specific problems identified for the Selma area are as follows.

- structural damages caused by flooding predominantly in Ward 8;
- shear bank failure along the Alabama River throughout the City of Selma caused by the rise and fall of the river;
- stormwater drainage during flooding events;
- flow resiliency of the City of Selma;
- flood risks to nationally registered historic and cultural resources;
- high social vulnerability; and
- threats to community cohesion.

A.4.1.2. *Opportunities*

There are several opportunities to address these issues. They are as follows.

- reduce effects of riverine flooding in the Selma;
- reduce structural inundation damages;
- reduce threats to Nationally Registered historic and cultural resources;
- improve resiliency;
- improve social vulnerability; and
- improve community cohesion.

A.4.2. *Study Goals, Objectives, and Constraints*

The objectives are what the alternative plans should achieve. To support accomplishment of the study goals and the Federal objectives, the PDT developed the following planning objectives to apply to this area over the next 50 years.

- Increase community resiliency and maintain community cohesion by reducing risk to vulnerable populations (human health and safety);
- to reduce threat to nationally registered historic resources between river miles 256-261 introduced by high water events; and
- increase resiliency by reducing damages to property and infrastructure.

A.4.3. *Constraints*

The planning constraints limit plan formulation. There are generally two types of planning constraints, universal and study specific constraints. The universal constraints are typically considered in every planning study and include the following for this study:

- do not increase impacts to floodplain management;
- avoid impacts to existing Federal projects in the Study Area. If impacts are unavoidable, engineer solutions and incorporate revisions as part of the study;
- avoid or minimize adverse impacts to T&E Species and wildlife habitat ;
- avoid or minimize adverse impacts to historic properties and cultural resources; and
- no use of public funds on private property without an overriding public benefit.

Legal constraints may include those associated with impacting existing Federally constructed projects. Policy constraints may include expanding the Study Area beyond the scope of the approved authority, including functional programs (i.e. capability to address bank-line erosion) not previously approved by SAD or HQ.

A.4.4. *Design Criteria*

Criteria used for the design of flood risk management measures was developed by the PDT based on the specific study objectives and constraints. A listing of the criteria organized by restoration objective is shown below.

- Objective: Reduce average annual flood damages to residential and commercial structures.
  - Criteria:
    - Structural
      - reduce/maintain level of life safety risk;
      - reduce peak flood elevations; and
      - reduce max footprint of floods.
    - Non-Structural
      - reduce/maintain level of life safety risk;
      - reduce risk to structures in the floodplain; and
      - remove risk from the floodplain.

- Objective: Improve community resilience by reducing flood risk of vulnerable populations.
    - Criteria:
        - implement measures that reduce flood risk in vulnerable communities.

A.4.5. *General Types of Flood Risk Management Measures Considered*

A suite of structural and non-structural measures were considered in this study to help satisfy the objectives and design criteria. These measures were utilized during the development of alternative designs and applied throughout the study area based on location-specific problems, constructability, and the flood risk management objectives. The PDT determined that a floodplain management plan/emergency evacuation plan could be combined with any of the measures considered to address life safety and therefore was not incorporated into each alternative description. These measures are discussed below.

A.4.5.1. *Structural Measures*

Six different structural measures were identified and analyzed for effectiveness in reducing flood risk in the vicinity of Selma. These six measures were: in-line detention/retention, off-line detention/retention, bridge/culvert modification, levees/floodwalls, channel diversions and stabilization of the streambank. These measures were screened in order to provide a solid basis for the formulation of alternatives. Measure screening was based on each measure's ability to meet the study objectives and avoid constraints. Investigations were performed by the PDT analyzing aerial imagery, digital terrains, project photos, model results, holding discussions with the non-federal sponsor and considering the practicality and feasibility of implementing each measure in this basin

A.4.5.1.1. *In-Line Detention/Retention*

In-line detention/retention consists of a damming surface being constructed across the stream/floodplain to create flood storage. The damming surface could be designed to create a permanent pool or to only attenuate flow during large events. Topography plays a critical role in determining the viability of in-line detention/retention. These structures are often placed in narrow floodplains directly downstream of wide, low floodplains in an effort to maximize the ratio of storage capacity to structure size, which generally translates to a higher performing, lower cost project.

In-line detention/retention must be carefully evaluated to ensure that the impoundment of water does not pose an increased risk to life safety or economic damage in the event of a structural failure. Effects of upstream water surface elevations must be investigated to ensure that the structure does not create incremental risk. Also, unless specifically designed for fish passage, inline structures often act as a hydraulic disconnect, which can have detrimental impacts to the upstream aquatic ecosystem. In-line reservoirs must conform to appropriate dam safety standards.

The topography in the Selma area and the size of the Alabama River Basin above the city preclude the use of inline detention. Additionally, Selma resides between two navigation dams, Robert F. Henry and Millers Ferry. These projects do not provide flood reduction, as the drainage basin above these projects is too large relative to the storage available. As it is known that storage of floodwaters in this area for the Alabama River is impractical, this measure was screened out.

A.4.5.1.2. *Off-Line Detention/Retention*

Off-line detention/retention consists of detention/retention reservoirs being constructed adjacent to the stream (Storage of floodwater is impractical in this part of the basin due to the size of the upstream basin and required storage volume. Off-channel storage is typically only an option on small creeks and tributaries where the drainage basin is reasonably small. For instance, storing 10% of the 10 year flood volume along the Alabama River would require a 20 foot deep pond that would extend 10 miles by 10 miles on the surface. This would neither be practical to construct nor cost effective for several reasons. There is not enough available space within the adjacent locations along the Alabama River to construct a structure of the magnitude necessary to make a meaningful difference in flooding. Cost of acquisition and excavation of such land would be in the order of billions of dollars which would clearly far exceed the benefits that could be derived. Therefore, this was screened out.

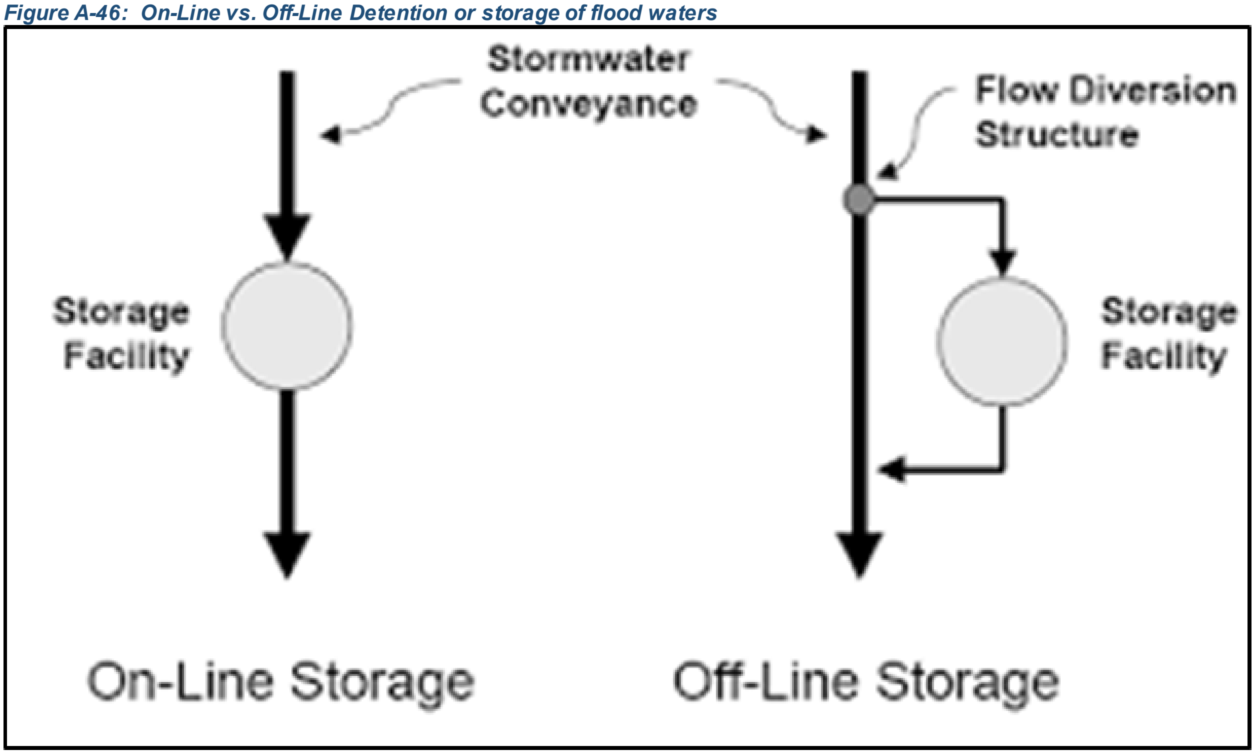
Figure A-46). These features are typically achieve storage through excavation and berm construction. Flood waters overflow into the reservoir, often through a weir, and are held until the falling limb of the hydrograph is observed, when they are slowly released back into the river. Typically, a berm is built around a low portion of the floodplain, with an overflow section being constructed near the upstream end of the berm, and adjacent to the stream. The height and length of the overflow section are optimized through model assessment of different weir geometries. The frequency and timing of filling can be tailored to optimize flood risk reduction in the study area. The height of the non-overflow berm is usually set optimize storage capacity and flood risk reduction. Constraints to reservoir capacity include available space, topography, however ideally, the features are constructed with sufficient bottom grade slope to permit gravity drainage. Discharge to the stream course is typically accomplished through constructed outlet works, such as culverts or gates.

Because these reservoirs generally have smaller storage capacity and less upstream to downstream water surface head differential than in-line reservoirs, they generally pose a lower risk to life safety, however, these impacts must still be considered. Changes to upstream and adjacent water surface elevations must also be investigated to ensure that the floodplain impingement does not cause additional flooding. Off-line reservoirs must conform to appropriate dam safety standards.

Storage of floodwater is impractical in this part of the basin due to the size of the upstream basin and required storage volume. Off-channel storage is typically only an option on small creeks and tributaries where the drainage basin is reasonably small. For instance, storing 10% of the 10 year flood volume along the Alabama River would require a 20 foot deep pond that would extend 10 miles by 10 miles on the surface. This would neither be practical to construct nor cost effective for several reasons. There is not enough available

space within the adjacent locations along the Alabama River to construct a structure of the magnitude necessary to make a meaningful difference in flooding. Cost of acquisition and excavation of such land would be in the order of billions of dollars which would clearly far exceed the benefits that could be derived. Therefore, this was screened out.

Figure A-46: On-Line vs. Off-Line Detention or storage of flood waters



A.4.5.1.3. *Bridge/Culvert Modification*

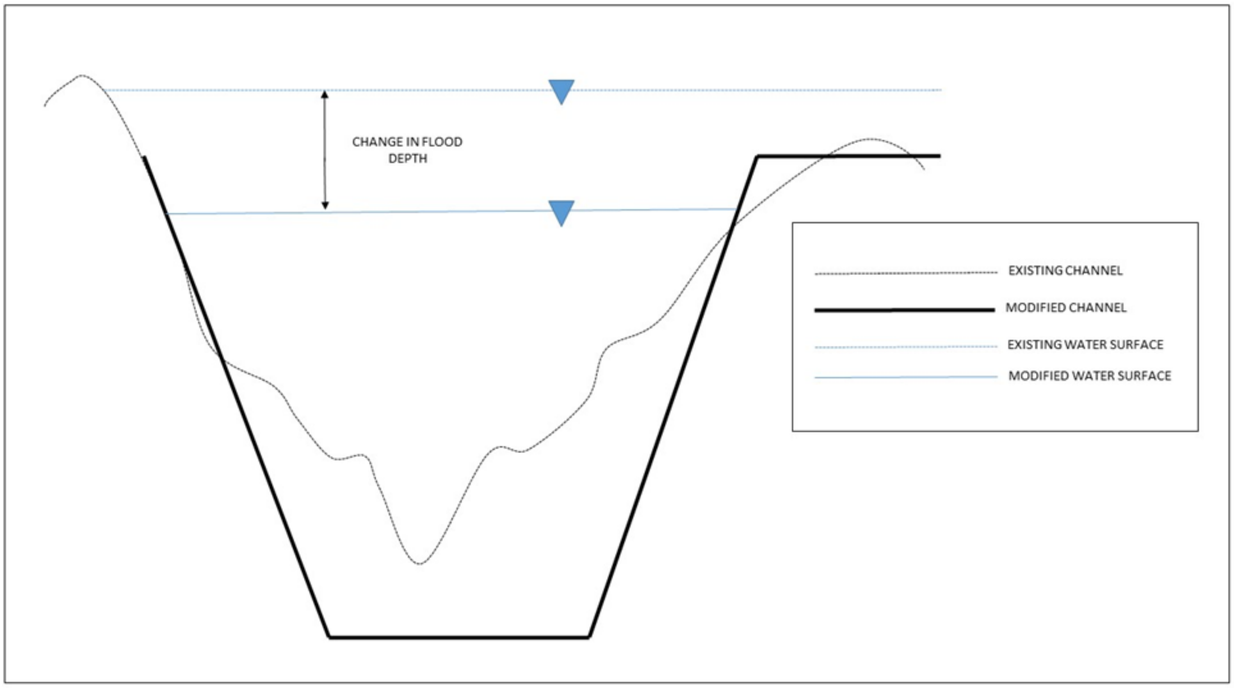
Bridge/culvert modification is the modification to or replacement of a bridge or culvert to allow for increased flow capacity. This measure-type aims to lower upstream water surface elevations. Changes to downstream water surface elevations must be investigated to ensure that the increased flow capacity does not create additional downstream flooding. Costs associated with this measure are generally high. This measure was not pursued further as there appears to be no locations where bridge constrictions result in flooding of structures along the Alabama River. Possible small constrictions at bridges along several tributaries where identified however, there were very few or no structures in the upstream floodplain in these locations. Therefore, it was determined that bridge modification would not be a cost-effective measure and was screened out.

A.4.5.1.4. *Channel Modification*

Channel modification consists of the enlargement of the stream channel to increase capacity and lower adjacent and upstream water surface elevations (Figure A-47). Changes to downstream water surface elevations must be investigated to ensure that the increased flow capacity does not create additional downstream flooding. Since flooding in the Selma area are typically from the mainstem Alabama River, it was determined a channel modification would be impractical. There were no constriction points identified which could be modified to effectively increase conveyance and reduce flooding.

Furthermore, preliminary hydraulic modeling showed that increased storage in the Alabama River would not produce a meaningful reduction in peak river stages for flood events that affected structures in the study area.

Figure A-47: Example schematic of channel modification to increase stream capacity and reduce flood depths

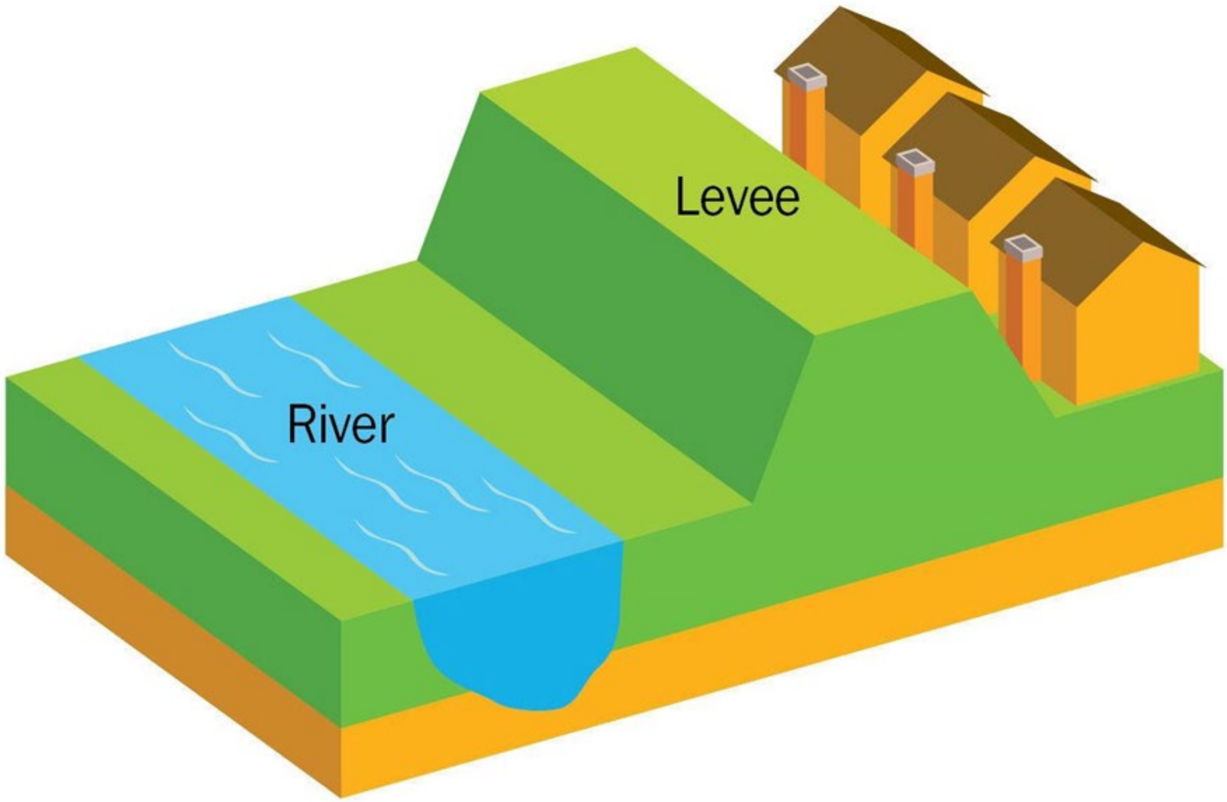


A.4.5.1.5. *Levee(s)/Floodwall(s)*

Levees/floodwalls are usually constructed adjacent to the stream to protect low-lying areas from being inundated by floodwaters (Figure A-48). Levees/floodwalls are usually designed to withstand a low frequency event such as the .01 AEP event. Although levees can prevent flood water from impacting structures up to the design event, it is important to note that they do not eliminate the flood risk. Two reasons contribute to this: first, there is always a risk of a levee/floodwall failure, and secondly, flood elevations can exceed a levee's design crest elevation. Levees/floodwalls are usually expensive to construct and maintain.

Any use of levees/floodwalls must be carefully evaluated to ensure that a failure of the proposed levee/floodwall would not pose an increased risk to life safety. Changes to upstream and adjacent water surface elevations must also be investigated to ensure that the floodplain impingement does not cause additional flooding. Several levee options where considered for protection of Wards 1, 6 and 8 in the city of Selma. Site specific levee configurations are discussed below in the site-specific structural measures section.

Figure A-48: Example of a constructed levee to protect inland structures adjacent and near a river



A.4.5.1.6. *Channel Diversion*

Channel diversions are used to convey floodwaters around segments of the natural channel that are vulnerable to flooding. This is usually done by creating a shorter, straighter overflow channel that moves water to a lower portion of the stream, or in some cases, takes water out of the basin and directs it to a different system (oftentimes this requires pump stations to move water across basin divides). Changes to downstream water surface elevations must be investigated to ensure that the modifications to the timing of the flow hydrograph do not create additional downstream flooding.

A diversion channel could possibly be feasible near the study area for small flood events below the 10-year flood. Floods in excess of 10-year floods would fully inundate the area available for channel diversions. Furthermore, the channel would have to be very large. For instance to divert just 10% of the 10 year flood peak, roughly 20,000 cfs, one would need to excavate a trapezoidal channel that was about 4.5 miles long, 100 feet wide at the bottom, 200 feet wide at the top and 12 feet deep. Also, preliminary model results showed there would be issue with backwater flow of the channel due to the very flat terrain that would further reduce its capacity to convey flow during even minor floods. Channel diversion was considered for this study, but this measure was determined to be impracticable based on expected costs, and because there are very few structures at risk for frequent floods, which suggests associated benefits would be very low. A potential channel diversion location and configuration for the Alabama River at Selma, AL is shown on Figure A-49.

Figure A-49: Potential channel diversion for the Alabama River near Selma

A.4.5.1.7. *Sluice Gate(s)*

Sluice gates are hydraulic structures that can be opened and closed to control the flow of water through an opening. These structures could be used to prevent flood waters from backing up tributaries that feed main stem rivers. During high flow events, as the river rises water may begin to flow up local tributaries causing flooding from the backwater effect of the main river.

A.4.5.2. *Non-Structural Measures*

A.4.5.2.1. *Emergency Evacuation and Floodplain Management Plan*

An Emergency Evacuation and Floodplain Management Plan can provide residents a comprehensive plan to direct evacuations of areas forecast to experience flooding. A properly utilized plan can also provide adequate time to prepare and move out of flood prone areas with the assistance of employing flood forecasting. This plan would assist an area in directing the evacuation of residents based on certain forecasted flood elevations and would include recommended locations to be evacuated, safe evacuation routes and identification of locations that would be inaccessible.

A.4.5.2.2. *Land Use Regulations*

Land use regulations can be implemented to prevent future construction in the floodplain; however, because the flooding comes from the basin above Selma, land use regulation changes in the study area would have little effect on the flooding cause by the Alabama River.

A.4.5.2.3. *Acquisition/Buy Outs & Relocation Assistance*

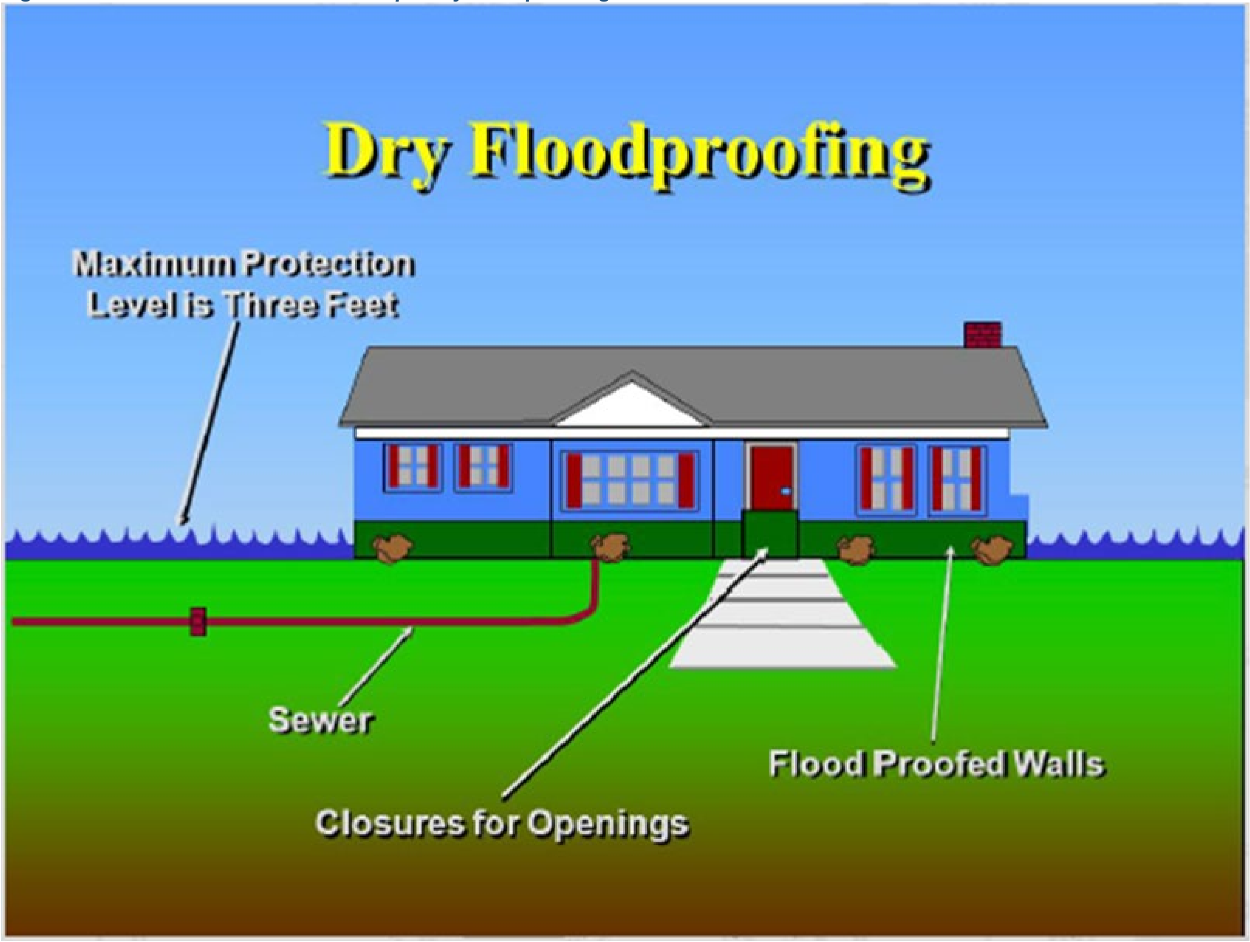
Structures within a specific frequency floodplain can be acquired and occupants can be relocated to areas outside of flood zones. This is the only measure that completely removes risk from the floodplain, as the structures are demolished after the acquisition is complete, and the property cannot be redeveloped.

A.4.5.2.4. *Flood Proofing of Structures*

Floodproofing typically involves constructing building walls and openings to create a water tight barrier. Some options for dry floodproofing structures include measures such as installing closures for openings (i.e., doors and windows) and flood proofed walls that would be impervious to flood waters (Figure A-50). For dry floodproofing, it is important only to use these alternatives if the building can withstand the hydrostatic pressure of flood waters without failing.

There are also a variety of measures which can reduce building damage, while allowing the structure to flood (i.e. wet floodproofing). The building must be properly anchored and ballasted to combat buoyant forces and should include flood drains to allow water to flow in and out of the building without causing damage to the foundation. Additionally, all electrical outlets and utilities should be elevated above the anticipated flood elevation or appropriately protected.

Figure A-50: Schematic of some example dry flood proofing alternatives



A.4.6. *Site Specific Measures Considered for the Array of Alternatives*

A.4.6.1. *Site Specific Structural*

A.4.6.1.1. *Levees/Floodwalls*

Additional site specific levee alignments were initially considered during previous study phases and some were screened out early on due to circumstances such as the alignment being outside the study area (e.g., L1 option). For the purposes of this study and report, four levee alignment alternatives were evaluated to reduce flood damages within the Study Area including alignments or options such as 1967 Selma Levee with Selmont Levee (USACE, 1967) alignment with floodgates/pumps where needed; a shortened/optimized levee version of this alignment; and a U.S. Highway 80 tie-in and floodgates/pump stations where needed (Figure A-51). Three of the four alignments considered specifically focused on flood damage reduction within Ward 8. In general, the levees evaluated would largely consist of an earthen structure with 3:1 side slopes, a top elevation around 121 feet, and a height that typically ranges from 5 to 12 feet depending on the terrain.

A.4.6.1.1.1. L2 Option

This alignment focused on the Selma portion of the 1967 levee (USACE, 1967). Preliminary professional judgment determined that this alignment would not provide additional benefits as compared to L3 and would cost a substantial amount more. Therefore, this alignment was not selected as the optimized footprint.

A.4.6.1.1.2. L3 Option

Alignment L3 footprint ran across the southern portion of Ward 8 with a tie-in feature to U.S. Highway 80. Review of modeled profiles showed that U.S. Highway 80 could withstand flooding up to the 0.1 AEP flood event with added features such as clay revetment and floodgates. This design was the least costly levee alignment while protecting the same amount of structures as the L2 and L5 options; therefore, this footprint was chosen as the “optimized levee alignment”.

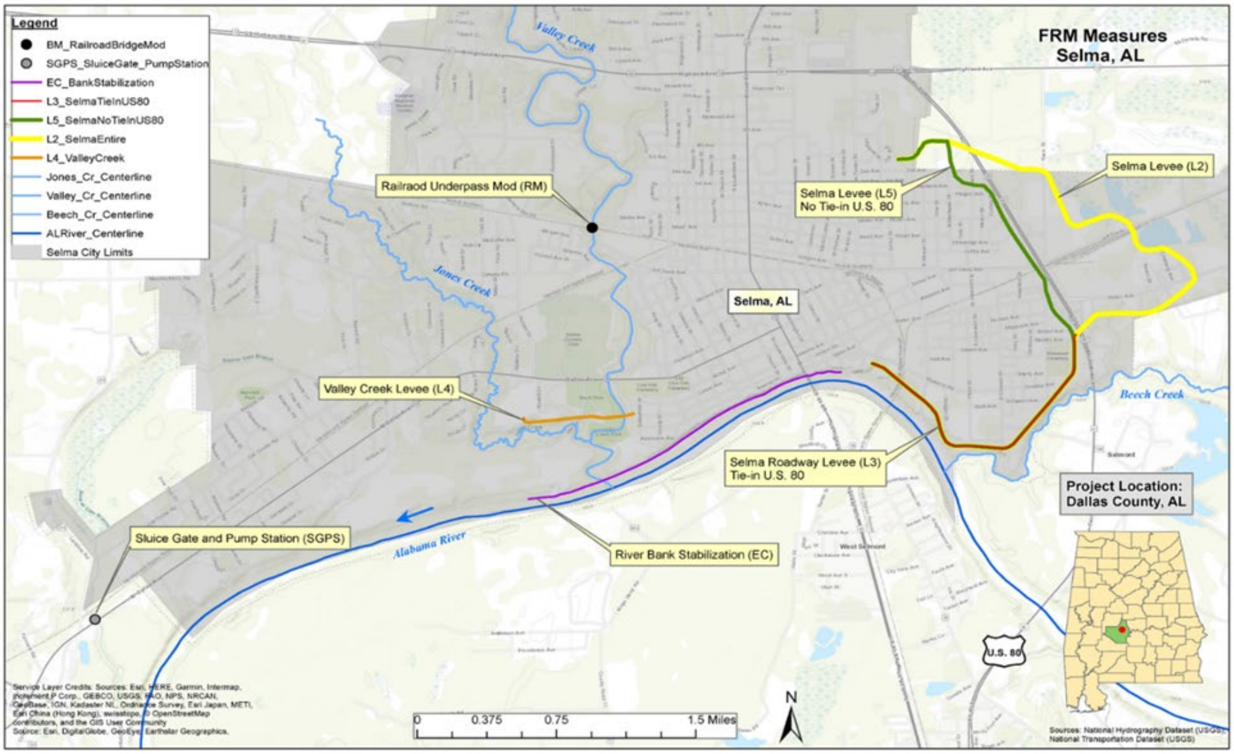
A.4.6.1.1.3. L4 Valley Creek

This measure includes a levee across Valley Creek that would have prevented backwater flow from the Alabama River up Valley Creek. The levee would have been located just above the confluence with Jones Creek and include a sluice gate to restrict flows during a large flood event on the Alabama River. Flood mapping showed that, of the structures within the Valley Creek floodplain, very few were affected by the 0.01 AEP flood event or less. This measure was ultimately screened out in the evaluation of the initial array of alternatives due to the lack structures in the Valley Creek floodplain.

A.4.6.1.1.4. L5 Option

The footprint of L5 was planned similar to L3; however, the levee ran parallel with U.S. Highway 80 rather than utilizing a tie-in feature. Like L2, preliminary professional judgment determined that this alignment would not provide additional benefits as compared to L3 and would cost a substantial amount more. Therefore, this alignment was not selected as the optimized footprint.

Figure A-51: Levee alignments evaluated for Selma, AL Flood Risk Management study



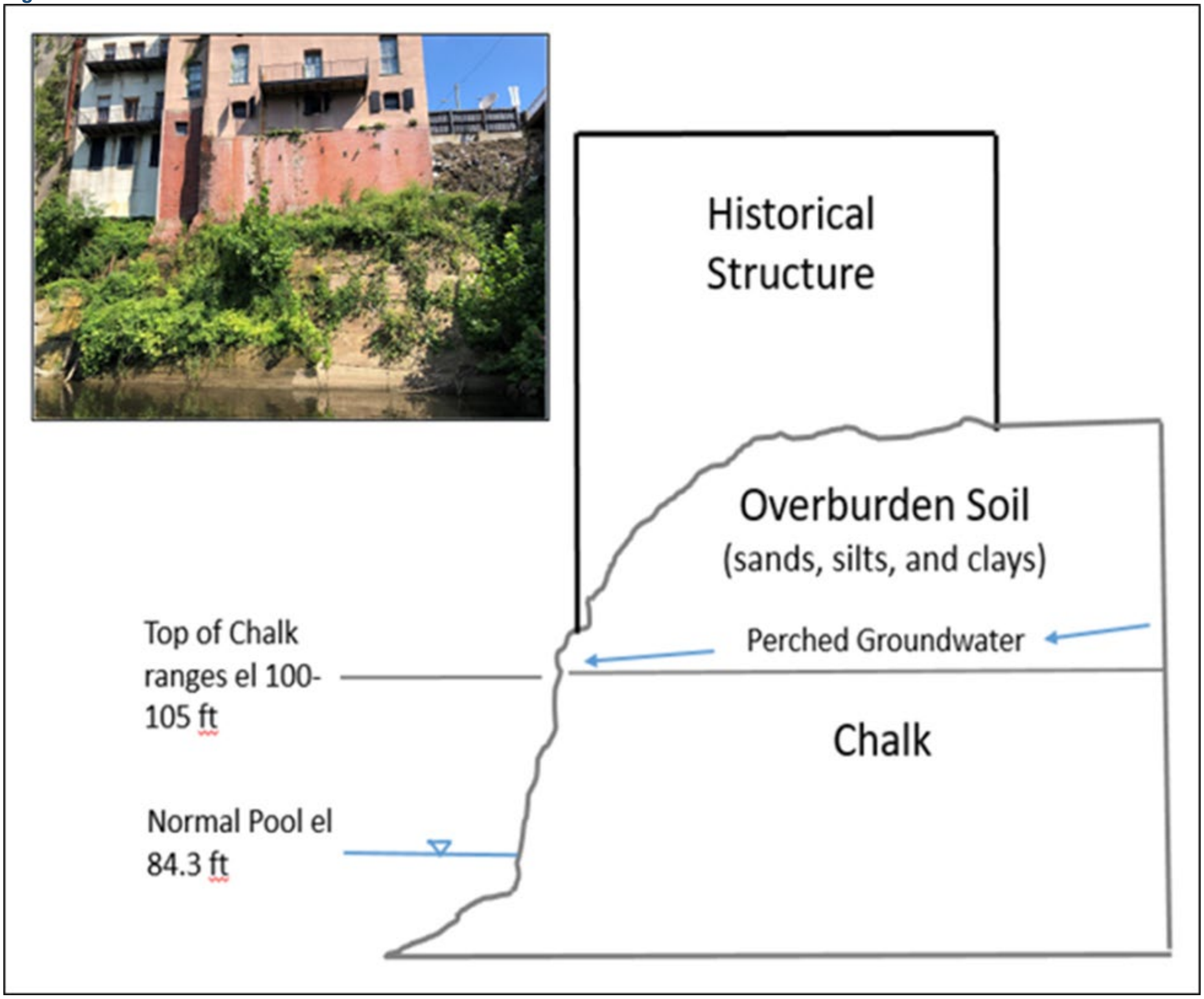
A.4.6.1.1.5. Sluice Gate and Pump Station (Beaver Dam Branch)

This measure was considered to prevent backflow of water from the Alabama River up the Beaver Dam Branch tributary into communities in Ward 1. This consisted of a sluice gate located under Dallas Avenue that could be closed during high flows along the Alabama River. A pump station would prevent the backup of water along the tributary. This was carried forward into the initial array of alternatives, but quickly screened based on the limited number of structures affected in Ward 1.

A.4.6.1.2. *Bank Stabilization*

As previously discussed in Section A.4 Formulation of Alternatives, this study included non-traditional flood risk management measures such as streambank stabilization which were included in the alternative analysis. Streambank stabilization was considered due to the benefits of protecting existing buildings along the river bank from structural failure that could result in the buildings collapsing into the Alabama River. Many historical buildings are situated along the riverbank between Franklin and Church Streets. Their foundations appear to be set in the overburden alluvial deposits, with little to no soil coverage on the riverside of the foundation. The chalk is somewhat impervious, causing concentrated groundwater to exit the bank slopes within the overburden material as this layer becomes saturated. This continual process could potentially result in material loss beneath the building foundations which, over time, would destabilize the buildings. Figure A-52 shows a generalized cross section of the geology of the river bank.

Figure A-52: Illustrated cross section of the downtown Selma bluffs



The interface of the overburden soils and underlying chalk fluctuates from approximate elevation 100 to 105 ft in the Study Area. When comparing this to river elevation, it puts the boundary of the two layers approximately 15 to 20 ft above the normal pool level of 84.3 ft. According to historical hydrologic data, this layer would see loading due to the river cresting at around the 0.5 AEP (2-year) flood event. This a fairly frequent loading and shows that minor flooding of the River could contribute to the building instability.

In addition to flooding, there were other possible contributors of building instability that are not linked to flooding. Historical and current photos show that there is a history of allowing vegetation to grow in the slopes where the building foundations are set. At times, this vegetation appears to have been removed, allowing for root systems to rot, and thus, allowing voids within the foundation soils to form.

A.4.6.1.3. *Bankline Stabilization Options*

This option consists of measures used to stabilize the bankline and protect structures such as buildings located along the river bank from experiencing failure due to erosion. Construction methods, presented as “options”, included a range of river shoreline stabilization techniques that were based on similar USACE projects. Bankline stabilization methods considered are further described in the below sections.

A.4.6.1.3.1. Bankline Stabilization Option 1, Sheet Pile Wall

This option consists of driving sheet piles into the ground to form a continuous wall. The sheet pile would be driven to the necessary embedment as determined by design. Additionally, dependent upon the final configuration, the sheet pile wall would likely require tie backs at a set spacing along the wall, anchored into the existing earth on the inland or dry side of the wall.

Vibrations from the placement (driving) of the sheet-pile wall could affect existing structures and foundations which could lead to failure of the structures. Contractors may be reluctant to assume the liability for this construction method. Because this variant of the alternative could negatively impact the stability of the historic structures along the bankline, this option was screened from further evaluation and comparison.

A.4.6.1.3.2. Bankline Stabilization Option 2a/b, Riprap and/or Extension

This option consists of reinforcing the bank by providing a large amount of riprap/large stone to the existing bank, creating a more gradual slope that extends out into the river.

This construction method presents both constructability and aesthetic concerns. This method would require a severe setback and the toe would extend far into the Alabama River, which would cause navigation impediments. As such, this configuration was screened out from further analysis.

A.4.6.1.3.3. Bankline Stabilization Option 3, Cast in Place

This option consists of dewatering, excavating, prepping the foundation, constructing formwork, and pouring a continuous cast-in-place concrete wall along the length of bank to be stabilized.

Although it would be aesthetically pleasing, the requirement for coffer dams and dewatering would add a significant amount to the cost of construction. Environmental impacts resulting from the dewatering would also be substantial. Therefore, this configuration was screened out from further analysis

A.4.6.1.3.4. Bankline Stabilization Option 4, Solider-Pile Wall and Riprap

Bankline stabilization utilizing a soldier pile wall consists of installing intermittently spaced piles (i.e., soldier piles) into the ground surface, which form part of the main structural resisting system. As opposed to the driving method of embedding the sheet piles, soldier piles can be installed into pre-drilled holes and grouted in-place. Horizontally spanning members, commonly referred to as lagging, span between the soldier piles and collect most of the retained earth pressures which are then transferred to the soldier piles. Riprap can be used at either end of the wall structure to help protect from erosion and scouring.

Since driving the piles can be avoided, construction of a soldier pile wall and placement of riprap is not likely to affect existing structures and foundations. It also presents the least environmentally damaging impacts to natural resources, cultural artifacts, and

Unexploded Ordnances (UXO(s)). Therefore, this configuration was selected as the Bank Stabilization structural design for Alternative 4.

A.4.6.2. *Site Specific Non-Structural*

A.4.6.2.1. *Buyout 1 option of 300 parcels:*

Buyout 1 consists of the buyout and removal of 300 structures in Ward 8 Figure A-53 below shows the areas buyouts were considered.

For owner-occupants, Housing of Last Resort will ensure availability of DSS housing, notwithstanding cost implications. For tenant-occupants, preliminary market research has indicated a shortage of DSS rental accommodations that would be in the financial capability of those displaced, and within the general project area. This negatively impacts the ability to implement this variant of the alternative. In the opinion of USACE - RE, the City of Selma does not have sufficient manpower to manage and/or execute this level of relocation assistance/buyout IAW P.L. 91-646. This option was screened out as a possible component of the TSP.

A.4.6.2.2. *Buyout 2 option of 157 Parcels:*

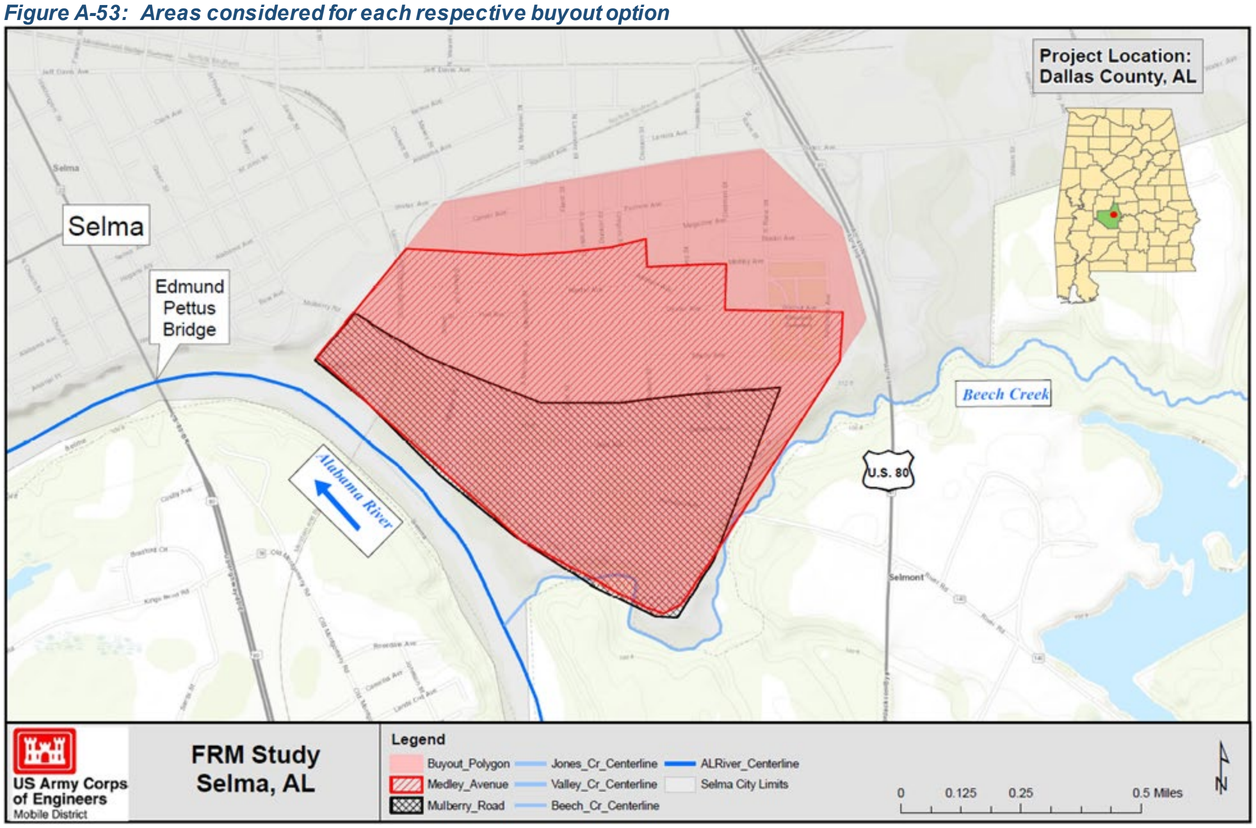
For owner-occupants, Housing of Last Resort will ensure availability of DSS housing, notwithstanding cost implications. For tenant-occupants, preliminary market research has indicated a shortage of DSS rental accommodations that would be in the financial capability of displaced and within general project area. This negatively impacts the ability to implement of this variant of the alternative. In the opinion of USACE - RE, City of Selma does not have sufficient manpower to manage and/or execute this level of relocation assistance/buyout IAW P.L. 91-646. This option was screened out as a possible component of the TSP.

A.4.6.2.3. *Buyout 3 option of 25 Parcels:*

Since 29 owners would be involved, and several of these would involve non-residential displacements, hypothetically a P.L. 91-646 involuntary relocation may be plausible. Nevertheless, shortage of DSS tenant-based housing would be a prevailing issue impacting the project's schedule, as well as questions regarding the capability of the City of Selma to execute the plan in accordance with P.L. 91-646. Discussions are currently underway with City Attorney/Planning Office regarding level of City's Capability. In the opinion of USACE-RE, the City would require additional specialized manpower to implement a P.L. 91-646 buyout/relocation alternative. Contractor resources could be used, but the City would be responsible for execution of all P.L. 91-646 provisions. This option was incorporated as a possible component to the TSP.

Pursuant to an analysis of the prevailing rental markets in the City of Selma conducted in December 2019, the market survey indicated an inadequacy of available Decent, Safe, and Sanitary (DSS) tenant dwellings, effectively rendering a larger-scale buyout effort nonviable to effectively execute within the City in accordance with the requirements of the Uniform Relocation Act, P.L. 91-646, as amended.

Figure A-53: Areas considered for each respective buyout option



A.4.7. *Initial Array of Alternatives*

The “future with project condition” is the most likely condition expected to exist in the future if a specific project is undertaken. A total of ten alternatives based on the site specific measures discussed above were considered for the Selma Flood Risk Management Study. Of these, three were structural, one was nonstructural, and the remaining seven were combinations of structural plans with the nonstructural plan. In addition, a floodplain management and emergency evacuation plan could be tailored to any of these alternatives to further address responsible floodplain management and life safety risk. The nonstructural plan did not include a recreation plan in the initial array. A description of the alternatives is listed in Table A-10 below.

Table A-10: Initial Array of Alternatives

Array of Alternatives	Plan Description
No Action Alternative (NAA)	No Federal undertaking would occur and the results would be consistent with FWOP conditions.
Alt. 1: Non-Structural (A-Buyouts, B-Raise Structural Elevation, Structural move)	There are two (2) non-structural options considered for the same group of structures. Alternative 1.A includes buyouts which entails the acquisition of parcels, relocation of inhabitants, and demolition of structures. Alternative 1.B includes elevating structures and relocations within Ward 8.

Array of Alternatives	Plan Description
Alt. 2: 1967 Selma Levee	1967 Selma Levee with Selmont Levee alignment with floodgates/pumps where needed, and buyouts as necessary
Alt. 3: Optimized (Short) Selma Levee	Shortened/optimized levee alignment, U.S. Highway 80 tie in, floodgates/pump station where needed, and buyouts as necessary
Alt. 4: Bankline Stabilization	Provide bank stabilization along all or part of RM 256-261
Alt. 5: Bankline Stabilization + Buyouts	Combines Alternatives 4 & 1.A-Buyouts.
Alt. 6: Optimized Selma Levee + Buyouts + Bank Stabilization	Combines Alternatives 3 & 4 & Partial Non-Structural Alt.1 in areas not within the Optimized Levee alignment
Alt. 7: Optimized Selma Levee + Valley Creek Levee + Pump Station & Sluice Gate + Bank Stabilization	Combines Alternatives 3 & 4 & a smaller levee at Valley Creek & a pump station with a sluice gate at Beaver Dam Branch (maximum structural protection)
Alt. 8: Optimized Selma Levee + Valley Creek Levee + Buyouts + Bank Stabilization	Combines Alternative 6 plus Valley Creek levee (only purchase, relocation or raising elevation in the Ward 8 considered)
Alt. 9: Optimized Selma Levee + Valley Creek Levee + Buyouts	Combines Alternative 3, levee at Valley Creek (purchase, relocation or raising elevation in the Ward 8 considered)
Alt. 10: Optimized Selma Levee + Valley Creek Levee + Pump Station with Sluice Gate	Alternative 7 with No bankline stabilization (maximum structural protection without bank stabilization)

A.4.7.1. *Initial Screening*

The initial round of screening was presented at an IPR held June 26, 2019 and captured in a Memorandum to the Chief of Planning and Policy Division at South Atlantic Division dated August 1, 2019. As a result of this meeting, Alternative 1.B Elevating or Relocating of Structures out of Ward 8 was screened due to the age and condition of the structures. Levee alternatives 2 and 3 were also screened from further analysis, as preliminary professional judgment determined that these alignments would be cost prohibitive (both initial construction cost and maintenance), would not provide additional benefits, has the potential to have cultural and environmental impacts, and would likely induce flooding in the adjacent town of Selmont, Alabama. A number of recommendations for buyout options were made and it was requested that the PDT include recreation benefits as part of the array of alternatives. The PDT determined no additional benefits would derive from recreation in the proposed buyout area as Ward 8 is too far removed from the economic/tourism hub of downtown Selma. Further analysis of the economic/tourism benefits of downtown Selma is detailed in the Economic Appendix.

The team then further refined the remaining alternatives and identified sub-options for the buyout and bank-line stabilization alternatives that were presented at the IPR held October 9, 2019. Alternative 1.A was expanded to include sub-options for the removal of

25, 157, or 300 parcels; and a range of construction methods were presented for Alternative 4, each based on techniques employed at similar USACE projects. A more detailed discussion on the feasibility of each of the options considered are provided in Appendix C – Economics.

A.4.8. *Focused Array of Alternatives*

After further refinement and screening of the initial array, the Focused Array of Alternatives was selected and is summarized in Table A-11 below.

Table A-11: Focused array of alternatives evaluated for Selma Flood Risk Management study

Array of Alternatives	Plan Description
No Action Alternative	No Action Alternative
Alt. 1: Non-Structural (NS-1-Buyouts)	The non-structural measures would be optimized through cost evaluations and viewpoints.
Alt. 2: Optimized Selma (1967) Levee (L3)	Levee tying into existing road (L3)
Alt. 3: Optimized Selma Levee + Non-Structural Measure	Combines Alternatives 2 & Partial Non-Structural Alt.1 in areas not protected by the Optimized Levee
Alt. 4: Bank Stabilization	1500 feet of bank stabilization along Water Avenue
Alt. 5: Bank Stabilization + Buyouts	Combines Alternatives 1 & 4
Alt. 6: Optimized Selma Levee + Buyouts + Bank Stabilization	Combines Alternatives 2 & 4 & Partial Non-Structural Alt.1 in areas not protected by the Optimized Levee

A.4.8.1. *Screening of Focused Array*

The focused array of alternatives (Alternatives 1.A, and 2-6) were screened based on their ability to meet objectives, avoid/minimize constraints, adherence to the planning criteria, as well as their resiliency and sustainability. All alternatives received an equal preliminary comparison using Rough Order of Magnitude (ROM) costs, National Economic Development (NED), Regional Economic Development (RED), Environmental Quality (EQ), and Other Social Effects (OSE) analysis. Of the entire focused array, only Alternative 2 was screened from further analysis. Alternative 2 met the study objectives but did not avoid the study constraints, particularly, the City of Selma's ability to maintain a large levee system. More details are available in the Plan Formulation section of the main report. Furthermore, this alternative was screened because it was determined to be more costly and have the potential to induce greater environmental and cultural impacts when compared with Alternative 3.

A.4.9. *Final Array of Alternatives*

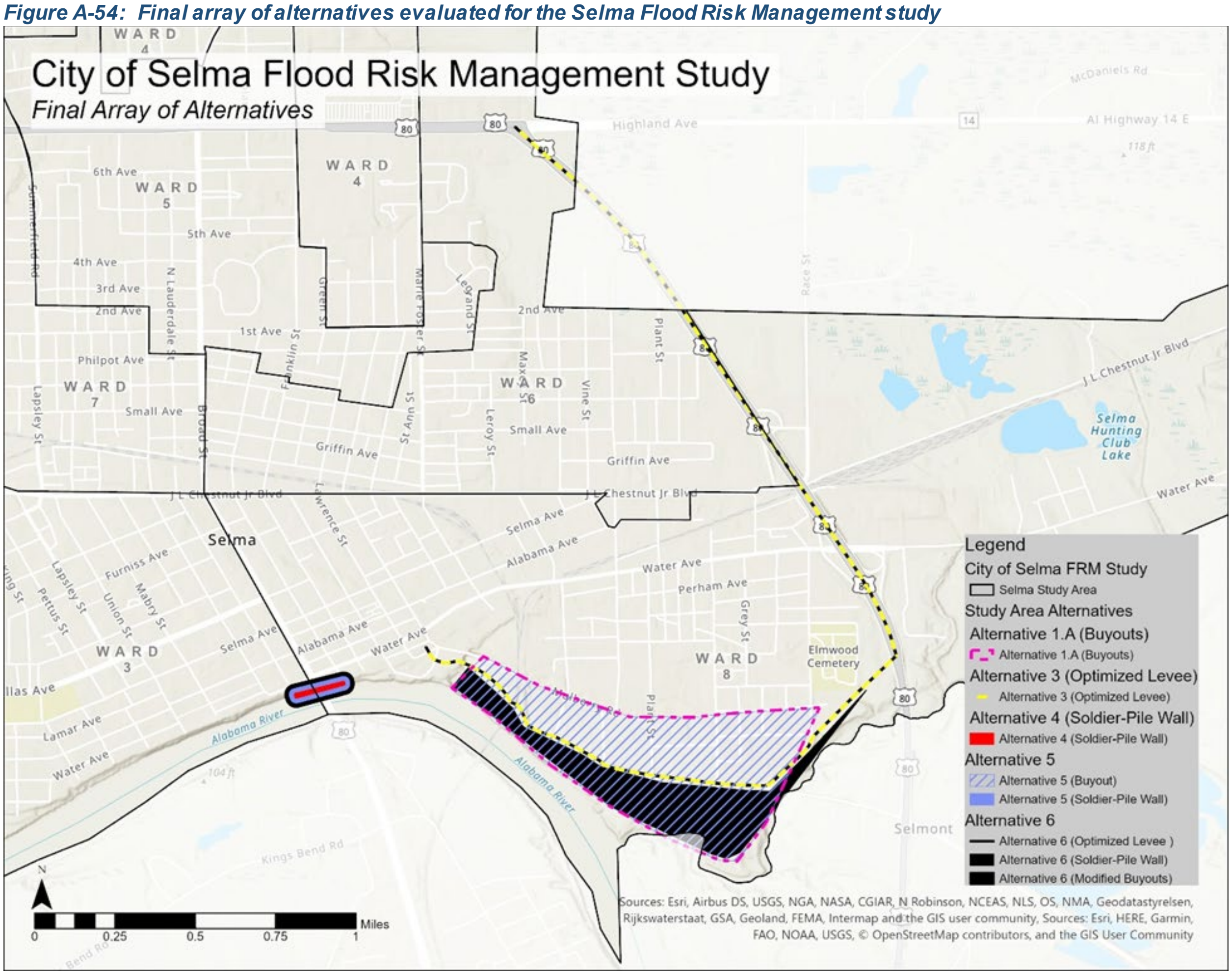
The final array of alternatives is shown on Figure A-54 and included the following:

- Alternative 1.A (Buyout);
- Alternative 3 (Optimized Levee);
- Alternative 4 (Soldier-Pile Wall);

- Alternative 5 (Soldier-Pile Wall and Buyout); and
- Alternative 6 (Combination of Alternative 1.A and 5, but with a modified buyout footprint to capture parcels within Ward 8 and outside the levee alignment).

Figure A-54 shows the location of all alternatives considered for the Final Array.

Figure A-54: Final array of alternatives evaluated for the Selma Flood Risk Management study

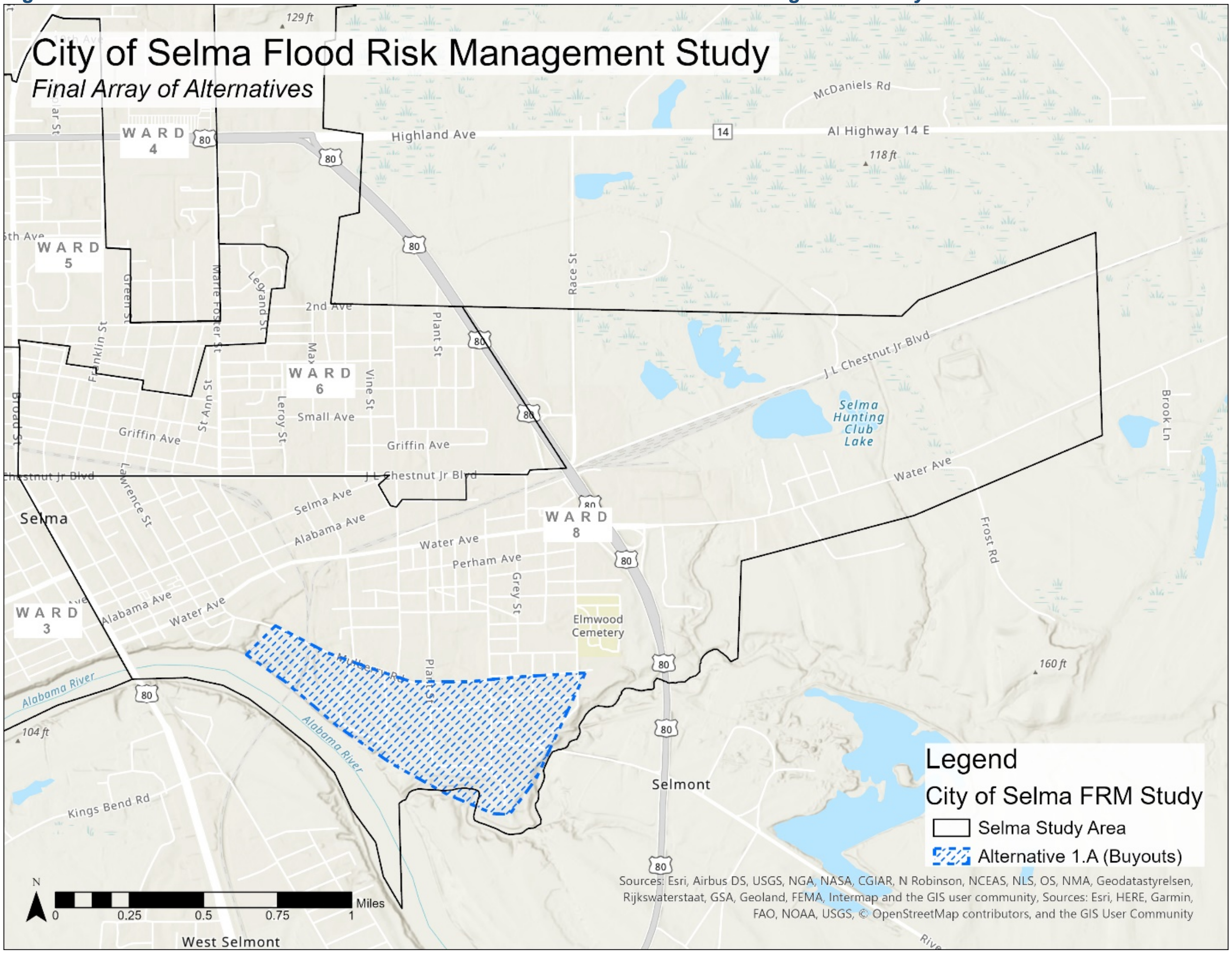


A.4.9.1. *Description of Final Array of Alternatives*

A.4.9.1.1. *Alt. 1A: Buyouts*

Alternative 1.A schematic is shown on Figure A-55 below. Approximately 25 parcels were identified within the buyout footprint encompassing approximately 170 acres. Implementation of this alternative would require acquisition of structures and relocation of inhabitants. Structures would then be demolished. Staging areas for demolition would be located within each parcel. This alternative would take approximately 2.7 months to complete.

Figure A-55: A schematic of the Alternative 1.A for the Selma Flood Risk Management Study.



A.4.9.1.2. *Alt. 3: Optimized Levee Alignment*

Alternative 3 is an optimized levee with two components: new levee construction and Highway 80 revetment and reinforcement (shown on Figure A-56). The full alignment would include approximately 1.6 miles of new levee construction across the southern portion of Ward 8 and approximately 2.0 miles of Highway 80 revetment and reinforcement for a total of 3.6 miles. The base of the new levee within Ward 8 would span approximately 94 feet, which would require a construction footprint of approximately 18 acres. Two flood gates would be placed at intersections along Highway 80. Table A-12 itemizes the quantities of fill material for each section of the alternative. Disposal areas would be required to place excavated material. Staging areas would also be required to contain all construction material necessary to build the levee and reinforce Highway 80; however, potential locations for this alternative have not been identified. This alternative would take approximately 21.5 months to complete.

Figure A-56: A schematic of the Alternative 3 for the Selma Flood Risk Management Study.

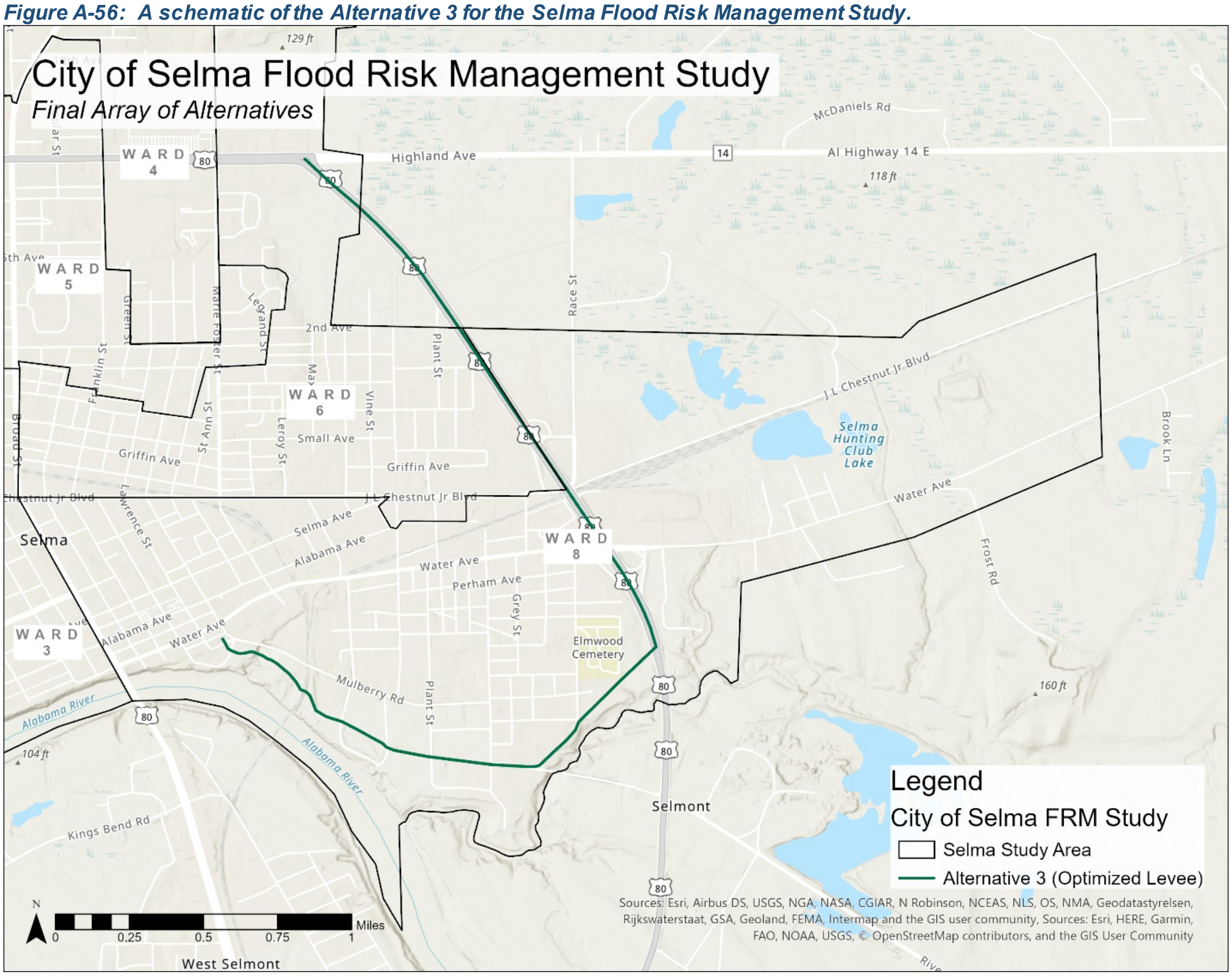


Table A-12: Levee Alignment Fill Materials and Quantities in Cubic Yards (cy)

Material	Levee (1.6 miles)	Highway 80 (2.0 miles)
Clay Core	80,592 cy	40,000 cy
Select Fill	241,777 cy	60,000 cy
Total Fill	322,369 cy	100,000 cy

A.4.9.1.3. *Alt. 4: Soldier-Pile Wall*

Alternative 4 includes the construction of a new solider pile for the purpose of bankline stabilization along the Alabama River bank near downtown Selma (Figure A-57). Staging and construction of the solider pile wall would occur from the Alabama River and a conceptual schematic of the soldier pile wall is shown on Figure A-58. Table A-13 is a preliminary/conceptual estimation of materials and quantities necessary to construct the soldier pile wall. Preliminary structural calculations are enclosed in Section A.9. Approximately 94 H–Piles would be placed at approximately 8 feet on center throughout the design length of 750 feet. The H-Piles would be installed into pre-drilled holes and grouted/concreted in-place. Tiebacks would be required for each H-Pile. Concrete wall panels will be placed between each H-Pile and rip-rap would cap each end. A geotechnical investigation is tentatively scheduled to be completed in March 2021, at which time the proposed layout and footprint of the Soldier-Pile Wall would be finalized.

At this phase of the study it has not been determined if clearing and grubbing of the riverbank would be required; however the maximum potential vegetation removal would encompass eight (8) acres. In total, this alternative would take approximately 15.6 months to complete.

Figure A-57: A schematic of the Alternative 4 for the Selma Flood Risk Management Study.

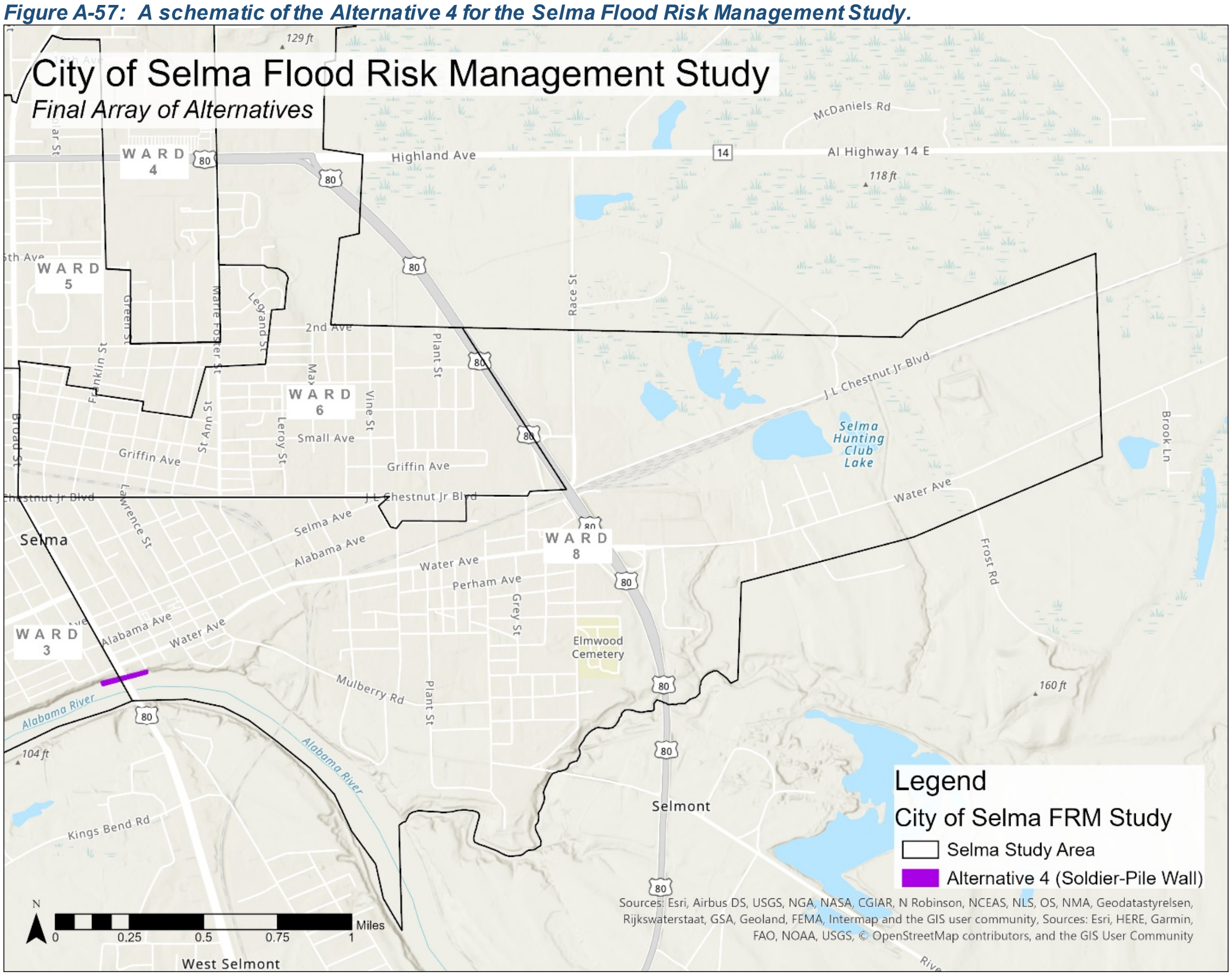
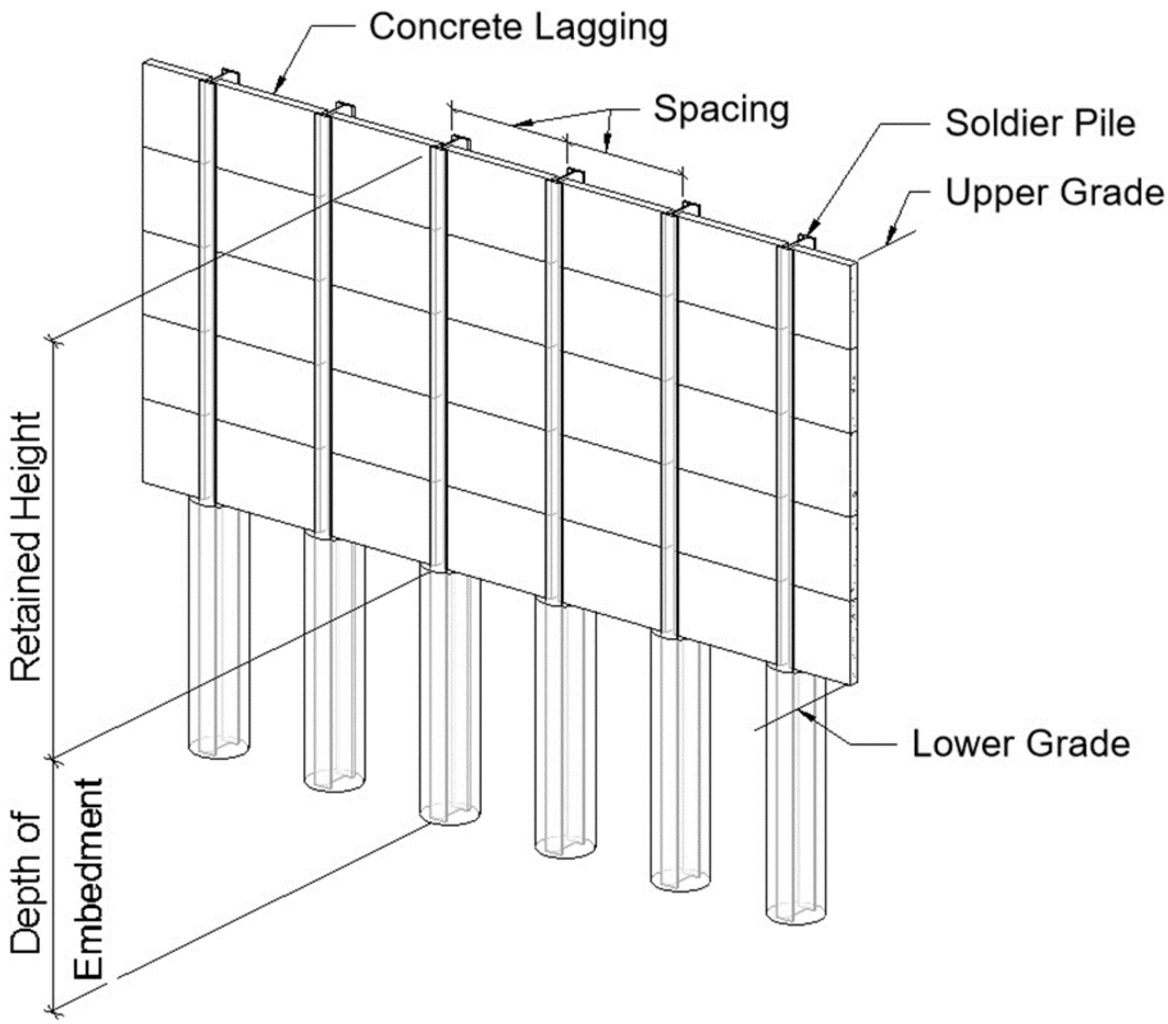


Table A-13: Soldier-Pile Wall Materials and Quantities

Material	Soldier-Pile Wall (750 linear ft)
H-Piles	94 (approximate)
Steel Anchor Tiebacks	94 (approximate)
Concrete Panels (4 feet x 8 feet x 4 inches)	22,500 square feet (sq ft)
Granular Fill	12,500 cubic yards (cy)
Riprap	3,333 cy
Total Fill	**15,833 cy**

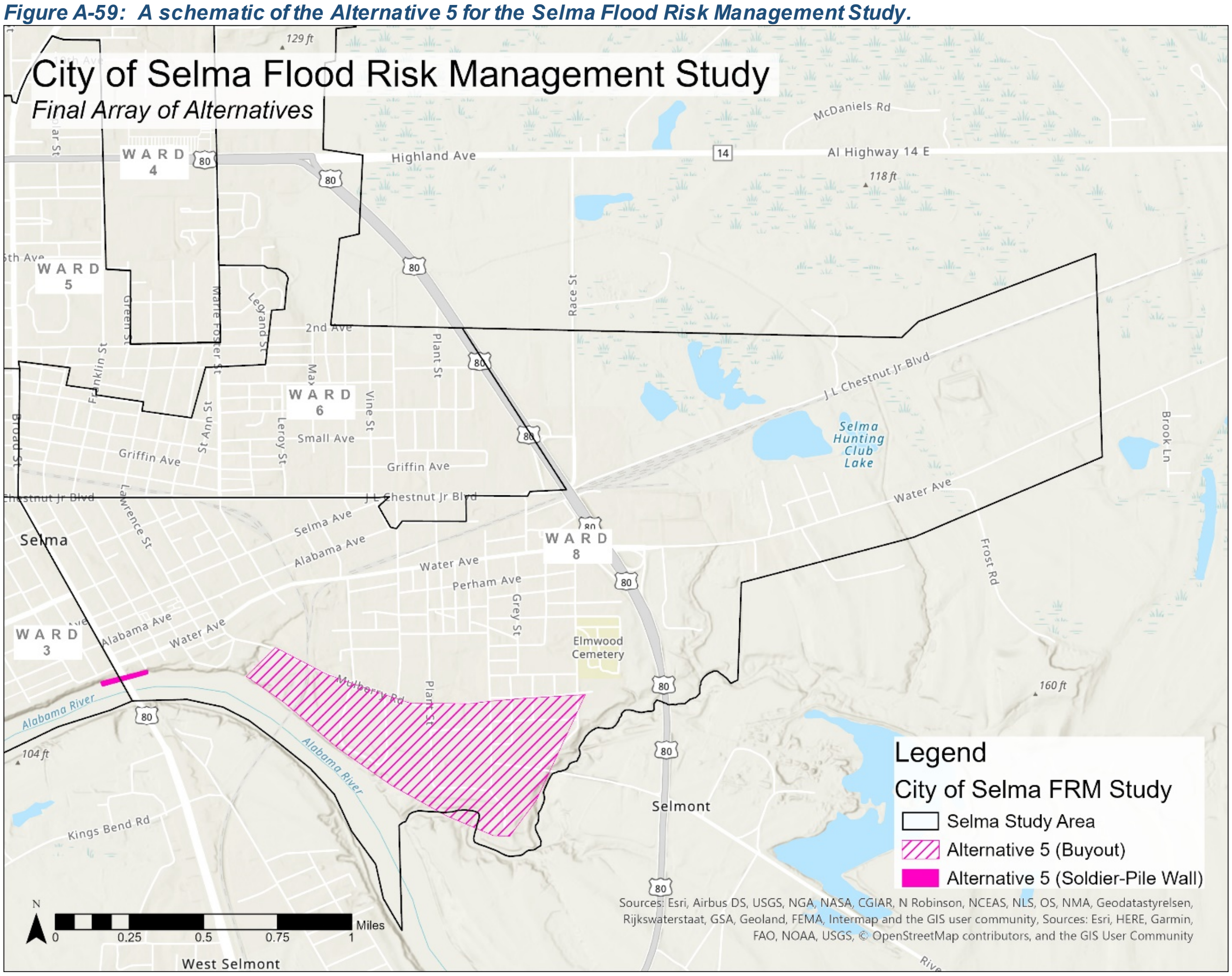
Figure A-58: Example schematic of a constructed soldier-pile wall.



A.4.9.1.4. *Alt. 5: Soldier-Pile Wall and Buyout*

Alternative 5 is a combination of Alternatives 1.A and 4. A schematic of the soldier pile wall and area buyouts were considered is shown on Figure A-59. This alternative would take approximately 18.3 months to complete.

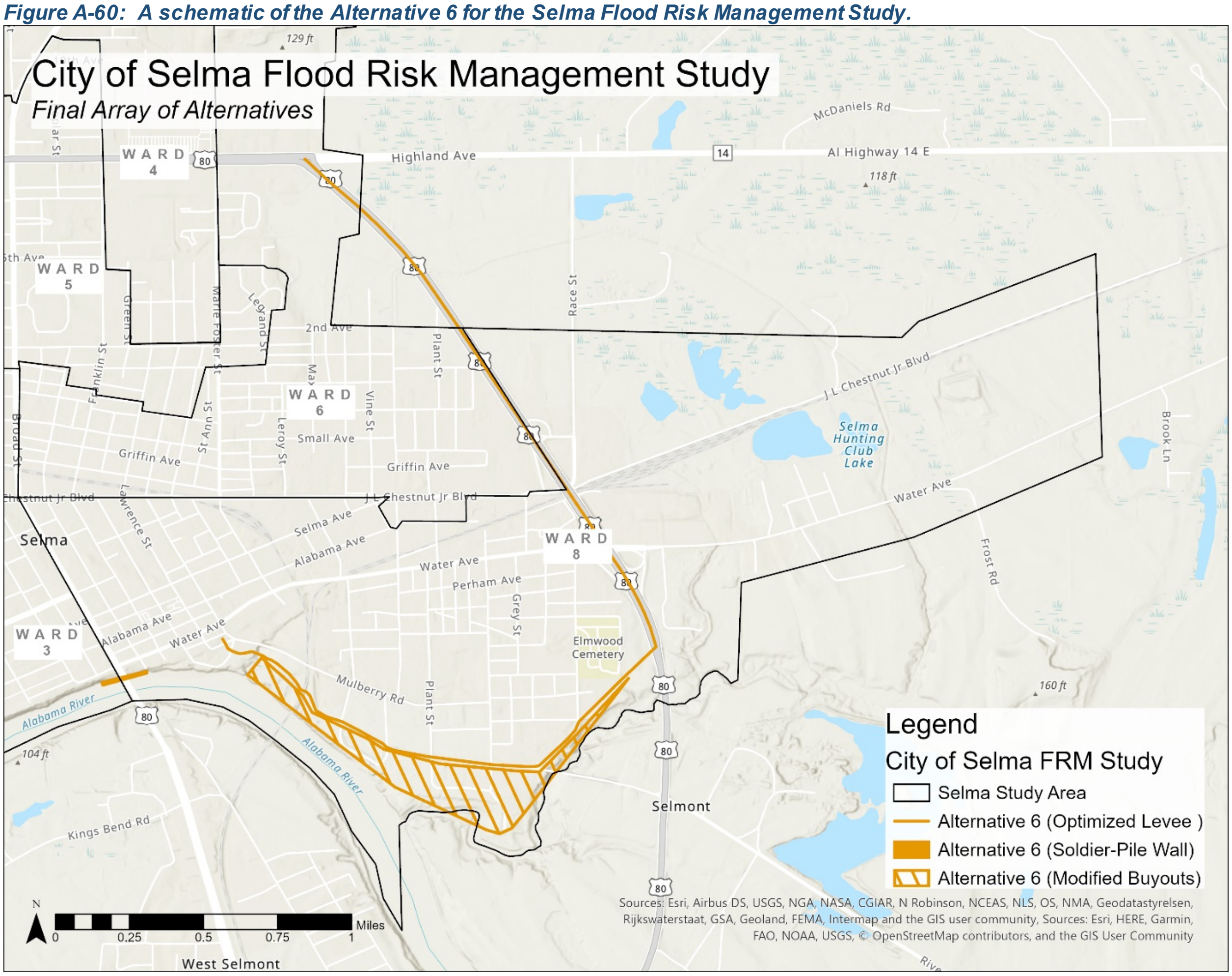
Figure A-59: A schematic of the Alternative 5 for the Selma Flood Risk Management Study.



A.4.9.1.5. *Alt. 6: Optimized Levee Alignment, Soldier-Pile Wall, and Buyout*

Alternative 6 is a combination of Alternatives 3 and 5 with the exception of differences in the buyout footprint to account for buyouts of structures outside the levee area along the Alabama River (. A total of nine (9) parcels in Ward 8 identified within the proposed 68-acre buyout footprint for this alternative would be located outside the levee alignment. This alternative would take approximately 26.9 months to complete.

Figure A-60: A schematic of the Alternative 6 for the Selma Flood Risk Management Study.



A.4.9.2. *Hydraulic Modeling of Final Array of Alternatives*

Hydraulic modeling of the final array of alternatives was performed to support the economics evaluation of any alternative tied to flood inundation of structures. There were five alternatives carried forward to the final array. Bankline stabilization measures did not involve any additional modeling and were not evaluated based on reduced damages.

Of the five alternatives included in the Final Array of Alternatives, four (4) were directly tied to flood inundation including Alterative 1 (Buyouts), Alternative 3 (Optimized Levee), and Alterative 6, which is a combination of 2 measures. Of those alternatives, there were only two unique measures considered, including the Optimized Levee and Buyout Option 3. Hydraulic modeling of alternatives are discussed below.

A.4.9.2.1. *Alternative 1.A: Buyout Option 3 Modeling*

As discussed above, buyout option 3 consists of buying 25 parcels located near the bank of the Alabama River in Ward 8. When determining inundation for buyout alternatives, no additional hydraulic modeling was required. The future without project conditions modeling and inundation is utilized in HEC-FDA to determine damages with and without structures to determine economic benefit.

A.4.9.2.2. *Alternative 3: Optimized Levee Modeling*

Modeling of the optimized levee involves new levee construction and Highway 80 revetment and reinforcement. The full alignment would span approximately 1.6 miles of new levee construction across the southern portion of Ward 8 and approximately 2.0 miles of Highway 80 revetment and reinforcement for a total of 3.6 miles. This levee alternative was designed to provide complete protection for Wards 8 and 6 up to the 0.01 AEP event. This elevation corresponds to a minimum top elevation of 120.6 feet-NAVD88 with a top width of 10 feet and an average bottom width of 94 feet.

To model this alternative, the levee dimensions where burned directly into the terrain. Then a 2D area connection was modeled, connecting an internal 2D area to an external 2D area. The 2D area connection was modeled as a weir with a coefficient of 1.5. Figure A-61 shows a schematic of the levee burned into the terrain. Figure A-62 shows the weir used to model the levee crest.

Figure A-61: Image depicting the burned in levee alignment for the L3 Optimized Levee

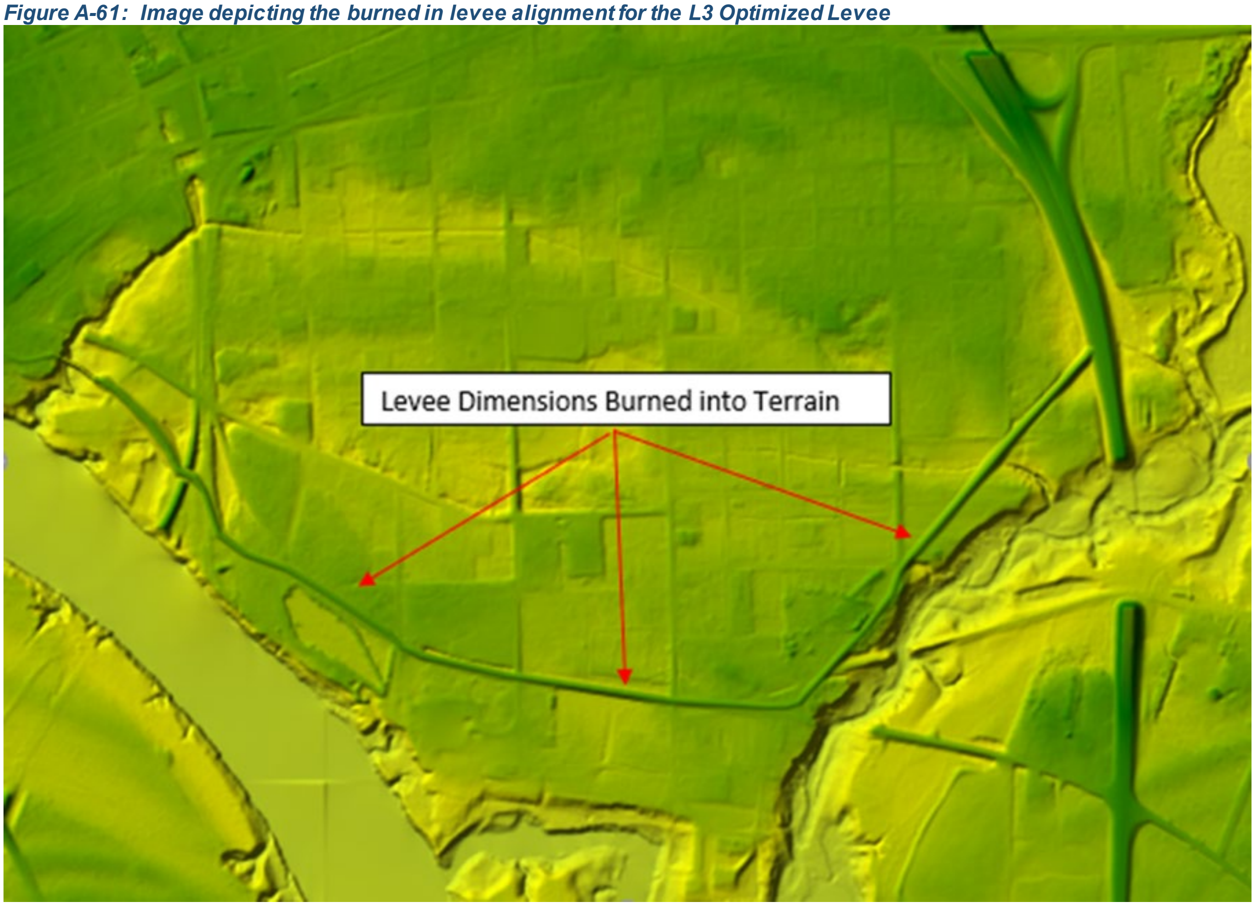
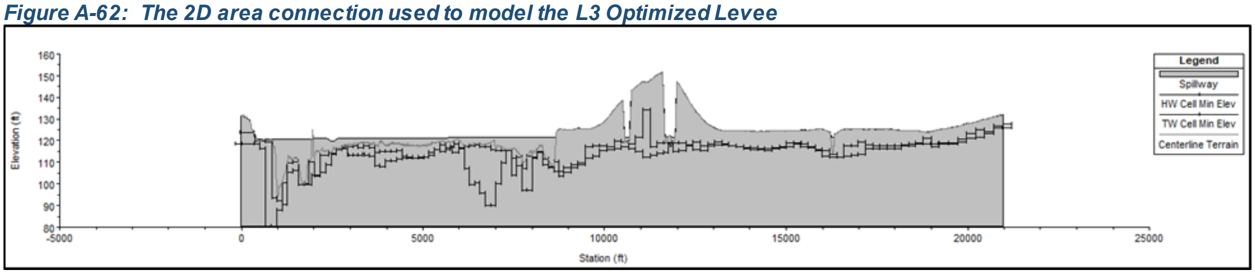


Figure A-62: The 2D area connection used to model the L3 Optimized Levee



Results of the modeling show that the levee does provide protection for wards 6 and 8 up to the 0.01 AEP event. For less frequent events, the levee is overtopped producing flooding in the interior areas. Figure A-63 shows the levee modeled with the 0.01 AEP event. Figure A-64 shows the levee modeled with the 0.002 AEP event.

Figure A-63: 0.01 AEP flood inundation for the L3 Optimized Levee

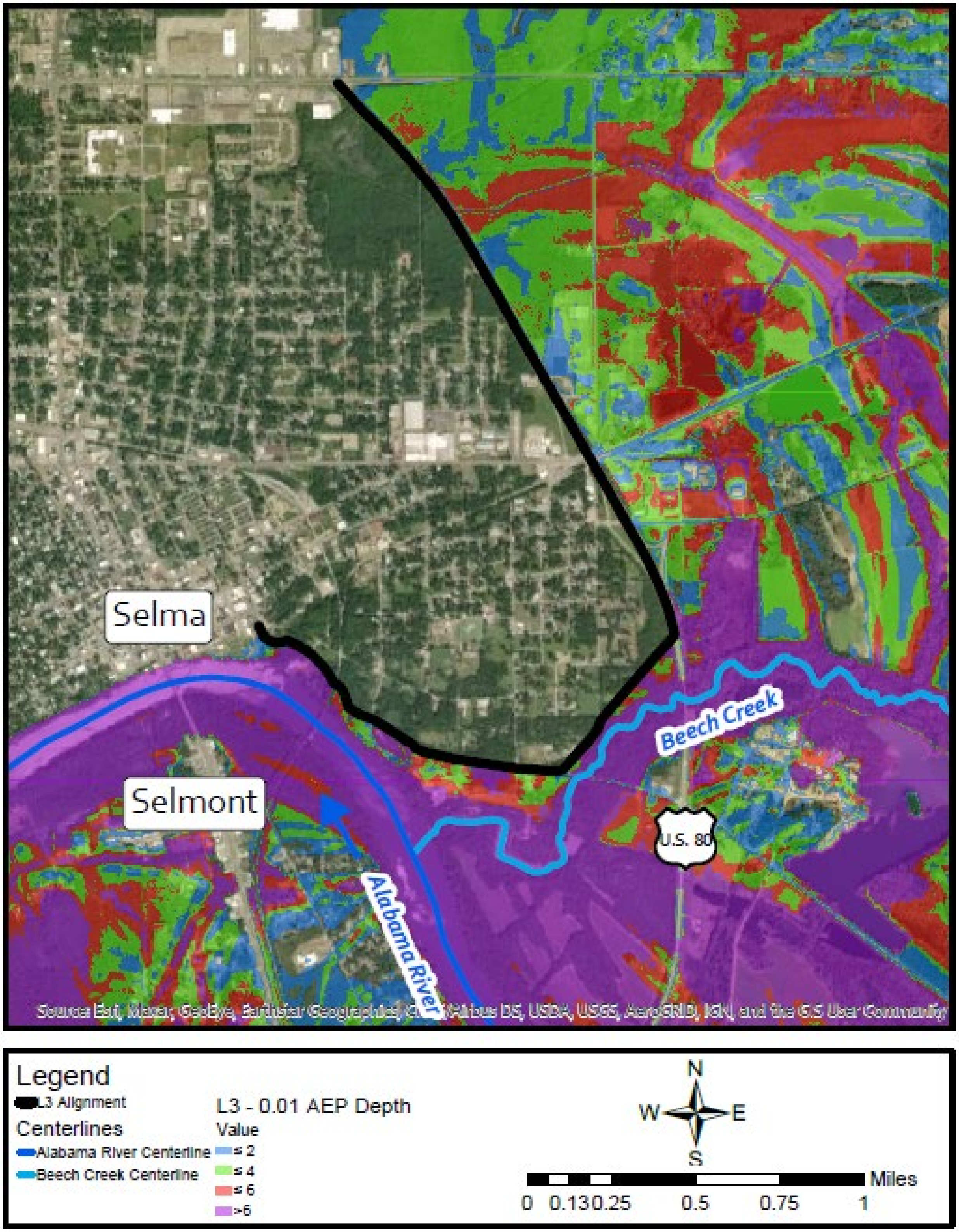
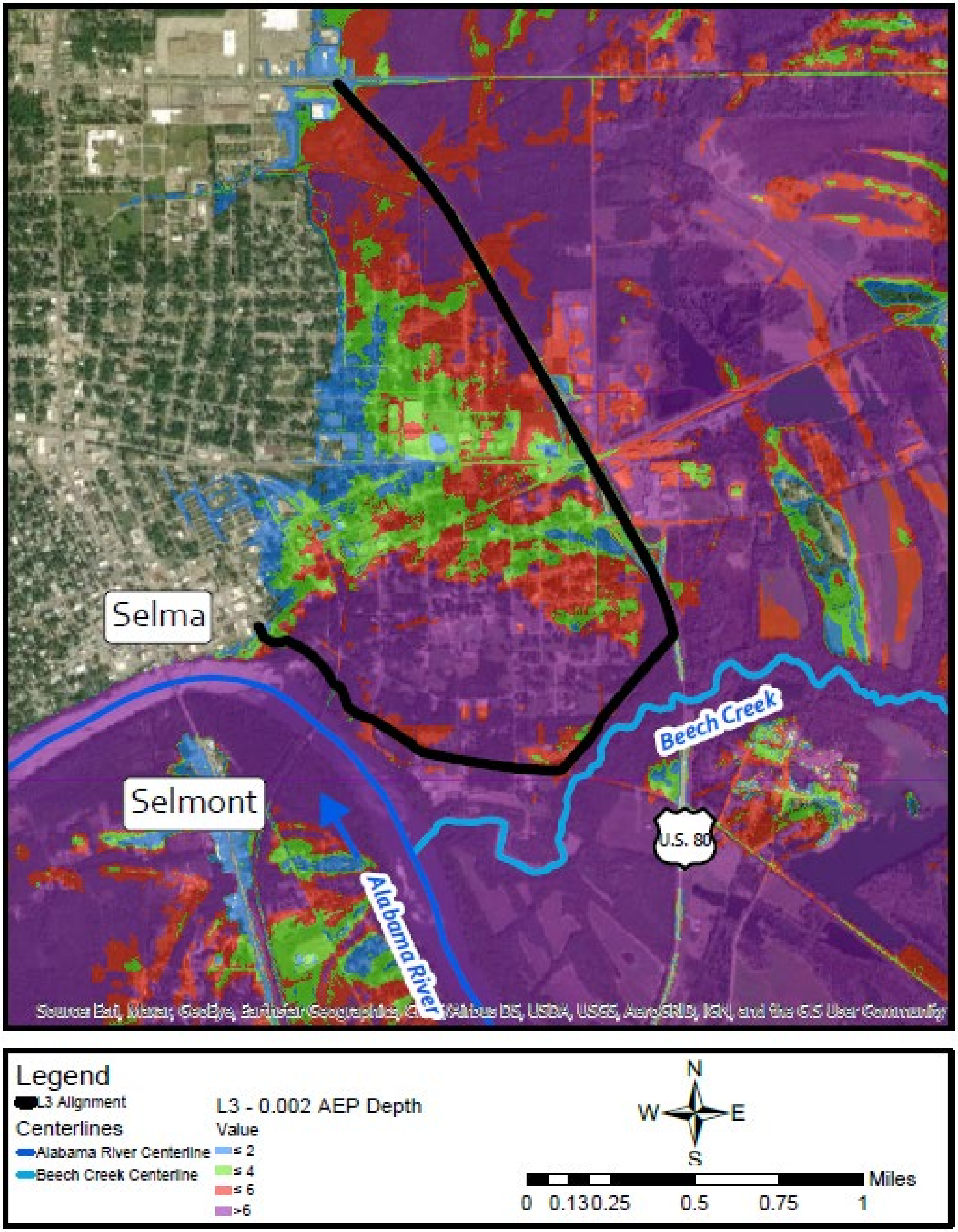
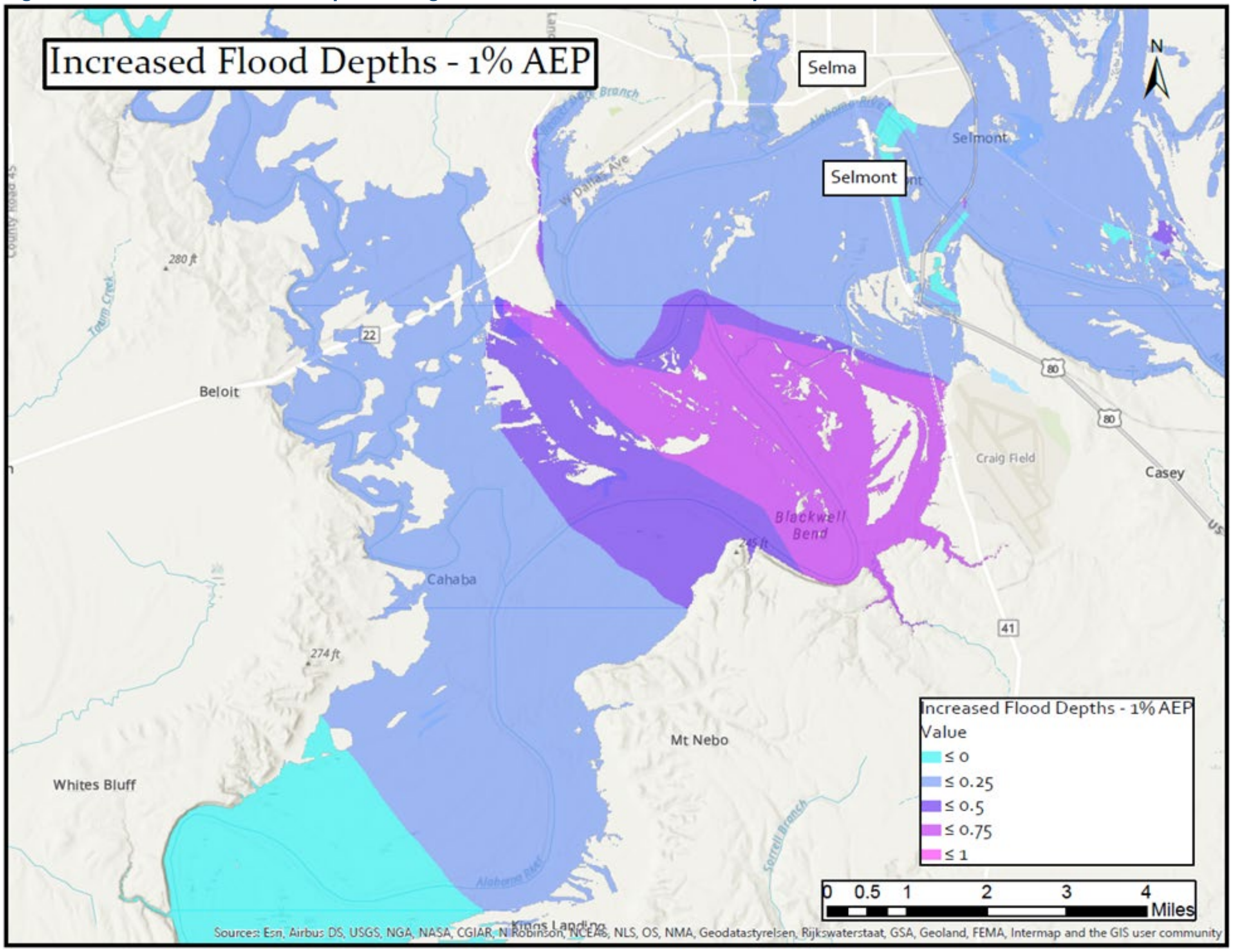


Figure A-64: 0.002 AEP flood inundation for the L3 Optimized Levee



Hydraulic modeling results show that flood risk reduction is provided by the selected levee alignment; however, there are several factors that would require further evaluation. First, as this levee does overtop for extremely infrequent events, a quantitative assessment of residual life risk would need to be performed. Second, consideration would need to be given to mitigation of induced flooding to any areas outside the levee system caused by constricting the flood plain. Results of the model show that there is increase depth outside the levee system of populated areas across the river as well as downstream of Selma. Figure A-65 shows this increase in flood depth for the 0.01 AEP.

Figure A-65: Increase in flood depths along the Alabama River for the L3 Optimized Levee



A.4.9.2.3. *Alternative 4: Soldier Pile Wall*

As previously discussed in Section A.4 Formulation of Alternatives, hydraulic modeling was not performed to support this alternative as no damages were derived within the HEC-FDA model. This study utilized the approach to formulating a project as applied under Section 14 of the Flood Control Act of 1946. As in Section 14 projects, the formulation and evaluation focus on the least cost alternative solution and that alternative plan is considered to be justified if the total cost of the alternative is less than the costs to relocate the threatened facility.

A.4.9.2.4. *Alternative 5: Solder Pile Wall and Buyout Option 3*

Additional hydraulic modeling was not performed to support this alternative as no damages were derived thought HEC-FDA model for the soldier pile wall. Buyout option 3 was modeled as a standalone measure for Alternative 1A and, was not incrementally justified. Furthermore, no damages where derived through HEC-FDA for the soldier pile wall. This study utilizes the approach to formulating a project as applied under Section 14 of the Flood Control Act of 1946. As in Section 14 projects, the formulation and evaluation focus on the least cost alternative solution and that alternative plan is considered to be justified if the total costs of the alternative is less than the costs to relocate the threatened facility.

A.4.9.2.5. *Alternative 6: Soldier Pile Wall, Optimized Levee and Buyout Option 3 Modified*

No additional modeling was done to support this alternative, because Buyout Option 3 and the Optimized Levee standalone alternatives could not be incrementally justified. Therefore no further consideration was given to this alternative.

A.4.10. *Tentatively Selected Plan*

Ultimately, Alternative 4, (solder-pile wall), was selected as the recommended plan with the addition of an emergency evacuation plan and floodplain management plan to address flood and life safety risk. The TSP recommendation is not based on NED benefits but on several other factors; some unrelated to engineering. These include community cohesion and the national and historical significance of the structures the solder pile wall would protect. The solider pile wall addresses the most pressing need of the city, which is protection of historic structures along the bank of the downtown area. More information on the determination of this as the TSP can be found in the Plan Formulation Section of the main report.

There is still the outstanding issue of life safety, especially in Wards 6 and 8. As another structural or non structural measure was justified in addressing this issue, it was decided to include an emergency evacuation plan and floodplain management plan discussed in Section A.4.5 to address this. All other structural and non-structural measures were screened from the study. Buyouts were determined to negatively affect community cohesion and also were determined to have negative net annual benefits. All other structural alternatives were deemed impractical or had severely negative net annual benefits. It was therefore determined that the driving factor for addressing flooding in the city was life safety risk as opposed to a reduction in economic damages. An emergency evacuation plan and floodplain management plan would adequately address these risks with little cost to the federal government and the sponsor. A draft of this plan will be developed and included as part of the final feasibility report.

A.5. Future Work

At the time of producing this appendix there, were several outstanding engineering issues to be addressed. All activities share the objective of improving confidence in cost estimates supporting the selected plan.

Detailed geotechnical investigations have not occurred to date. Engineering Division will shortly begin this work to support the refinement of the design of the soldier pile wall. A better understanding of the subsurface conditions will buy down the highest risk that exists, which is considered to be the length requirements of the 94 soldier piles supporting the embankment stabilization. This work is anticipated to be complete in early FY 21. Additional topographic surveys are being performed to further support a feasibility-level design and to refine costs of the wall. This includes Light Detection and Ranging (LiDAR) survey of the vertical banks as well as surveys of the upland areas along the bank.

An additional unexploded ordinance (UXO)survey will be performed to determine if there are any unexploded ordinances in the area as many Civil War munitions where produced in Selma.

A.6. Cost Estimates

A Total Project Cost Summary (TPCS) was prepared for each alternative. The TPCS combines the real estate (RE) costs, construction costs, contingency, preconstruction engineering and design (PED), and construction management (CM), and applies escalation factors to calculate a first cost and total project cost for each alternative. The first cost is used for the economics analysis in conjunction with the damage reduction estimates to determine net benefits for each alternative. Table A-14 shows the first costs, estimated operations and maintenance (O&M) costs, and estimated construction durations for each of the final array of alternatives. More information is available on the development of costs in Appendix F.

Table A-14: First costs, estimated O&M costs, and duration of construction for final array of alternatives

Alternative	First Cost	Annual O&M	Construction Duration
Alt 1. Acquisition and Buy-Out	$4,950,000	$0	2.7 Months
Alt 3. Optimized Levee Alignment	$74,040,000	$27,000	21.5 Months
Alt 4. Soldier Pile Retaining Wall and Flood Management Plan	$27,537,000	$4,000	15.6 Months
Alt 5. Soldier Pile Retaining Wall and Buy-Out	$32,400,000	$4,000	18.3 Months
Alt 6. Combination Alternative	$104,860,000	$29,500	26.9 Months

A.7. Risk and Uncertainty

The Selma FRM TSP is unique in that it does not include any traditional FRM structural or non-structural measures. Then bank line stabilization measure addresses risk to historic structures, and to some small extent, life safety to anyone occupying a building nearing failure along the bank line. Risk drivers with respect to this measure are mostly independent of hydrologic conditions on the Alabama River. That is, hydraulic model variability and uncertainty have no effect on this aspect of the TSP. The major uncertainties associated with this measure are geotechnical driven costs. At the time of this report, there has been no geotechnical investigations to the subsurface where soldier piles plan to be driven or on the upland area where tiebacks will be placed for wall stability. These investigations are planned for the near future and will substantially buy down the uncertainty and, therefore, the cost risk associated with this measure.

Another risk associated with the implementation of this measure is the stability of the foundations as tie backs are placed in between foundations of the structures along the bank. As the purpose is to protect these structures, any further damage could lead to a failure and condemnation of a building and therefore a failure of the measure's intent. Planned surveys, structural analysis in PED and the geotechnical investigations will ensure that this risk is minimized.

The floodplain management plan and emergency evacuation plan have risk associated with the hydrology of the Alabama River. This plan will be largely driven by the inundation results of the hydraulic analysis presented in this report. Flood events can be examined as the results of a meteorological risk-driver, basin development, stormwater management practices, and hydraulic characteristics. In the area of study, the meteorological risk-driver is considered heavy rainfall produced from frontal or dissipating tropical events falling in the middle northern portion of the ACT basin. The frequency and severity of the risk-driver and its response (flooding in this case) have associated uncertainties. Fuguitt and Wilcox (1999) distinguish between the two types of uncertainty: future unknowns and data inaccuracy / measurement error. Future unknowns, in the case of this study, may be encountered in forecasting future watershed development, storm water management throughout the large basin, or the effect of climate change on hydrology. Measurement uncertainty may be encountered in model calibrations to observed data, whereby error may be associated with reported values (i.e. stage and discharge). These uncertainties create future unknowns when attempting to tie a response (evacuation route) to a flow-frequency event. To mitigate this issue, this plan will tie specific actions to a given stage, as opposed to a frequency flow. In other words, there will be direction with respect to forecasted water surface elevations on the Alabama River as opposed to a flow-frequency event. There are, however, still uncertainties associated with the accuracy of inundation mapping that will drive the plan. Incorrectly mapped topography could, and often does, result in inaccurate representation of a flooded area. The only reasonable way to but this down is to obtain high quality topography and ensure proper quality checks are done on the resulting surface developed for modeling. Communication to the sponsor on this uncertainty in also extremely important for them to understand risk associated with the recommended plan.

The overall purpose of the floodplain management plan and emergency evacuation plan is to address life safety. This plan would address life safety in two ways. First, it would provide the City of Selma with a comprehensive plan to direct evacuations of areas forecast to flood. The Alabama River is a slow-moving river with floods often taking days to reach the City of Selma. This is adequate time for the City to prepare and move residence out of flood prone areas. AS discussed, though the use of stream gages near Selma, Robert F Henry Lock and Dam and Montgomery, Alabama with flood forecasting already being provided by the Southeast River Forecast Center, an evacuation plan would assist the city in directing the evacuation of residents based on certain forecasted flood elevations. This would include recommended locations to be evacuated, safe evacuation routes and identification those locations that would be inaccessible, all based on a forecasted flood elevation. Second, the Floodplain Management Plan would address future use of the floodplain within the city limits. As structures are condemned in the future and residents move out of heavily flood prone areas, responsible redevelopment of the floodplain can reduce or eliminate life safety risk in the future.

In theory, this plan would eliminate flood risk with respect to life safety from the areas it covers. If followed, residents would have adequate time to fully evacuate. In practice, this will greatly reduce life safety risk but not eliminate it. Even mandatory evacuations are often ignored by residents who decide to accept the risk of remaining in a flood prone location during a flood. Historically, it has been impractical to fully enforce a complete evacuation of an area. Furthermore, future floodplain management of the area will ultimately be at the discretion of the city to enforce. It will likely involve locale legislation to enforce the recommendations laid out in the Floodplain Management portion of this to prevent residential redevelopment of the floodplain. In this case residual life risk is directly correlated to degree at which this document is utilized and enforced by the city of Selma.

A.8. Water Surface Profiles

Subpart 1: Existing Conditions

Figure A-66: Existing Conditions Water Surface Profiles

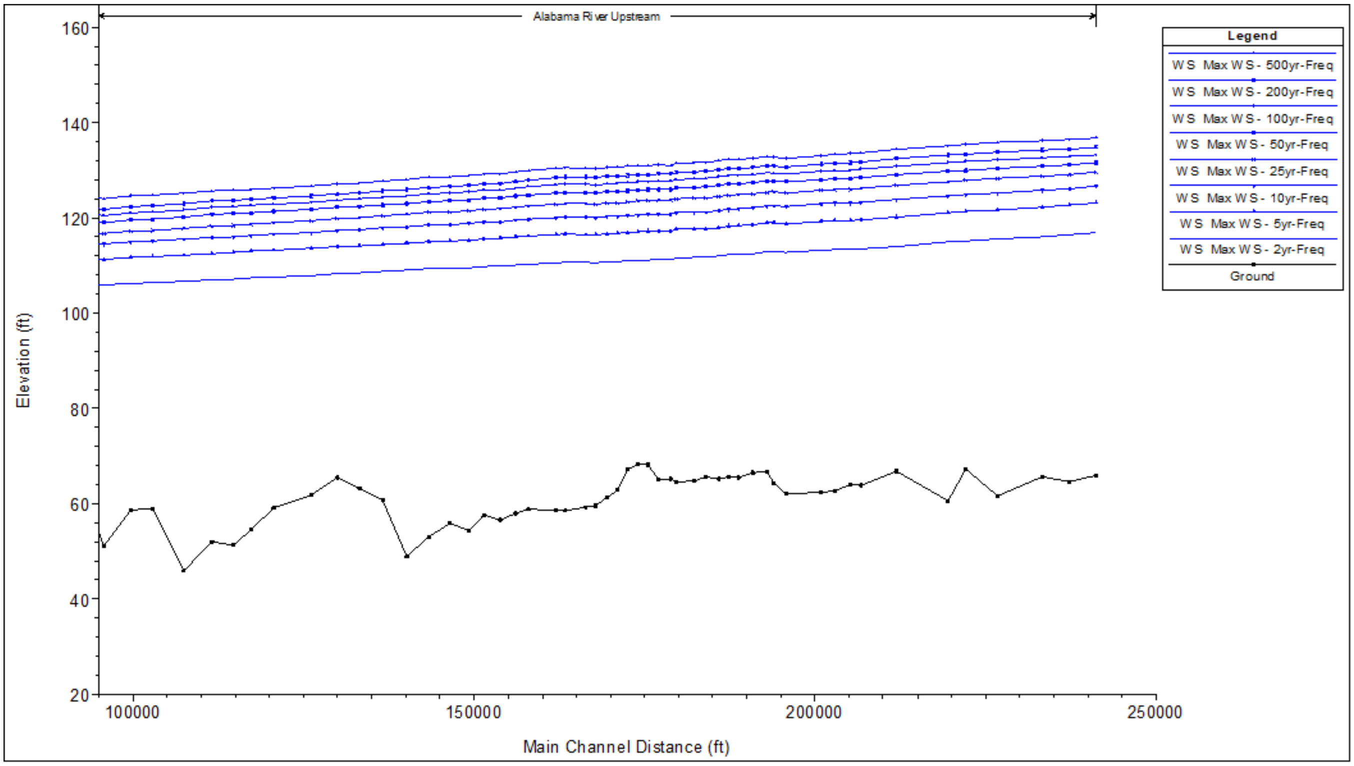


Figure A-67: Existing Conditions Water Surface Profiles 2

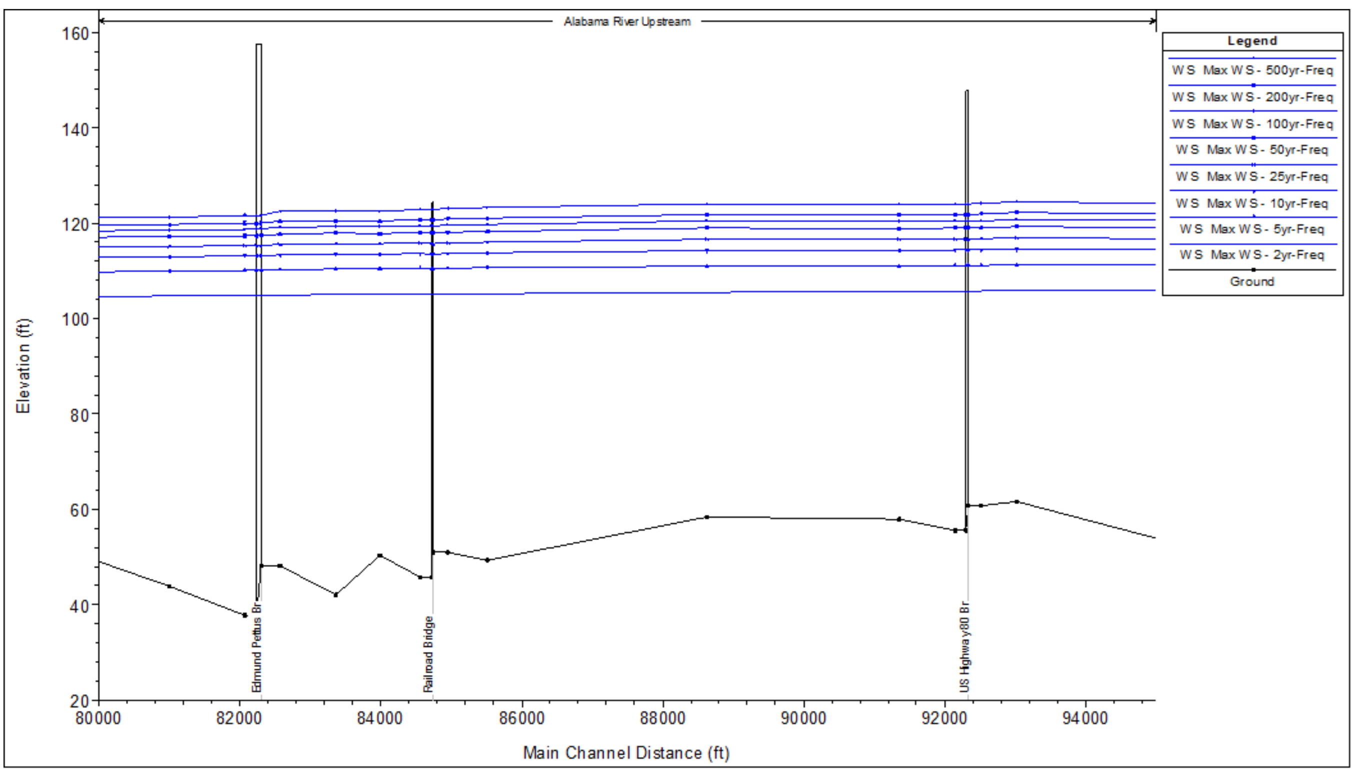


Figure A-68: Existing Conditions Water Surface Profiles 3

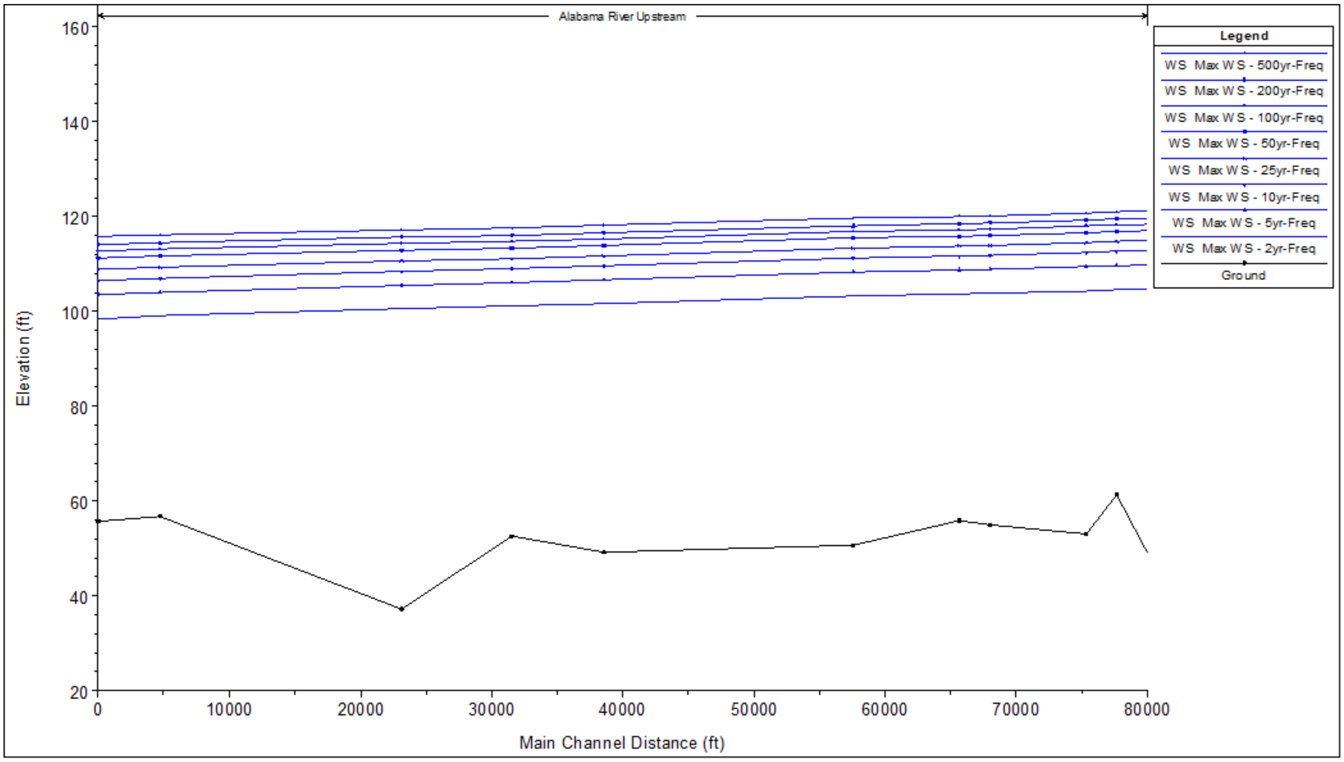
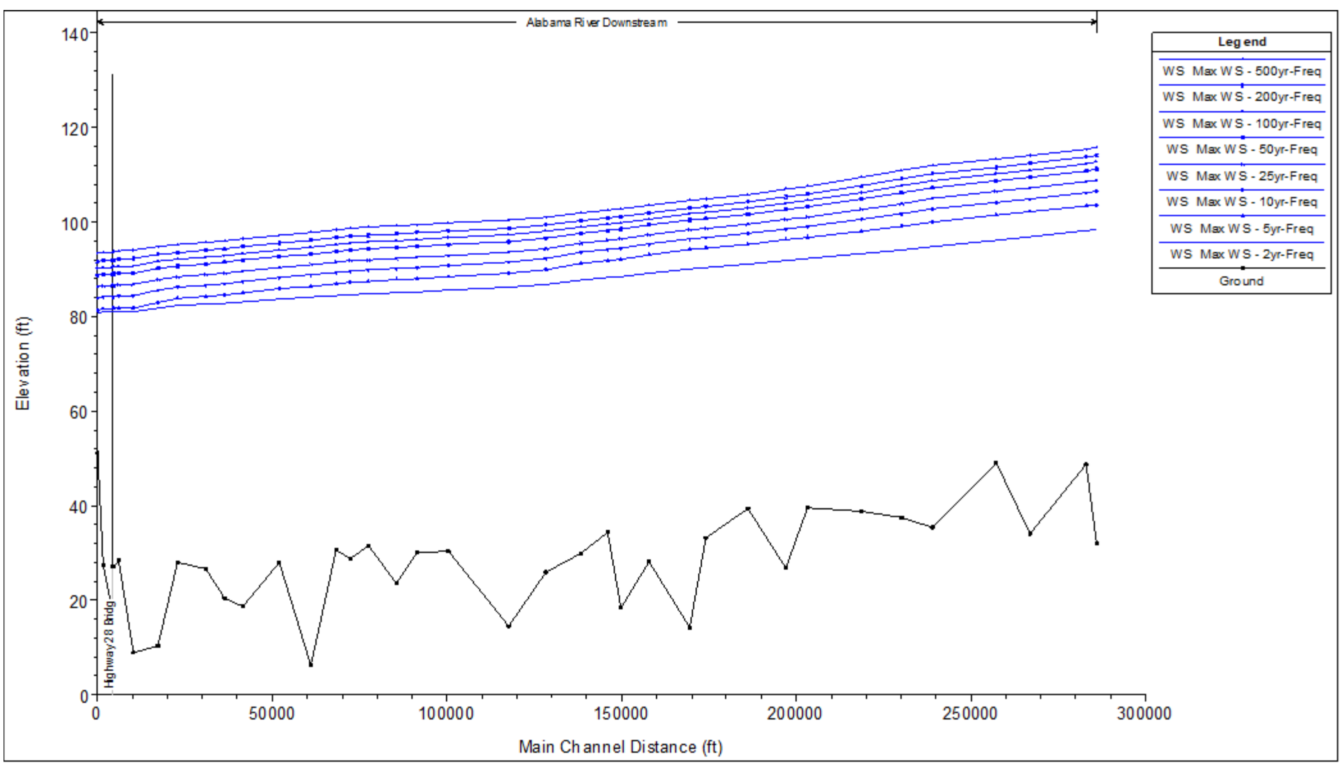


Figure A-69: Existing Conditions Water Surface Profiles 4



Subpart 2: Future Without Project

Figure A-70: Future Without Project Water Surface Profiles

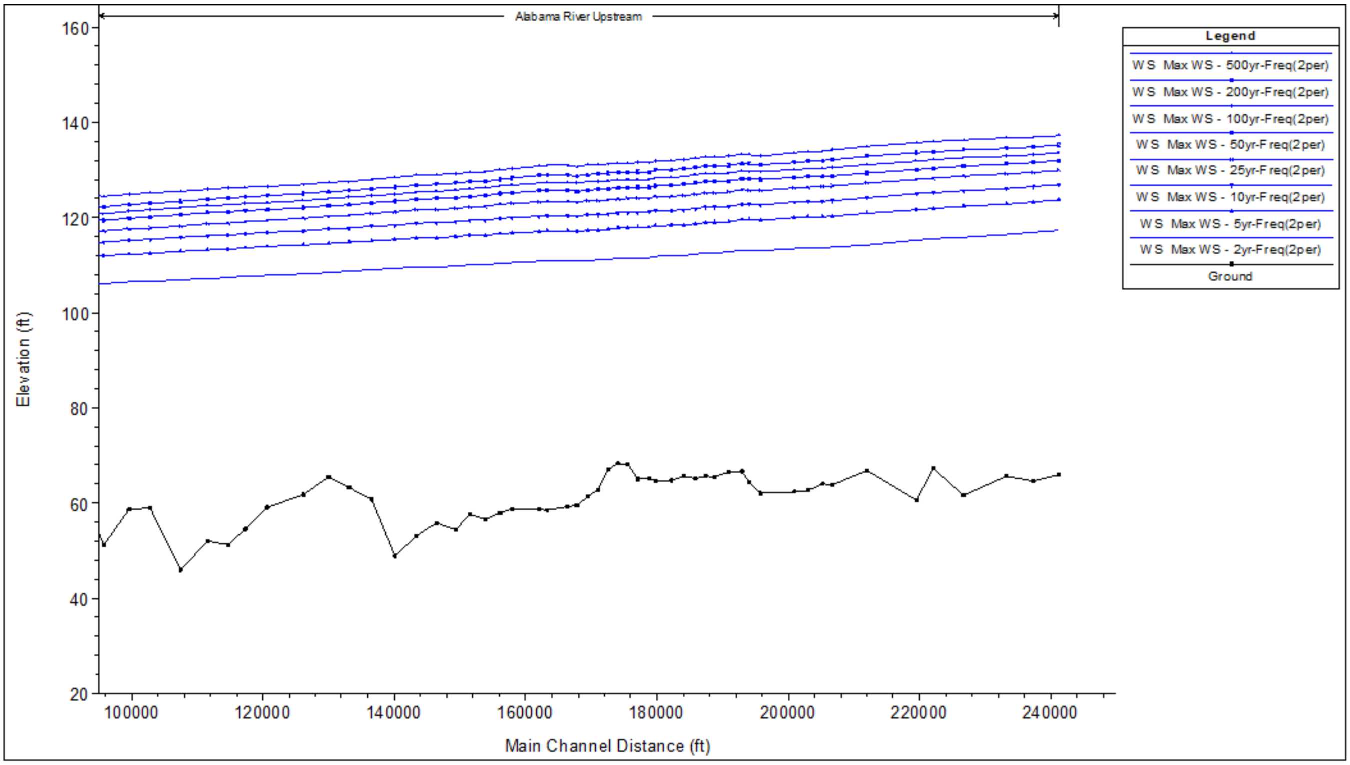


Figure A-71: Future Without Project Water Surface Profiles 2

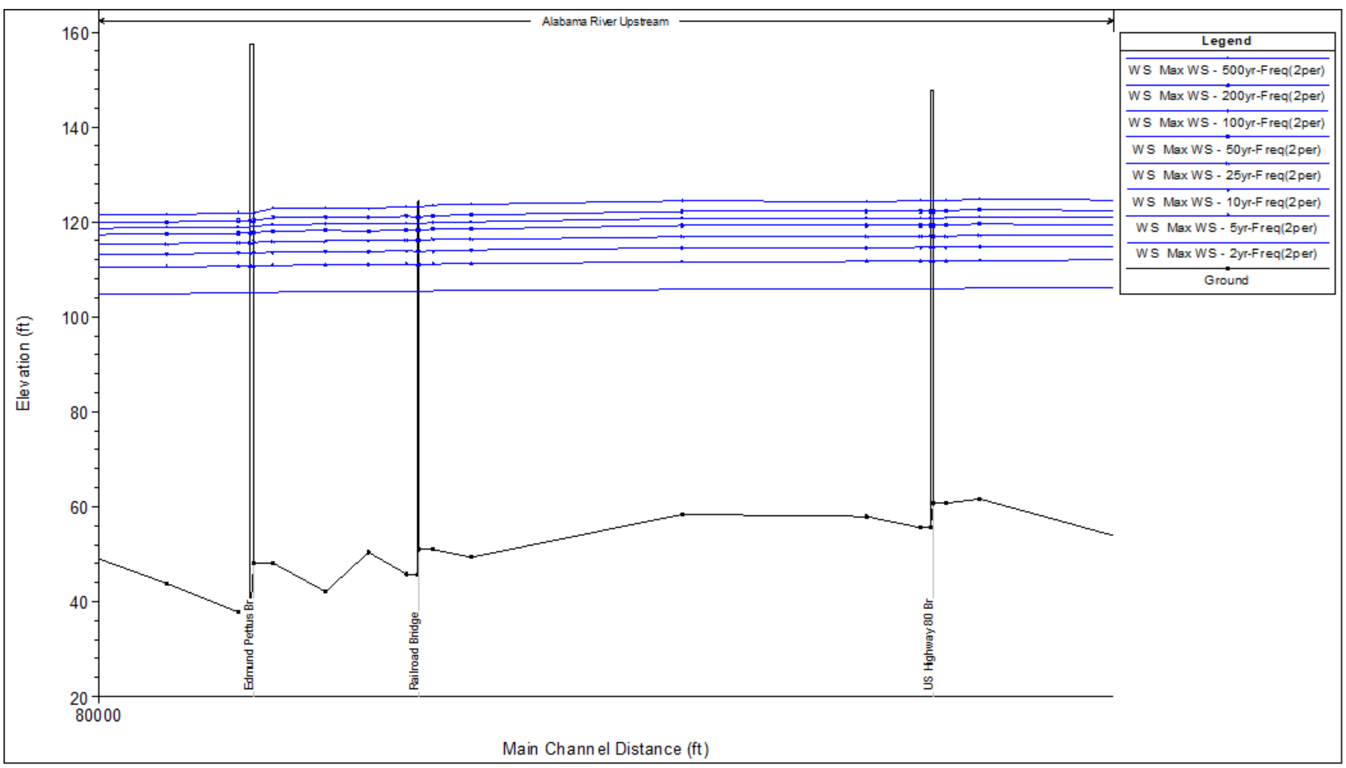


Figure A-72: Future Without Project Water Surface Profiles 3

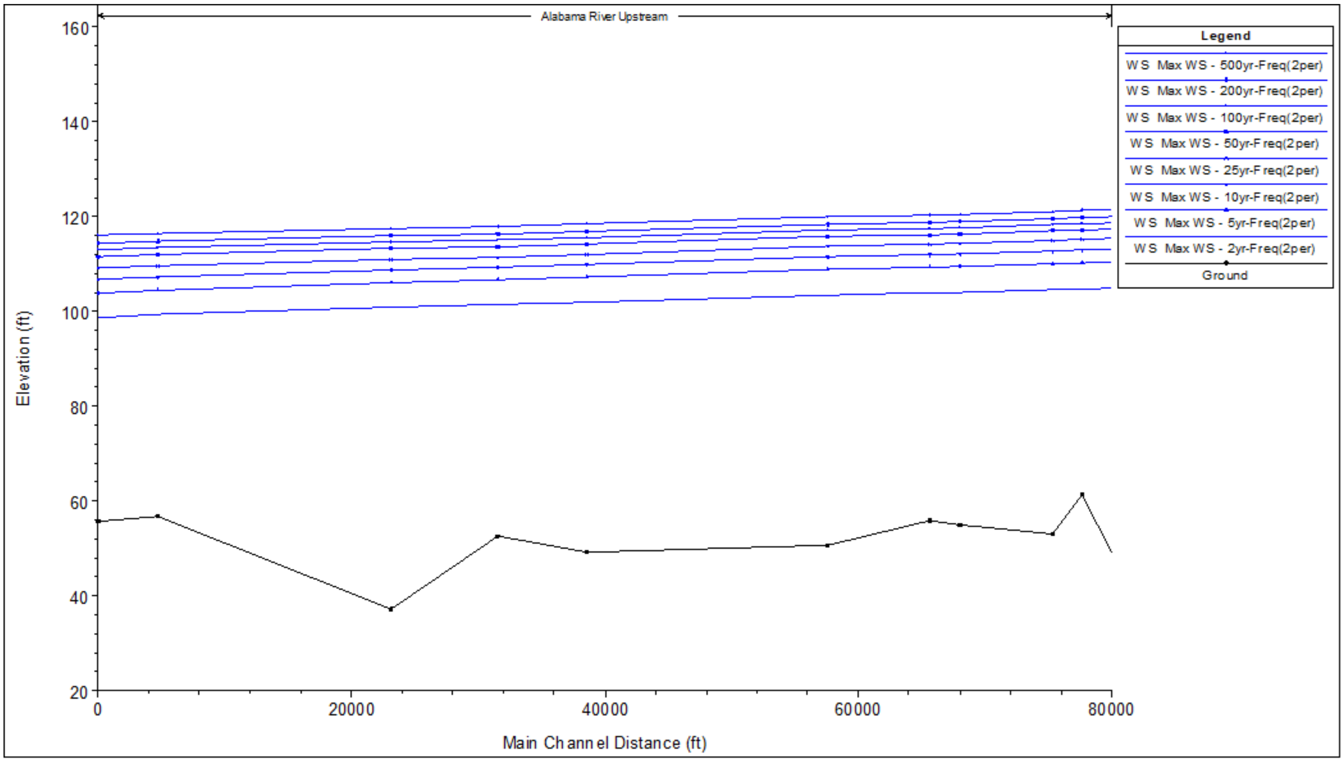
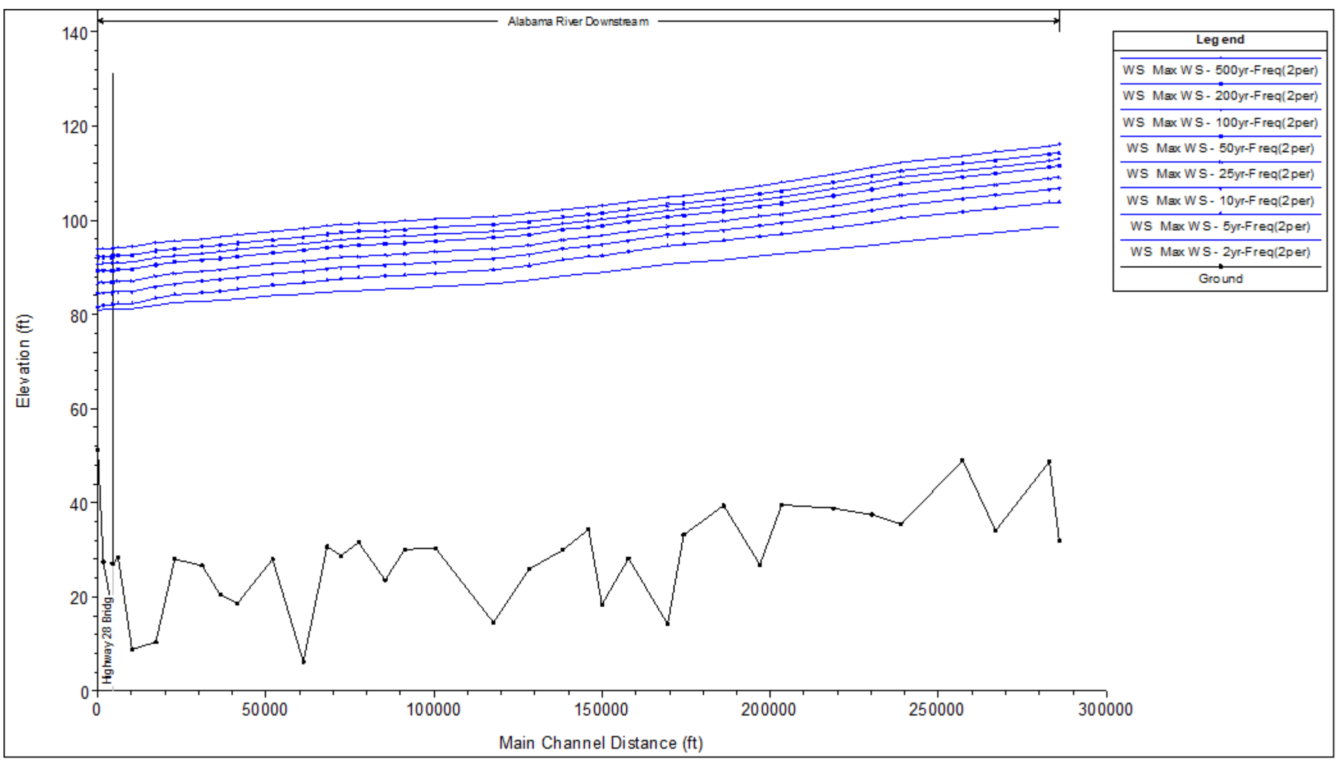


Figure A-73: Future Without Project Water Surface Profiles 4



A.9. Preliminary Structural Calculations for Soldier Pile Wall

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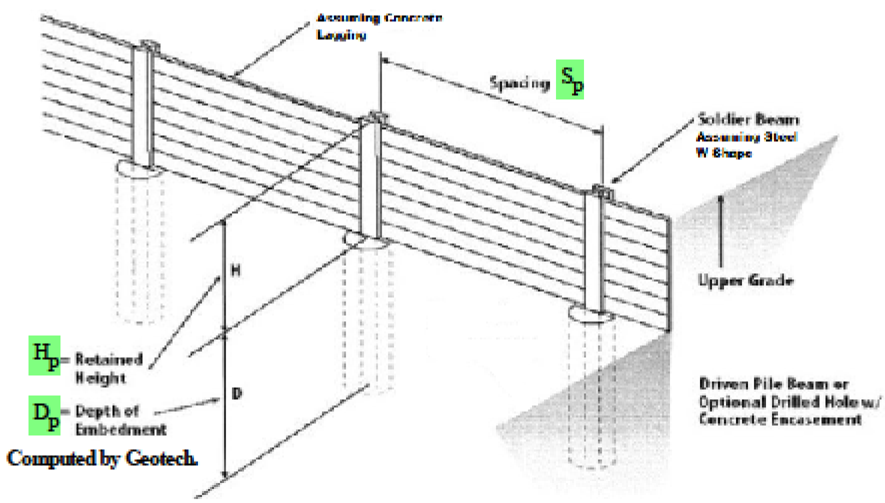
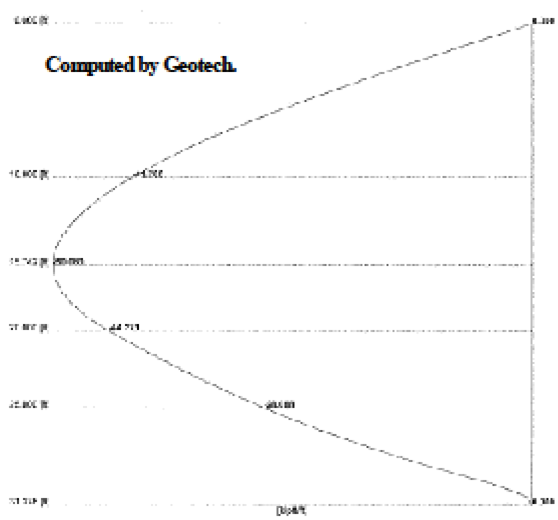
SELMA RIVER WALL

Computed By: ALJ
Date: 9/23/2019
Checked By:_________
Page: 1 of 10

PRELIMINARY STRUCTURAL DESIGN





INPUT PARAMETERS

Moment from Geotech Sheet Pile Wall Analysis.

$$M_a := 51 \frac{\text{kip}\cdot\text{ft}}{\text{ft}}$$

Max pressure from Geotech Sheet Pile Wall Analysis.

$$p_a := 0.73\text{ksf}$$

Spacing of Soldier Piles / Beams: $S_p := 8\text{ft}$

Retained Height $H_p := 30\text{ft}$

1

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Mobile District

SELMA RIVER WALL

Computed By: ALJ
Date: 9/23/2019
Checked By:__________
Page: 2 of 10

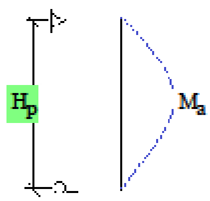
Forces on Soldier Pile

Forces provided be Geotech are per a unit (1 ft) width of wall.

Actual forces applied to soldier pile will be the portion of this that is tributary to the soldier pile, dependent on the soldier pile spacing.

$S_p = 8\,ft \qquad H_p = 30\,ft$

Bending Moment



Bending Moment Taken by Soldier Pile

$M_{a.sp} := M_a \cdot S_p = 408 \cdot kip \cdot ft$

Consider Strength Design. Use Load Factor of 1.4.

$\boxed{M_u := 1.4 M_{a.sp} = 571.2 \cdot ft \cdot kip}$

Assuming steel W Section for Soldier Piles.

2

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Mobile District

SELMA RIVER WALL

Computed By: ALJ
Date: 9/23/2019
Checked By:__________
Page: 3 of 10

W Section Table

SaveData(data, Get_Save_Clear, index) := W21X73HSS24X12X3/4

(data Get_Save_Clear index)

BM :=

W21X122
W21X111
W21X101
W21X93
W21X83
W21X73
W21X68
W21X62
W21X55
W21X48
W21X57
W21X50
W21X44

SaveData("", "Get", 0)

SaveData(BM, "Save", 0) = "W21X73"

BM = "W21X73"

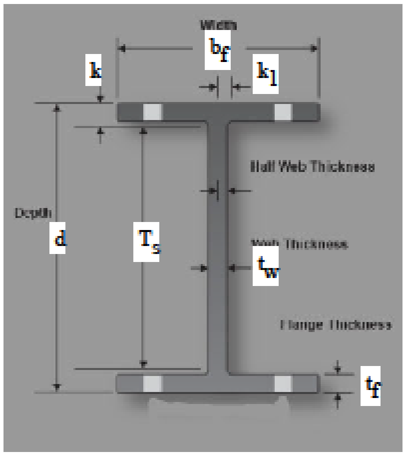
V Lookup Functions

3

US Army Corps of Engineers
Mobile District

SELMA RIVER WALL

Computed By: ALJ
Date: 9/23/2019
Checked By:________
Page: 4 of 10



Section Properties

$d = 21.2 \cdot in$

$b_f = 8.3 \cdot in$

$t_w = 0.46 \cdot in$

$t_f = 0.74 \cdot in$

$k = 1.24 \cdot in$

$k_1 = 0.88 \cdot in$

$T_s = 18.72 \cdot in$

$\frac{b_f}{2 \cdot t_f}$ $\quad r_{b.f\_2t.f} = 5.6$

$\frac{h}{t_w}$ $\quad r_{h\_t.w} = 41.2$

Distance between flange Centroids: $h_0 = 20.5 \cdot in$

Beam Weight:	$W_{BM} = 73 \cdot plf$	Torsional Constant:	$J_s = 3.02 \cdot in^4$
Beam Area:	$A_s = 21.5 \cdot in^2$	Warping Constant:	$C_w = 7410 \cdot in^6$
Section Moment of Inertia about the X Axis:	$I_x = 1600 \cdot in^4$	Effective Radius of Gyration:	$r_{ts} = 2.19 \cdot in$
Section Modulus about the X Axis:	$S_x = 151 \cdot in^3$		
Radius of Gyration about X:	$r_x = 8.64 \cdot in$		
Plastic Section Moduls about X:	$Z_x = 172 \cdot in^3$		
Section Moment of Inertia about the Y Axis:	$I_y = 70.6 \cdot in^4$		
Section Modulus about the Y Axis:	$S_y = 17 \cdot in^3$		
Radius of Gyration about Y:	$r_y = 1.81 \cdot in$		
Plastic Section Moduls about Y:	$Z_y = 26.6 \cdot in^3$		

ADDITIONAL PROPERTIES

$E := 29000 ksi$

$F_y := 50 ksi$

$T_s = 18.72 \cdot in$

$\phi_b := 0.90$ (AISC, Sec. F1)

$\phi_v := 0.90$ (AISC, Sec. G1)

MEMBER CAPACITIES (BENDING - AISC SPEC. CHAPTER F)

Determine member capacities in accordance with AISC Steel Construction Manual, 14th Ed.

Design Requirements

Compactness limits of AISC Table B4.1.

Case 1

$$\lambda_{p.f} := 0.38 \cdot \sqrt{\frac{E}{F_y}} = 9.15$$

$$r_{b.f\_2t.f} = 5.6$$

$$\lambda_{r.f} := 1.0 \cdot \sqrt{\frac{E}{F_y}} = 24.08$$

$$\text{Flange\_Slenderness} := \begin{cases} \text{"C"} & \text{if } r_{b.f\_2t.f} < \lambda_{p.f} \\ \text{"NC"} & \text{if } r_{b.f\_2t.f} \geq \lambda_{p.f} \wedge r_{b.f\_2t.f} < \lambda_{r.f} \\ \text{"S"} & \text{if } r_{b.f\_2t.f} \geq \lambda_{r.f} \end{cases}$$

$$\text{Flange\_Slenderness} = \text{"C"}$$

Case 9

$$\lambda_{p.w} := 3.76 \cdot \sqrt{\frac{E}{F_y}} = 90.55$$

$$r_{h\_t.w} = 41.2$$

$$\lambda_{r.w} := 5.70 \cdot \sqrt{\frac{E}{F_y}} = 137.27$$

$$\text{Web\_Slenderness} := \begin{cases} \text{"C"} & \text{if } r_{h\_t.w} < \lambda_{p.w} \\ \text{"NC"} & \text{if } r_{h\_t.w} \geq \lambda_{p.w} \wedge r_{h\_t.w} < \lambda_{r.w} \\ \text{"S"} & \text{if } r_{h\_t.w} \geq \lambda_{r.w} \end{cases}$$

$$\text{Web\_Slenderness} = \text{"C"}$$

F2 - COMPACT SECTIONS

1. Yielding

$M_p := F_y \cdot Z_x = 8600 \cdot kip \cdot in$ $\qquad \phi_b = 0.9$

$M_p = 716.67 \cdot kip \cdot ft$

$\boxed{\phi M_{n1} := \phi_b \cdot M_p = 645 \cdot kip \cdot ft}$

2. Lateral - Torsional Buckling

(a)

$L_b := 48in$ Can the lagging provide lateral bracing to the flange? Conservative length used here.

$$L_p := 1.76 \cdot r_y \cdot \sqrt{\frac{E}{F_y}} = 76.72 \cdot in$$

$$L_r = 1.95 r_{ts} \cdot \frac{E}{0.7 \cdot F_y} \cdot \sqrt{\frac{J \cdot c}{S_x \cdot h_o} + \sqrt{\left(\frac{J \cdot c}{S_x \cdot h_o}\right)^2 + 6.76 \cdot \left(\frac{0.7 \cdot F_y}{E}\right)^2}}$$

$r_{ts} = 2.19 \cdot in$

$c_s := 1.0$

$h_0 = 20.5 \cdot in$

$$L_r := 1.95 \cdot r_{ts} \cdot \frac{E}{0.7 \cdot F_y} \cdot \sqrt{\frac{J_s \cdot c_s}{S_x \cdot h_0} + \sqrt{\left[\left(\frac{J_s \cdot c_s}{S_x \cdot h_0}\right)^2 + 6.76 \cdot \left(\frac{0.7 \cdot F_y}{E}\right)^2\right]}} = 230.99 \cdot in$$

LTB_app := | "LTB Does NOT Apply - Skip Sec. F2.2b & c" if $L_b \le L_p$
| "Check LTB using Sec. F2.2.b & c" otherwise

$\boxed{\text{LTB\_app = "LTB Does NOT Apply - Skip Sec. F2.2b \& c"}}$

(b)

If setting $C_b = 1.0$,

$C_{b1} := 1.0$

$$M_{nb} := C_{b1} \cdot \left[M_p - \left(M_p - 0.7 \cdot F_y \cdot S_x \right) \cdot \left(\frac{L_b - L_p}{L_r - L_p} \right) \right] = 9217.11 \cdot kip \cdot in$$

$\phi M_{nb} := \phi_b \cdot M_{nb} = 8295.4 \cdot kip \cdot in$

$\boxed{\phi M_{nb} = 691.28 \cdot kip \cdot ft}$

(c)

$L_b = 48 \cdot in$

$$F_{cr} := \frac{C_{b1} \cdot \pi^2 \cdot E}{\left(\frac{L_b}{r_{ts}} \right)^2} \cdot \sqrt{1 + 0.078 \cdot \frac{J_s \cdot c_s}{S_x \cdot h_0} \cdot \left(\frac{L_b}{r_{ts}} \right)^2} = 606.6 \cdot ksi$$

$M_{nc} := F_{cr} \cdot S_x = 91596.09 \cdot kip \cdot in$

$\phi M_{nc} := \phi_b \cdot M_{nc} = 82436.48 \cdot kip \cdot in$

$\boxed{\phi M_{nc} = 6869.71 \cdot kip \cdot ft}$

Controlling Bending Results

$$\phi M_n := \begin{cases} \phi M_{n1} & \text{if } L_b \le L_p \\ \phi M_{nb} & \text{if } L_b > L_p \land L_b \le L_r \\ \phi M_{nc} & \text{if } L_b > L_r \end{cases}$$

$\boxed{\phi M_n = 645 \cdot kip \cdot ft}$ $\boxed{M_u = 571.2 \cdot kip \cdot ft}$ $\boxed{\text{if}(\phi M_n > M_u, \text{"OK"}, \text{"NO GOOD"}) = \text{"OK"}}$

SOLDIER PILE DEFLECTION

Deflection from Retained Backfill

Approx. max pressure reported by geotech.

$p_a = 0.73\,\mathrm{ksf}$

Assume 3/4 of this for a uniform distributed load to distribute to soldier pile.

$w := 0.75 \cdot p_a \cdot 1\mathrm{ft} = 0.55\,\mathrm{klf}$

Distributed load to soldier pile.

$$w_{sp} := w \cdot \frac{S_p}{1\mathrm{ft}} = 4.38\,\mathrm{klf}$$

$$\Delta_{max.L} := \frac{\left[5 \cdot (w_{sp}) \cdot H_p^{\ 4}\right]}{384 \cdot E \cdot I_x} = 1.72 \cdot \mathrm{in}$$

$$L_{\Delta.ratio.L} := \frac{H_p}{\Delta_{max.L}} = 209$$

Assume max deflection criteria is L/120.

$\boxed{\mathrm{if}\left(L_{\Delta.ratio.L} \geq 120, \text{"OK"}, \text{"NO GOOD"}\right) = \text{"OK"}}$

Estimated Thickness of Lagging (Assuming Concrete Lagging)

Analyzing a 1ft width of lagging.

Simply supported span of lagging: $L_l := S_p = 8\,ft$

Applied Bending Moment

Approx. max pressure reported by geotech.

$p_a = 0.73\,ksf$

Assume lagging sees this complete pressure.

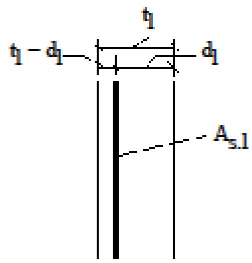
$w_l := p_a \cdot 1ft = 0.73\,klf$

$$M_l := \frac{w_l \cdot L_l^2}{8} = 5.84\,kip \cdot ft$$

Consider Strength Design. Use Load Factor of 1.4.

$M_{u.l} := 1.4 \cdot M_l = 8.18\,kip \cdot ft$

Lagging Properties



Assumed Section

Compressive strength assuming precast concrete lagging. $f_c := 5000\text{psi}$

Steel yield strength: $f_y := 60\text{ksi}$

Strength reduction factor: $\phi_{b.1} := 0.9$

Area of tension steel: #6 @ 9" spacing $A_{s.1} := 0.59\text{in}^2$

$$\phi M_n = \phi \cdot A_s \cdot f_y \cdot \left(d - \frac{a}{2}\right) \geq M_{u.1}$$

$$\left(d - \frac{a}{2}\right) \geq \frac{M_{u.1}}{\phi \cdot A_s \cdot f_y} \qquad d \geq \frac{M_{u.1}}{\phi \cdot A_s \cdot f_y} + \frac{a}{2}$$

$$0.85 f_c \cdot b \cdot a = A_s \cdot f_y$$

$$a_l := \frac{A_{s.1} \cdot f_y}{0.85 \cdot f_c \cdot 12\text{in}} = 0.69\,\text{in}$$

$$d_l := \frac{M_{u.1}}{\phi_{b.1} \cdot A_{s.1} \cdot f_y} + \frac{a_l}{2} = 3.43\,\text{in}$$

Assume that total thickness equals d + 4.5 inches.

$t_l := d_l + 4.5\text{in} = 7.93\,\text{in}$

Summary

Spacing of Soldier Piles: $S_p = 8\,\text{ft}$

Depth of Soldier Piles: BM = "W21X73" $d = 21.2\,\text{in}$

Thickness of Concrete Lagging: $A_{s.1} = 0.59\,\text{in}^2$ $t_l = 7.93\,\text{in}$

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Selma, Alabama

Flood Risk Management Study
Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX B

US Army Corps
of Engineers
Mobile District

September 14, 2020

APPENDIX-B: Environmental

Table of Contents

List of Figures

List of Tables

B.1. WRRDA 2014 Section 1005 Compliance

B.1.1. *List of Federal and State Agencies Contacted*

Table B-1: Distribution List

AGENCY	ADDRESS	PHONE NUMBER
EPA Region 4	Sam Nunn Federal Building 61 Forsyth Street South West Atlanta, Georgia 30303	
FEMA Region 4	9500 Wynlakes Place Montgomery, Alabama 36117	(334) 274-6350
FHA	9500 Wynlakes Place Montgomery, Alabama 36117	(334) 274-6350
USGS SE Region	U.S. Geological Survey 1170 Corporate Drive, Suite 500 Atlanta, Georgia 30093	
USFWS SE Region	Michael_oetker@fws.gov	
USFWS DFO	bill_pearson@fws.gov	(251) 441-5181
DOI Atlanta Region	Office of Environmental Policy and Compliance, Atlanta Region Suite 1144 75 Ted Turner Drive, S.W. Atlanta, GA 30303	
AHC (SHPO)	468 South Perry Street P.O. Box 300900 Montgomery, Alabama 36130-0900	
ACHP	ljohnson@achp.gov athompson@achp.gov	(202) 517-0215 (202) 517-0225
NPS	100 Alabama Street, SW 1924 Building Atlanta, GA 30303	(404) 507-5600
HUD	U.S. Department of Housing and Urban Development 950 22nd Street N Suite 900 Birmingham, Alabama 35203	
NRCS	3381 Skyway Drive Auburn, AL 33830	(334) 887-4500
ADCNR	64 N. Union Street Montgomery, Alabama 36130	(334) 242-3486
ADCNR WFFRD	64 N. Union Street, Suite 551 Montgomery, Alabama 36130	(334) 242-3465
ADEM	P.O. Box 301463 Montgomery, Alabama 36130-1463	(334) 271-7710
ASOS	P.O. Box 5616 Montgomery, Alabama 36103-5616	(334) 242-7200
AEMA	P.O. Drawer 2160 Clanton, Alabama 35046	
ALDOT	P. O. Box 303050, Montgomery, Alabama 36130-3050	(334) 242-6776
ALDOT Bridge Bureau	P. O. Box 303050, Montgomery, Alabama 36130-3050	(334-242-6007
ADPH	P.O. Box 303017 Montgomery, Alabama 36130-3017	(334) 295-1000 (251) 275-3772 (334) 206-5375

B.1.2. *Cooperating Agency Agreement Letters*

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

January 24, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Michaela Noble
Director, Office of Environmental Policy and Compliance
Department of the Interior
1849 C Street, Northwest
Washington, DC 20240

Dear Ms. Noble:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost-share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

The Council on Environmental Quality (CEQ), Regulations on Implementing National Environmental Policy Act Procedures (NEPA) (40 CFR 1500-1508) emphasizes agency cooperation early in the NEPA process through the establishment of Cooperating Agency status. In essence, any Federal or State agency which has jurisdiction over activities to be considered in the EA has the opportunity to serve as a Cooperating Agency. Responsibilities of a Cooperating Agency include but are not limited to provision of data and/or information, and review of the preliminary draft EA for completeness. Information relative to the rights and responsibilities of lead and cooperating agencies may be found in CEQ's Forty Most Asked Questions Concerning CEQ's NEPA Regulations (http://ceq.eh.doe.gov/nepa/regs/40).

As lead agency in the preparation of the integrated feasibility report and EA, USACE, Mobile District is requesting your participation as a cooperating agency in this effort and would appreciate a confirmation of your willingness to do so. We look forward to working with you on this project and if you should have any questions, please contact Ms. Heather Bulger at (251) 694-3889 or via email at heather.p.bulger@usace.army.mil.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Joyce A. Stanley
Regional Environmental Protection Specialist
Department of the Interior, Office of Environmental Policy and Compliance
Atlanta Region, Suite 1144
75 Ted Turner Drive, Southwest
Atlanta, Georgia 30303

Dear Ms. Stanley:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Trey Glenn
Regional Administrator
U.S. Environmental Protection Agency, Region 4
Sam Nunn Federal Building
61 Forsyth Street South West
Atlanta, Georgia 30303

Dear Mr. Glenn:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Gracia B. Szczech
Regional Director
Federal Emergency Management Agency, Region 4
3003 Chamblee Tucker Road
Atlanta, Georgia 30341

Dear Ms. Szczech:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Michael Oetker
Acting S.E. Regional Director
U.S. Fish and Wildlife Service
1875 Century Boulevard
Atlanta, Georgia 30345

Dear Mr. Oetker:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Holly Weyers
Regional Director, Southeast Region
U.S. Geological Survey
1170 Corporate Drive, Suite 500
Atlanta, Georgia 30093

Dear Ms. Weyers:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Bob Vogel
Regional Director
National Park Service
100 Alabama Street, SW
1924 Building
Atlanta, Georgia 30303

Dear Mr. Vogel:

The U.S. Army Corps of Engineers (USACE). Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost-share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

The Council on Environmental Quality (CEQ), Regulations on Implementing National Environmental Policy Act Procedures (NEPA) (40 CFR 1500-1508) emphasizes agency cooperation early in the NEPA process through the establishment of Cooperating Agency status. In essence any Federal or State agency which has jurisdiction over activities to be considered in the EA has the opportunity to serve as a Cooperating Agency. Responsibilities of a Cooperating Agency include but are not limited to provision of data and/or information, and review of the preliminary draft EA for completeness. Information relative to the rights and responsibilities of lead and cooperating agencies may be found in CEQ Forty Most Asked Questions Concerning CEQ's NEPA Regulations (http://ceq.eh.doe.gov/nepa/regs/40).

As lead agency in the preparation of the integrated feasibility report and EA, USACE, Mobile District is requesting your participation as a cooperating agency in this effort and would appreciate a confirmation of your willingness to do so. We look forward to working with you on this project and if you should have any questions, please contact Ms. Heather Bulger at (251) 694-3889 or via email at heather.p.bulger@usace.army.mil.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Ben Malone
State Conservationist
Natural Resources Conservation Service
U.S. Department of Agriculture
3381 Skyway Drive
Auburn, Alabama 36830

Dear Mr. Malone:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost-share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Patricia A. Hoban-Moore
Director, Alabama Field Office
U.S. Department of Housing and Urban Development
950 22nd Street N Suite 900
Birmingham, Alabama 35203

Dear Ms. Hoban-Moore:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost-share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Amanda McBride
Alabama State Historical Preservation Officer
468 South Perry Street
Post Office Box 300900
Montgomery, Alabama 36130-0900

Dear Ms. McBride:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Steven O. Jenkins
Alabama Department Environmental Management
Field Operation Division
Post Office Box 301463
Montgomery, Alabama 36130-1463

Dear Mr. Jenkins:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

The Honorable John H. Merrill
Alabama Secretary of State
Post Office Box 5616
Montgomery, Alabama 36103-5616

Dear Mr. Merrill:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Curtis M. Flakes
Chief, Planning and Environmental Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Chris M. Blankenship
Commissioner
Alabama Department of Conservation and Natural Resources
64 North Union Street
Montgomery, Alabama 36130

Dear Mr. Blankenship:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Charles F. Sykes
Director, Wildlife and Freshwater Fisheries Division
Alabama Department of Conservation and Natural Resources
64 North Union Street
Montgomery, Alabama 36130

Dear Mr. Sykes:

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. John R. Cooper
Transportation Director
Alabama Department of Transportation
1409 Coliseum Boulevard
Montgomery, Alabama 36110

Dear Mr. Cooper:

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Curtis M. Flakes
Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. William Colquett, P.E.
Bridge Engineer
Alabama Department of Transportation, Bridge Bureau
1409 Coliseum Boulevard
Montgomery, Alabama 36130-3050

Dear Mr. Colquett:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Lee Ann Wofford
Alabama Historical Commission
468 South Perry Street
Montgomery, Alabama 36130-0900

Dear Ms. Wofford:

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Ms. Patti Powell
Director, State Lands Division
Alabama Department of Conservation and Natural Resources
64 North Union Street
Montgomery, Alabama 36130

Dear Ms. Powell:

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Division

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CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Lance R. Lefleur
Director
Alabama Department of Environmental Management
Post Office Box 301463
Montgomery, Alabama 36130-1463

Dear Mr. Lefleur:

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Brian Hastings
Director
Alabama Department of Emergency Management
Post Office Box 2160
Clanton, Alabama 35046

Dear Mr. Hastings:

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Dr. Scott Harris
State Health Officer
Alabama Department of Public Health
Post Office Box 303017
Montgomery, Alabama 36130-3017

Dear Dr. Harris:

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Chief, Planning and Environmental
Division

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO
ATTENTION OF

February 12, 2019

Inland Environment Team
Planning and Environmental Division

Mr. Mark D. Bartlett
Division Administrator
Alabama Division, Federal Highway Administration
9500 Wynlakes Place
Montgomery, Alabama 36117

Dear Mr. Bartlett:

The U.S. Army Corps of Engineers (USACE), Mobile District is preparing an Integrated Feasibility Report and Environmental Assessment (EA) for the City of Selma Flood Risk Management project located in Dallas County, Alabama.

The Selma Feasibility Study is a cost-share agreement between the USACE and the City of Selma that was initiated on October 9, 2018. The study has identified 10 focused alternatives which meet the goals and objectives. These alternatives will be compared and evaluated based on planning criteria, engineering, cost, and benefits in order to create a final array of alternatives from which a tentatively selected plan will be chosen.

The Council on Environmental Quality (CEQ), Regulations on Implementing National Environmental Policy Act Procedures (NEPA) (40 CFR 1500-1508) emphasizes agency cooperation early in the NEPA process through the establishment of Cooperating Agency status. In essence any Federal or State agency which has jurisdiction over activities to be considered in the EA has the opportunity to serve as a Cooperating Agency. Responsibilities of a Cooperating Agency include but are not limited to provision of data and/or information, and review of the preliminary draft EA for completeness. Information relative to the rights and responsibilities of lead and cooperating agencies may be found in CEQ Forty Most Asked Questions Concerning CEQ's NEPA Regulations (http://ceq.eh.doe.gov/nepa/regs/40).

As lead agency in the preparation of the integrated feasibility report and EA, USACE, Mobile District is requesting your participation as a cooperating agency in this effort and would appreciate a confirmation of your willingness to do so. We look forward to working with you on this project and if you should have any questions, please contact Ms. Heather Bulger at (251) 694-3889 or via email at heather.p.bulger@usace.army.mil.

Sincerely,

Curtis M. Flakes
Chief, Planning and Environmental
Division

B.1.3. *Agency Scoping Meeting*

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO

CESAM PD-EI

10 June 2019

SUBJECT: City of Selma Flood Risk Management (FRM) Feasibility Study Interagency Meeting

Memorandum for the Record

Attendees: Reference Table 1

Table 1: Federal and State Agency Invites and Participants

NAME	*AGENCY*	*RESPONSE*	*ATTENDANCE*
director@adem.alabama.gov	ADEM	None	
Suzanne.terrell@adph.state.al.us	ADPH	None	
Amanda.McBride@ahc.alabama.gov	AHC	Accepted	
Kinder, Christopher	AHC	Accepted	✓
Sipes, Eric	AHC	Accepted	✓
chris.blankenship@dcnr.alabama.gov	ALDCNR	None	
dcnr.wffdirector@dcnr.alabama.gov	ALDCNR	None	
Johnson, Paul	ALDCNR	None	
mark.bartlett@dot.gov	ALDOT	None	✓
cooperjr@dot.state.al.us	ALDOT	None	
colquettw@dot.state.al.us	ALDOT	None	
brian.hastings@ema.alabama.gov	ALEMA	Accepted	✓
Jonathan Gaddy	ALEMA	Accepted	
Ricky Adams	ALEMA	Accepted	
Brett Howard	ALEMA	None	
Michael Johnson	ALEMA	None	✓
Lacy Thorton	ALEMA	None	✓
John.Merrill@sos.alabama.gov	ALSOS	None	
Gracia.szczech@dhs.gov	DHS	None	
Joyce_Stanley@ios.doi.gov	DOI	None	
Kajumba, Ntale	EPA	Accepted	✓
Warren.Camilla@epa.gov	EPA	Accepted	✓
Glenn, Trey	EPA Region 4	None	
Militscher, Chris	EPA Region 4	Declined	
Patricia.a.hoban-moore@hud.gov	HUD	None	
Hillary_conley@nps.gov	NPS	None	✓
Nissa_fink@nps.gov	NPS	None	
Bulger, Heather P CIV USARMY CESAM (USA)	USACE	None	✓
Perkins, Rita B CIV CESAM CESAD (USA)	USACE	Accepted	
Newell, David P CIV CESAM CESAD (USA)	USACE	Accepted	✓
Smith, Alexandria N CIV USARMY CESAM (USA)	USACE	Accepted	✓

1 | Page

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO

CESAM PD-EI

10 June 2019

SUBJECT: City of Selma Flood Risk Management (FRM) Feasibility Study Interagency Meeting

Jacobson, Jennifer L CIV USARMY CESAM (USA)	USACE	Accepted	✓
Boatman, Todd H CIV USARMY CESAM (USA)	USACE	Accepted	✓
Flakes, Curtis M CIV (USA)	USACE	None	✓
Bass, John E CIV USARMY CESAM (USA)	USACE	None	
Black, Joseph M IV CIV (USA)	USACE	Declined	
Caldwell, Timothy J II CIV USARMY CESAM (USA)	USACE	None	
Crane, Ryan B (Bailey) CIV USARMY CESAM (USA)	USACE	None	✓
Durden, Susan E CIV USARMY CEIWR (USA)	USACE	Accepted	✓
Ephriam, Troy L CIV USARMY CESAM (UAS)	USACE	Accepted	✓
Phillips, Stephen P CIV USARMY CESAM (UAS)	USACE	None	
Rooney, Katherine T CIV USARMY CESAM (USA)	USACE	None	✓
Tetreau, John J CIV USARMY CESAM (USA)	USACE	Accepted	✓
Throop, Ashley N CIV USARMY CESAM (USA)	USACE	None	
Var, Vongmony CIV (USA)	USACE	None	
ben.malone@al.usda.gov	USDA	None	
Michael_oetker@fws.gov	USFWS	None	
bill_pearson@fws.gov	USFWS	None	
Ford, Anthony	USFWS	None	✓
hsweyers@usgs.gov	USGS	None	

Meeting Summary: The U.S. Army Corps of Engineers presented the Selma FRM Array of Alternatives and the identified environmental impacts to the participating agencies in order to facilitate discussion regarding each agency's concerns. The Alabama Historical Commission (AHC) informed the USACE that the entire downtown district of Selma is currently proposed for World Heritage Site, as well as the Edmund Pettis Bridge and possibly the Brown Chapel. The AHC also informed the USACE of the City of Selma proposed floating dock. Each alternative discussion is listed below.

<u>LEVEE</u>

SHPO: Serious concerns

- Archaeological sites within alignment of levee
- Cemetery within levee alignment

<u>BUYOUTS</u>

SHPO: Serious concerns

- Potential impacts because of adjacency to downtown historic district

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, MOBILE DISTRICT
P.O. BOX 2288
MOBILE, AL 36628-0001

REPLY TO

- Potential Impacts to structures that may qualify for National Register listing
- Adverse effects including community cohesion and economics resulting from demolition of structures

EPA: Serious concerns about extent of buy-outs.

- Maximum identified structures (300) is significant
- May have additional concerns as plan is refined

BANK STABILIZATION

SHPO: Serious concerns

- Significant viewshed impacts
- Landmark status impacts
- Civil war artifacts within river (live ordinances)

NPS: Moderate concerns

- Adverse effects to historic district as a whole

USFWS: Moderate concerns

- Adverse effects to tulatoma snail
- Section 6 grant was awarded to survey for tulatoma snail and several live ordinances were discovered within the bank stabilization footprint

B.2. Water Quality

DRAFT
SECTION 404(B) (1) EVALUATION FOR
BANK STABILIZATION
CITY OF SELMA FLOOD RISK MANAGEMENT STUDY
DALLAS COUNTY, ALABAMA

I. PROJECT DESCRIPTION:

A. Location. City of Selma, Dallas County, Alabama (**Figure 1**).

B. General Description. As illustrated in **Figure 2**, the proposed work would span approximately 750 linear feet and would involve installation of approximately 94 H-Piles from which to insert a retaining wall feature. Riprap would be placed at the upstream and downstream ends.

Figure B-1: Site Location

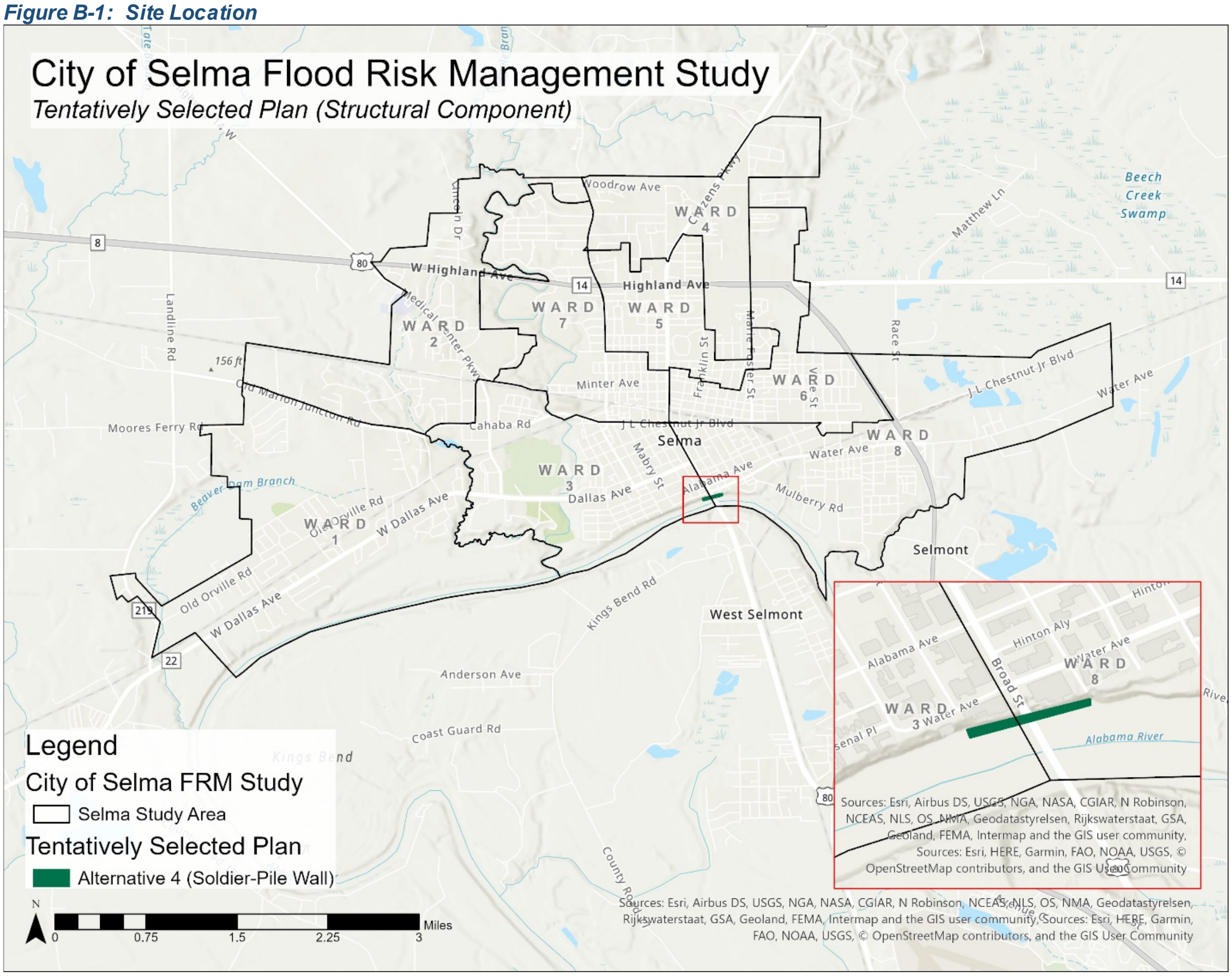
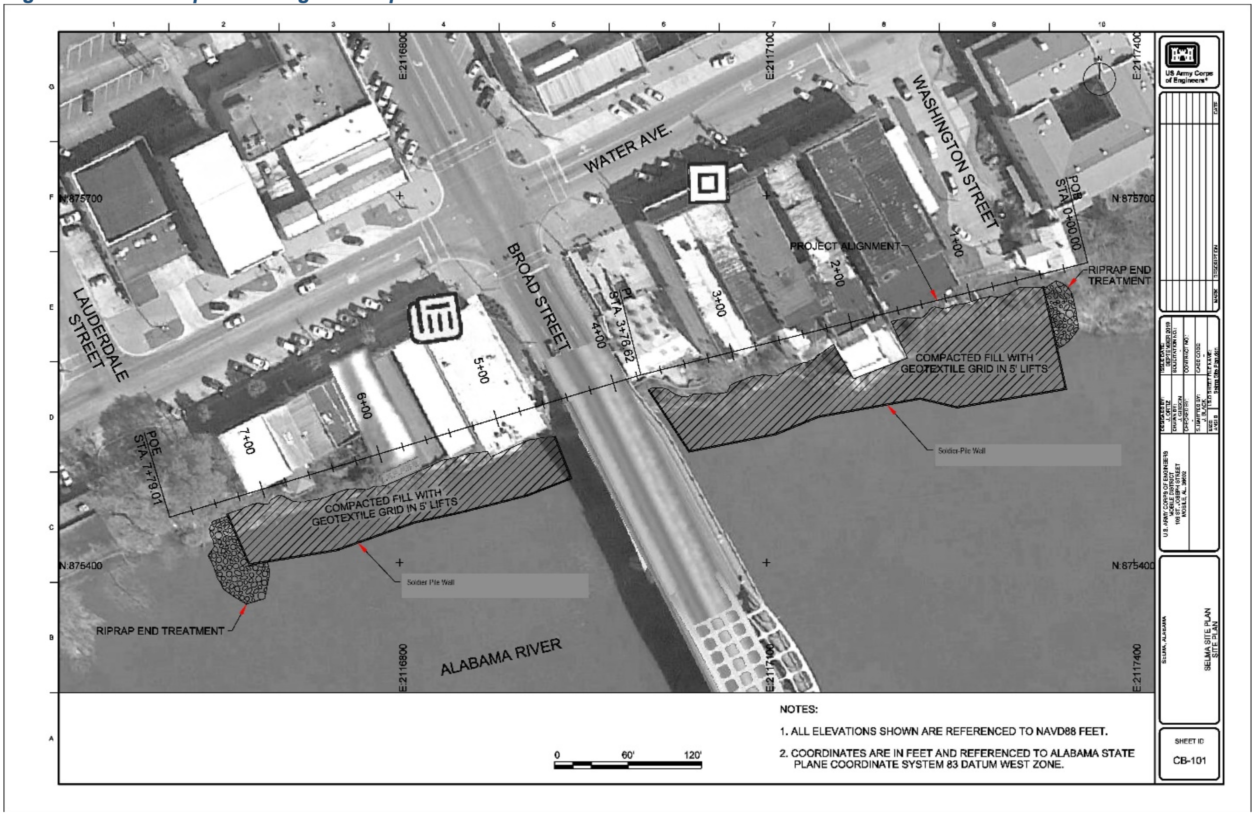


Figure B-2: Conceptual Design of Proposed Work



C. <u>Authority and Purpose</u>.

This feasibility study is authorized by House Resolution No. 66, June 7, 1961:

> *"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report on Alabama-Coosa Branch of Mobile River, Georgia and Alabama, published as House Document No. 66, Seventy-fourth Congress, first, session, with a view to determining the advisability of providing improvements for flood control on Alabama River in Dallas County, Alabama."*

The Bipartisan Budget Act of 2018 (Public Law (P.L.) 115-123), Division B, Subdivision 1, Title IV, appropriates funding for the study at full Federal expense. As identified under this "Supplemental Appropriation" bill, the study is subject to additional reporting requirements and is expected to be completed within three years and for $3 million dollars.

In accordance with the memorandum for the Commander dated July 16, 2020 from Headquarters (HQ) United States Army Corps of Engineers (USACE) to the South Atlantic Division (SAD), the investigation of streambank (bankline) erosion measures is being conducted under the authority of Section 1203 of Water Resources Development Act of 2018 as authorized:

"(a) Feasibility Reports.--The Secretary shall expedite the completion of a feasibility study for each of the following projects, and if the Secretary determines that the project is justified in a completed report, may proceed directly to preconstruction planning, engineering, and design of the project: (1) Project for riverbank stabilization, Selma, Alabama."

D. General Description of Fill Material.

(1) General Characteristic of Material. Reference **Table 1**.

(2) Quantity of Material. Reference **Table 1**.

Table B-2: Quantities for Fill Material

Material	*Soldier-Pile Wall (~750 linear ft)*
H-Piles	94 (approximate)
Steel Anchor Tiebacks	94 (approximate)
Concrete Panels (4 ft x 8 ft x 8")	22,500 square feet (sq ft)
Granular Fill	12,500 cy
Riprap	3,333 cy
Total Fill	**15,833 cy**

(3) Source of Material. The riprap will be selected from a commercial quarry in the region.

E. Description of the Proposed Discharge Site.

(1) Location. The center of the proposed Soldier-Pile Wall footprint is located approximately 1,500 feet upstream of River Mile 205.

(2) Size. The proposed length is approximately 750 linear feet. The current design is less than 10% developed and therefore a total square footage is not available at this time.

(3) Type of Site. The proposed work would be performed along the riverbank and riverbed within the Alabama River.

(4) Type of Habitat. The Alabama River within the Study Area consists of large sized gravel and rock with continuous flow.

(5) Timing and Duration of Discharge. The current design is less than 10% developed and therefore construction timeframe and duration not available at this time.

F. Description of Disposal Method. Pilings would be spaced to allow a retaining wall to slide into place. Fill Material and riprap would be placed behind the retaining wall. Riprap would also be placed on the upstream and downstream ends.

II. Factual Determinations:

A. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. TBD. A geotechnical survey is tentatively scheduled for March 2021.

(2) Sediment Type. Large size gravel and rock.

(3) Dredged/Fill Material Movement. No dredging would occur. Fill material would be placed inside the retaining wall with riprap at upstream and downstream ends.

(4) Physical Effects on the Benthos. Benthos would be adversely impacted through direct disturbance to riverbed. Indirect impacts to the immediate vicinity may occur due to increase local turbidity during construction.

(5) Actions Taken to Minimize Impacts (Subpart H). Construction Best Management Practices (BMPs) and an Erosion, Sediment, and Pollution Control Plan (ESPCP) would be implemented to contain potential increased turbidity resulting from the disposal and construction. Relocation for federally listed species would occur. Coordination with U.S. Fish and Wildlife Service (FWS) and Alabama Department of Conservation and Natural Resources (ALDCNR) is ongoing to ensure adverse impacts are minimized.

B. Water Circulation, Fluctuation, and Salinity Determinations.

(1) Salinity. Not applicable.

(2) Water Chemistry. Water chemistry would not be significantly impacted.

(3) Clarity. Water clarity would be temporarily decreased in the vicinity of the construction activities. These impacts would subside once construction activities are completed.

(4) Color. Color would not be significantly impacted.

(5) Taste. Taste would not be significantly impacted.

(6) Dissolved Gas Levels. Dissolved gas levels would not be significantly affected.

(7) Nutrients. Nutrient levels would not be significantly impacted.

(8) Eutrophication. Eutrophication would not be significantly impacted.

C. Water Circulation, Fluctuation, and Salinity Gradient Determinations:

(1) Current Patterns and Circulation.

(a) Current Patterns and Flow. The construction of the retaining wall would not significantly alter current and flow patterns. No significant induced flooding would occur.

(b) Velocity. Velocity may increase within the immediate vicinity due to the reduced friction from the retaining wall; however the riprap caps would absorb the bulk of the energy in order to reduce erosion in the surrounding area.

(2) Stratification. There would be no impacts on water stratification.

(3) Hydrologic Regime. There would be no significant impacts on the hydrologic regime.

(4) Normal Water Level Fluctuations. There would be no significant impacts on water level fluctuations.

(5) Salinity Gradients. Not applicable.

D. Suspended Particulate/Turbidity Determinants.

(1) Expected Changes in Suspended Particulate and Turbidity Levels in Vicinity of Disposal Sites. A temporary increase in suspended particulates and turbidity levels would occur in the immediate vicinity of the construction zone. These impacts will subside when the activities are completed.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light Penetration. Increases in suspended solids concentrations will be nominal and temporary. No significant impacts to light penetration are anticipated.

(b) Dissolved Oxygen. Dissolved oxygen will not be significantly impacted.

(c) Toxic Metals and Organics. No significant increases in toxic metals and organics are expected to occur due to the construction activities.

(d) Pathogens. Pathogen levels will not be affected as a result of this project.

(e) Aesthetics. The area would be permanently altered from the construction of a retaining wall; however should no bank stabilization be implemented the Study Area aesthetics would decline due to degradation of the riverbank and continual erosion.

(3) Effects on biota.

(a) Primary Production, Photosynthesis. Temporary, localized impacts to primary production or photosynthesis levels may result from turbidity plumes generated by construction activities. These effects would be localized and would subside upon project completion.

(b) Suspension/Filter Feeders. Suspension/filter feeders in the immediate vicinity of the project footprint would be adversely impacted. Relocation would occur to minimize impacts. Species within the surrounding vicinity would not be significantly affected by this action. Increased turbidity will be contained using Best Management Practices and an Erosion and Sediment Control Plan.

(c) Sight Feeders. Sight feeders would vacate the vicinity and may be temporarily affected by increased turbidity. These effects would subside upon completion of the construction activities.

(4) Actions taken to Minimize Impacts (Subpart H). Construction BMPs and an ESPCP would be implemented in order to minimize impacts. Federal and State Agency coordination is ongoing to ensure adverse impacts to federally listed species are minimized.

E. Contaminant Determinations. Sediment samples would be taken to determine chemical composition of the riverbed within the footprint of the proposed project. Historical Unexploded Ordnances (UXOs) were placed within the footprint of the TS. These UXOs were likely made using lead material. It is unknown at this time whether any leeching of toxic chemicals occurred while the UXOs were buried. A cultural data recovery coupled with an UXO Survey would remove any existing hazardous material found within the footprint. The riprap rock used for the repair would be tested prior to implementation to ensure the material is not contaminated.

F. Aquatic Ecosystem and Organism Determinations.

(1) Effects on plankton. There may be temporary effects on plankton in the immediate vicinity of the construction zone due to increased turbidity; however these effects would be localized and short-term.

(2) Effects on Benthos. Benthic organisms within the construction zone would be crushed underneath riprap placement. Adjacent benthic communities would be indirectly impacted from increased turbidity. No significant impacts would result from this project.

(3) Effects on Nekton. Nektonic species are expected to be temporarily affected during disposal and construction and may evacuate the immediate vicinity; however they are expected to return once turbidity levels return to pre-project conditions. No significant impacts are anticipated.

(4) Effects on Aquatic Food Web. This project would pose no significant impacts to the aquatic food web.

(5) Effects on Special Aquatic Sites.

(a) Sanctuaries and Refuges. No sanctuaries or refuges occur within the proposed project area; therefore there would be no impacts resulting from this project.

(b) Wetlands. It is unlikely that jurisdictional wetlands occur within the footprint; however a survey would be conducted to verify and delineate any existing wetlands.

(c) Mud Flats. No mud flats exist within the project vicinity; therefore there would be no impacts as a result of the project.

(d) Vegetated Shallows. No vegetated shallows would be affected by this

(e) Coral Reefs. Not applicable.

(f) Riffle and Pool Complexes. No riffle or pool complexes would be affected by this project.

(6) Threatened and Endangered Species. The USACE recognizes that the proposed action area contains suitable habitat and an established population of tulotoma snail (*Tulotoma magnifica*) as well as critical habitat for the Alabama sturgeon (*Scaphirhynchus suttkusi*), orangenacre mucket (*Lampsilis perovalis*), southern clubshell (*Pleurobema decisum*), and the Georgia rockcress (*Arabis georgiana*). The USACE determined that the proposed action may affect and is likely to adversely affect the tulotoma snail and the aforementioned critical habitats. Coordination with the FWS is ongoing to ensure adverse impacts are minimized.

(7) Other Wildlife. No impacts to wildlife are anticipated.

(8) Actions to Minimize Impacts. Impacts to the species will be minimized by avoidance of the animal's habitat.

G. Proposed Fill Site Determination.

(1) Mixing Zone Determination. This activity does not require a mixing zone determination. The nature of the construction activities and constituent concentrations preclude the need for a mixing zone determination.

(2) Determination of Compliance with Applicable Water Quality Standards. The proposed action will comply with applicable water quality standards as established by the Alabama Department of Environmental Management. Water Quality Certification will be obtained prior to construction.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supply. This project would not significantly impact municipal or private water supplies.

(b) Recreation and Commercial Fisheries. Fishing activities at the sites would be temporarily interrupted during the construction activities. No long-term impacts are anticipated to result from this project.

(c) Water Related Recreation. The proposed action would temporarily disrupt water-related recreation at the construction site; however no negative long-term effects are anticipated from the action. Recreationers would be able to access surrounding areas for enjoyment.

(d) Aesthetics. Aesthetics would be permanently impacted as a result of the proposed action. The proposed bank stabilization would convert a portion of the natural river into a man-made structure designed to reduce erosion; however should no bank stabilization be implemented the Study Area aesthetics would degrade due to continual and ongoing erosion.

(e) Parks, National and Historic Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. No parks, national historic monuments, national seashores, wilderness areas, research sites and similar preserves in the vicinity will be adversely impacted as a result of this project.

(f) Other Effects. The proposed project location is located within several cultural resources' Area for Potential Effects. Coordination with the Alabama Historical Commission is ongoing.

(4) Determination of Cumulative Effects on the Aquatic Ecosystem. A thorough cumulative assessment considers past, present, and future action which affect the Study Area. Historical activities to reduce riverbank erosion repairs include lining the bank with debris. Additionally, the Federal Emergency Management Agency has conducted emergency bank stabilization using concrete blocks along the downtown riverfront. Currently, the USACE is conducting a bank stabilization project within the City limits. The City of Selma had designed plans to develop the riverfront property to include a riverwalk and revitalization however no funding to complete the work has been allocated at this time. Collectively, bank stabilization efforts have resulted in the decreased erosion in the immediate locations; however each effort in itself has not been substantial enough to reduce erosion throughout the entire reach of the Study Area.

(5) Determination of Secondary Effects on the Aquatic Ecosystem. Temporary and localized impacts may occur downstream of the construction activities.

III. Findings of Compliance or Noncompliance with the Restrictions on Discharge.

A. No significant adaptations of the guidelines were made relative to this evaluation.

B. The proposed discharge represents the least environmentally damaging practicable alternative that would accomplish the project objectives.

C. Based on the nature of the fill material, the placement of riprap would be in compliance with applicable state water quality standards. Furthermore, water quality certification will be obtained from the State of Alabama.

D. The fill material would not violate the Toxic Effluent Standard of Section 307 of the Clean Water Act.

E. The placement of fill material would not jeopardize the continued existence of any Federally listed endangered or threatened species or their critical habitat.

F. The proposed discharge of fill material would not contribute to significant degradation of waters of the United States. Nor would it result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing; life stages of organisms dependent upon the aquatic ecosystem; ecosystem diversity, productivity and stability; or recreational, aesthetic or economic values.

G. Appropriate and practicable steps to minimize potential adverse impacts of the discharge on the aquatic ecosystem include:

(1) Locations, times and duration of the project have been selected to minimize potential adverse impacts to the aquatic ecosystem.

(2) An interdisciplinary team has evaluated sites, and project designs have been altered per their recommendations.

DATE:______________________________ ________________________________

Sebastien P. Joly
Colonel, U.S. Army
District Commander

B.3. Endangered Species Act and Fish and Wildlife Coordination Act

Formal consultation under the Endangered Species Act (ESA) is ongoing. Final Coordination will be included within the Final Appendix.

Due to the limited resources of the USFWS, coordination for the FWCA will be included within the Biological Opinion and will be separated and distinct from ESA language. This solution was approved by the Vertical Chain via In Progress Review on February 27, 2020.

Biological Assessment
For
Selma Flood Risk Management Study
City of Selma, Dallas County, Alabama

Table of Contents

1.0 Introduction

The U.S. Army Corps of Engineers (USACE) is conducting a Flood Risk Management study for the City of Selma. The Tentatively Selected Plan (TSP) is Alternative 4 plus a floodplain management/emergency evacuation plan (FMEEP) to reduce the flood induced threats to cultural resources while also reducing the life-safety risk to citizens affected by flooding within the Study Area. Alternative 4 is the construction of a Soldier-Pile Wall for bankline stabilization spanning 750 linear feet (ft). Staging, access, and construction would occur via barge from the Alabama River. The FMEEP would identify at-risk zones and create a warning and evacuation system designed to efficiently direct citizens out of flood prone areas with advance notice.

2.0 Previous Coordination

The USACE, Mobile District requested technical services regarding the study with the U.S. Fish and Wildlife Service (USFWS) Daphne Field Office in January 2019 and has kept regular communication throughout the study process. Through this coordination, the USFWS agreed that no additional mussel surveys were needed to confirm presence, but that a mussel relocation may be required prior to construction activities.

3.0 Location

The Study Area is located along the Alabama River in the City of Selma, Alabama as represented by the shaded area in Figure 1. Selma is home to the largest historic district in Alabama. It is located approximately 50 miles (mi) west of Montgomery, Alabama. The city itself is divided into wards with each having a representative in the city government. The wards receiving frequent flooding are identified and are the focused project area for this study. They include: Wards 1, 3, 6 and 8. River Mile(s) (RM) 256 through 261 have been assessed for this study.

Figure 1: Selma Study Area

4.0 Project Description

The TSP (recommended plan) for this study is Alternative 4 in conjunction with a FMEEP measure that was identified during the Alternative Milestones Meeting. Exact construction details of the Soldier-Pile Wall tie-in to the Edmund Pettus Bridge abutment will be fully developed during the Preconstruction Engineering and Design phase; however upcoming site surveys and geotechnical investigations will help in the development of preliminary plans and footprint during the feasibility study phase. Preliminary plans are anticipated to include a Soldier-Pile Wall upstream and downstream from the existing Edmund Pettus Bridge and its abutments as shown in Figure 2. For the purposes of this Biological Assessment (BA), the analysis will be focused on the proposed Soldier-Pile Wall.

4.1 Construction

Exact dimensions of the proposed Soldier-Pile Wall are currently being developed and are awaiting a geotechnical survey to determine the necessary requirements. Approximately 750 linear feet (ft) of bank stabilization would be achieved through a Soldier-Pile Wall design with riprap caps on the upstream and downstream ends. The conceptual design, including construction materials, was developed in order to estimate first costs of the alternative, which are listed in Table 1. Prior to construction, a survey crew would identify and relocate any unexploded ordnances (UXOs) within the footprint.

Figure 2: Soldier-Pile Wall Conceptual Design and Location

Staging, construction, and access of the Soldier-Pile Wall would occur via the Alabama River. Table 1 is a preliminary estimation of materials and quantities necessary to construct the Soldier-Pile Wall. Approximately 94 H–Piles would be set at approximately 8 ft on center throughout the 750 linear ft design and would be drilled in place. Tiebacks may be required for each H-Pile. Concrete wall panels will be placed between each H-Pile and rip-rap caps would be placed at the outermost upstream and downstream ends. The H-Piles would be drilled into place using equipment such as an auger, and the excavated material for each H-Pile would be graded at the location of each hole. At this phase of the study it has not been determined if clearing and grubbing of the riverbank would be required; however the maximum potential vegetation removal would encompass eight acres. In total, construction would take approximately 30 months to complete. Best Management Practices (BMPs) (e.g. erosion control blankets, fiber rolls, geotextiles, sediment traps, seeding, silt fences, vegetated buffers) will be specified in a Stormwater Pollution Prevention Plan which would be used to reduce environmental impacts.

Table 1: Soldier-Pile Wall Materials and Quantities

Material	Soldier-Pile Wall (750 linear ft)
H-Piles	94 (approximate)
Steel Anchor Tiebacks	94 (approximate)
Concrete Panels (4 ft x 8 ft x 4")	22,500 square feet (sq ft)
Granular Fill	12,500 cy
Riprap	3,333 cy
Total Fill	15,833 cy

4.2 Operation and Maintenance

No regular operation would be required. The proposed Soldier-Pile Wall would be self-sustaining. Species control (e.g. herbaceous, woody, and invasive species growth) measures would be necessary, such as weeding and spraying. Intermittent inspections would be required to review structural integrity for things such as cracks, sloughing, and other signs of structural movement.

5.0 Status of the Species/Critical Habitat

The project location is on the Alabama River in Selma, Dallas County, Alabama falls within the Strategic River Reach Unit number 24. The federally listed species within the county are listed in Table 2. As shown in Figure 3, much of the Study Area is heavily developed and has undergone a significant amount of habitat degradation. Additionally, the proposed project footprint lies in a continually disturbed area due to the erosional processes. As such, no suitable habitats necessary for federally listed terrestrial species exist within the project location. The project location also contains no suitable habitat for the heavy pigtoe and is located one mile downstream of the remaining population; therefore no direct or indirect impacts to the species are anticipated.

Figure 3: Study Area habitat degradation

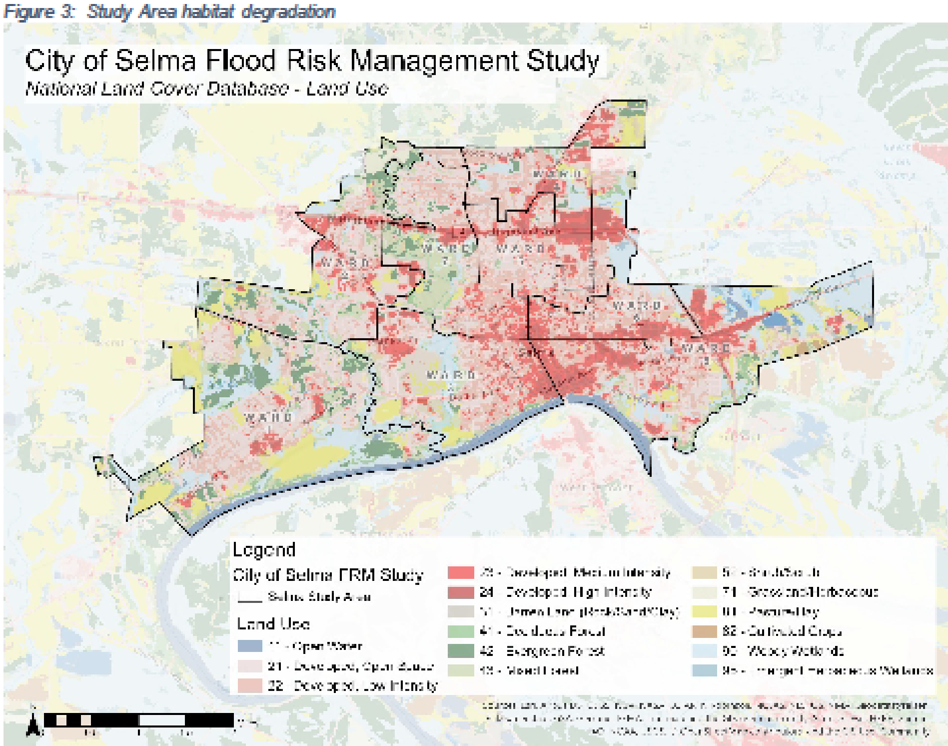


Table 2: Threatened and Endangered Species and Critical Habitat in Dallas County, Alabama dated August 1, 2020.

Common Name	Scientific Name	Status	Suitable Habitat	Critical Habitat
Red-cockaded Woodpecker	*Picoides borealis*	E	Open, mature pine woodlands; suitable habitat is not present within the Study Area	None
Wood Stork	*Mycteria americana*	T	Forested/herbaceous wetland; suitable habitat is not present within the Study Area	None
Alabama Sturgeon	*Scaphirhynchus suttkusi*	E	main channels of major rivers in areas below the Fall Line	Final – within
Alabama Moccasinshell	*Medionidus acutissimus*	T	sand and gravel substrate in clear water of moderate flow in small to large rivers; suitable habitat is not present within the Study Area	Final – outside
Heavy Pigtoe	*Pleurobema taitianum*	E	gravel with large component of coarse sand in water exceeding 6 m with variable current	None
Orangenacre Mucket	*Lampsilis perovalis*	T	high quality stream and small river habitat on stable sand/gravel/cobble substrate in moderate to swift currents	Final – within
Ovate Clubshell	*Pleurobema perovatum*	E	sand/gravel shoals and runs of small rivers and large streams; suitable habitat is not present within the Study Area	Final – outside
Southern Clubshell	*Pleurobema decisum*	E	highly oxygenated streams with sand and gravel substrate in shoals	Final – within

Common Name	Scientific Name	Status	Suitable Habitat	Critical Habitat
			of large rivers to small streams	
Tulotoma Snail	*Tulotoma magnifica*	T	riffles and shoals on the undersides of large rocks	None
Alabama Canebrake Pitcher-plant	*Sarracenia rubra ssp. alabamensis*	E	Sandhill seeps, swamps, and sloping bogs along the Fall Line Hills that divide the upper Coastal Plain and Piedmont physiographic regions; suitable habitat is not present within the Study Area	None
Georgia Rockcress	*Arabis georgiana*	T	Shallow soil accumulations on rocky bluffs, ecotones of gently sloping rock outcrops, outcrops along rivers, and sandy loam along eroding riverbanks; however the habitat within the Study Area is too erosional to sustain critical habitat	Final – outside
Price's Potato-bean	*Apios priceana*	T	open, mixed-oak forests, forest edges and clearings on river bottoms and ravines, being unable to tolerate deep shade; suitable habitat is not present within the Study Area	None

Key 1: E = Endangered; T = Threatened; Final – within = designated critical habitat within Study limits; Final – outside = designated critical habitat outside Study limits; None = no designated critical habitat

The species and/or their critical habitats that are being considered as no effect due to lack of suitable habitat and/or outside Study Area are as follows:

- Red-cockaded woodpecker (*Picoides borealis*)

- Wood stork (*Mycteria Americana*)
- Alabama moccasinshell (*Medionidus acutissimus*)
- Heavy pigtoe (*Pleurobema taitianum*)
- Ovate clubshell (*Pleurobema perovatum*)
- Alabama canebrake pitcher-plant (*Sarracenia rubra ssp. alabamensis*)
- Georgia rockcress (*Arabis georgiana*)
- Price's potato-bean (*Apios priceana*)

Of particular concern in the Study Area are the following listed species and/or their critical habitat:

- Alabama sturgeon (*Scaphirhynchus suttkusi*)
- Orangenacre mucket (*Lampsilis perovalis*)
- Southern clubshell (*Pleurobema decisum*)
- Tulotoma snail (*Tulotoma magnifica*)

5.1 Alabama sturgeon

5.1.1 Life History

The Alabama sturgeon is the smallest of all the North American sturgeons, typically weighing only 2 to 4 pounds at maturity. The head is broad and flattened shovel-like at the snout, with a tubular and protrusive mouth. As with all sturgeon species, there are four barbells (whisker-like appendages) located on the bottom of the snout in front of the mouth that are used to locate prey. Bony plates called scutes line the body in five rows, one on the back and two each on the middle and lower sides. Bony plates separated by sutures also cover the head. The body narrows abruptly to the rear-forming a narrow stalk between the body and tail. The upper lobe of the tail fin is elongated and ends in a long filament. Coloration of the upper body is light tan to golden yellow, with a creamy white belly. Sturgeon are long-lived fishes. Although the life span of the Alabama sturgeon in the wild is unknown, Burke and Ramsey (1985) provided estimates on three preserved specimens that ranged from 2 to 10 years of age.

5.1.2 Feeding Habits

The examination of stomach contents of museum and captured specimens indicate that sturgeons feed in a broad range of habitat, including shallow water in swift currents, and maybe even in the water column. However, they generally tend to be opportunistic bottom feeders primarily preying on aquatic insects, plant material, and mollusks (Mayden and Kuhajda, 1996; Williams and Clemmer, 1991; Burke and Ramsey, 1985; Haynes et al., 2005; and Keevin et al., 2007). However, commercial fisherman report that sturgeon have been taken on trotlines using a variety of bait, including poultry parts, fish, and commercially prepared bait (Williams and Clemmer 1991).

Sexual maturity of the Alabama sturgeon is believed to occur between 5 to 7 years of age. Spawning frequency of both sexes is likely influenced by food supply and fish condition, and presumably like other shovelnose sturgeon, may only occur at 2-3 year intervals (Mayden and Kuhajda 1996). As with most riverine sturgeon, spawning is likely initiated by environmental cues such as, temperature, photoperiod, and an increase in river discharge during the late winter and early spring. Following spawning, Scaphirhynchus species larvae require highly oxygenated, flowing water for development. The larvae are planktonic, drifting with river currents for 12 to 13 days after hatching, and exhibit a swim-up and drift behavior while floating in currents (Kynard et al., 2005). Research indicates that pallid sturgeon larvae (*Scaphirhynchus albus*) can drift more than 200 km (125 mi) during the first 11 days of the larval life stage, depending on water velocities, before settling to a benthic existence (Braaten and Fuller 2005). This information suggests that Alabama sturgeon may require some minimum distance of flowing river conditions for development of larval to juvenile stage, and for sustainable recruitment of the species.

5.1.3 Habitat

The Alabama sturgeon is endemic to rivers of the Mobile River Basin below the Fall Line (Mettee et al. 1996, p. 83; Boschung and Mayden 2004, p. 109). Its current range includes the Alabama River from R.F. Henry Lock and Dam downstream to the confluence of the Tombigbee River. The species is also known to survive in the Cahaba River. Only eight Alabama sturgeon have been captured, or reported captured and released in the decade prior to listing despite numerous efforts. These fish were collected from several locations in the Alabama River between Millers Ferry Lock and Dam and its confluence with the Tombigbee River (Rider and Hartfield 2007, p. 490). Since federal listing in 2000 only two Alabama sturgeon have been captured or reported captured: the first in July 2000 within lower Cahaba River, and the second in April 2007 within the Alabama River below Claiborne Lock and Dam by the Alabama Department of Conservation and Natural Resources (ADCNR). Recent efforts to study e-DNA have detected Alabama sturgeon presence within the Alabama River; however exact locations of occupancy cannot be determined.

5.1.4 Critical Habitat Description

Only one Critical Habitat Unit exists and is designated as "Alabama and Cahaba Rivers." It was believed to be occupied at the time of critical habitat designation and encompasses approximately 524 kilometers (km) or 326 miles (mi). As stated in 73 FR 30361:

> *"The Alabama and Cahaba Rivers are the last known areas that still support the sturgeon, both of which were occupied at the time of listing. This was recently confirmed by the 2007 collection of an individual from the Alabama River below Claiborne Lock and Dam, and the 2000 collection of an individual from the lower Cahaba River (ADCNR pers. comm. 2007). Although the Alabama River, within this unit, contains two physical barriers (Claiborne and Millers Ferry Locks and Dams), it supports the PCEs to sustain this extremely rare fish. The single critical habitat unit includes the channel of the rivers and streams listed between the ordinary high water mark on each bank, which is defined in 33 CFR*

329.11 as "the line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank; shelving; changes in the character of the soil; destruction of terrestrial vegetation; the presence of litter and debris; or other appropriate means that consider the characteristics of the surrounding areas." The distances between landmarks marking the upstream and downstream boundaries of the unit are given in kilometers and equivalent miles, as measured by tracing the thalweg (a line connecting the lowest points of successive cross sections) of the stream, not the straight-line distance. River miles referenced in this rule were taken from a Corps of Engineers 1985 stream mileage table."

5.1.4.1 Primary Constituent Elements

Based on the habitat needs and the current knowledge of the life history, biology, and ecology of the species, the Alabama sturgeon's Primary Constituent Elements (PCEs) are:

1) A range of flows with a minimum 7-day flow of 4,640 cubic feet per second during normal hydrologic conditions, measured in the Alabama River at Montgomery.
2) River channel with stable sand and gravel river bottoms, and bedrock walls, including associated mussel beds.
3) Limestone outcrops and cut limestone banks, large gravel or cobble such as that found around channel training devices, and bedrock channel walls that provide riverine spawning sites with substrates suitable for egg deposition and development.
4) Long sections of free-flowing water to allow spawning migrations and development of eggs and larvae.
5) Water temperature not exceeding 90 °Fahrenheit (32 °Celsius), dissolved oxygen content over 4 milligrams per liter, and pH (a measure of acidity) within the range of 6.0 to 8.5.

5.2 Orangenacre mucket and southern clubshell

The orangenacre mucket (*Lampsilis perovalis*) is a medium-sized inflated mussel with an oval, moderately thick, yellow to dark reddish shell that may or may not have green rays. The southern clubshell (*Pleurobema decisum*) is a medium sized slightly rectangular mussel about 70 millimeters (mm) or 2.8 inches (in) long, with a yellow to yellow-brown thick shell, and heavy hinge plate and teeth.

5.2.1 Life History

Early life stage of these species begin an incubation period following fertilization within the female and are released as glochidia. Glochidia act as parasites on the gills of freshwater fish. Following a period of development, the glochidia disperse from the fish host and settle in suitable riverbed habitats as juvenile mussels. Juvenile mussels bury within substrate completely and feed using their foot to bring nutrients into the shell until they are fully formed. Stable substrates with low to moderate amounts of sediment, algae, correct flow, and water quality are required to facilitate development (Yeager et al. 1994; Gatenby et al. 1996). Once juvenile mussels have developed into adults, male mussels release sperm into the water column where females filter the sperm for fertilization and the cycle repeats.

5.2.2 Feeding Habits

Freshwater mussels partially bury themselves within substrate and siphon suspended oxygen and organic material from the water column. Food sources include algae, bacteria, and detritus.

5.2.3 Habitat

These mussels live embedded in stable sand, gravel, and/or cobble substrates of rivers and streams with swift water flow, clean water quality.

5.2.4 Critical Habitat Description

A total of 15 Critical Habitat Units are designated for the orangenacre mucket and 26 for the southern clubshell. According to 69 FR 40083, the Study Area is within critical habitat unit number 14 "Alabama River" was believed to be unoccupied at the time of listing and encompasses 73km or 45mi. As stated in 69 FR 40083:

> ***"Alabama River Drainage, Alabama***
>
> *The Alabama River mollusk community has been reduced due to the effects of historic pollution events and impoundment for navigation. Historical records from this river include the Alabama moccasinshell, orange-nacre mucket, fine-lined pocketbook, triangular kidneyshell, and southern clubshell. The habitat units defined below contain primary constituent elements (e.g., flow, water quality, substrate, channel stability) to a degree that allows the survival of two of these mussels. Fish hosts for these species are also known to be present (Mettee et al., 1996). The introduced Asian clam is locally present in these drainages in low to moderate densities.*
>
> ***Unit 14. Alabama River, Autauga, Lowndes, Dallas Counties, Alabama***
>
> *Unit 14 encompasses 73 km (45 mi) of the Alabama River channel, extending from the confluence of the Cahaba River, Dallas County, upstream to the confluence of Big Swamp Creek, Lowndes County, Alabama. The southern clubshell is known to occur within this reach (Hartfield and Garner, 1998). This area may become suitable for reintroduction of the orange-nacre mucket."*

5.2.4.1 Primary Constituent Elements

PCEs 1, 2, 3, 4, and 6 are essential to the conservation of the species and provide space for individual and population growth and for normal behavior. PCEs 1 and 2 are essential to provide food, water, air, light, minerals, or other nutritional or physiological requirements. PCEs 4 and 5 provide cover or shelter, sites for breeding, reproduction, and rearing (or development) of offspring. PCEs 1 provides habitats that are protected from disturbance.

1) Geomorphically stable stream and river channels and banks;
2) A flow regime (i.e., the magnitude, frequency, duration, and seasonality of discharge over time) necessary for normal behavior, growth, and survival of all life stages of mussels and their fish hosts in the river environment;
3) Water quality, including temperature, pH, hardness, turbidity, oxygen content, and other chemical characteristics necessary for normal behavior, growth, and viability of all life stages;
4) Sand, gravel, and/or cobble substrates with low to moderate amounts of fine sediment, low amounts of attached filamentous algae, and other physical and chemical characteristics necessary for normal behavior, growth, and viability of all life stages;
5) Fish hosts with adequate living, foraging, and spawning areas for them; and,
6) Few or no competitive or predaceous nonnative species present.

5.3 Tulotoma snail

5.3.1 Life History

The tulotoma snail produce live-born offspring year round (Christman et al. 1996, pp. 45-59). Rapid growth is experienced during the first year where the species reaches approximately 11 to 14 mm. The life span of tulotoma snail is approximately two years in the lower Coosa River (Christman et al. 1996, p. 61). As stated in 76 FR 31866:

> *Based on a study of the tulotoma life history in the Coosa River below Jordan Dam, Elmore County, Alabama, tulotoma produce live-born offspring year round, but reproduction peaks during the months of May to July, and at sizes of about 3 to 5 millimeters (mm) (0.1 to 0.2 inches (in)) height of last whorl (HLW) or coil in a tulotoma shell (Christman et al. 1996, pp. 45-59). They grow rapidly during their first year reaching sizes of 11 to 14 mm (0.4 to 0.5 in), with females producing an average of 16 offspring in their second year (Christman et al. 1996, pp. 45-59). Females that live beyond their second year grow more slowly and produce an average of 28 juveniles per year (Christman et al. 1996, pp. 45-59); few tulotoma survived longer than 2 years of life in the lower Coosa River (Christman et al. 1996, p. 61).*

5.3.2 Feeding Habits

This species is gill-breathing and filter feeds on suspended particles in the water column.

5.3.3 Habitat

Though historical habitats included large coastal plain river, large high-gradient rivers, and multiple upland tributary streams, the species is now restricted to the Alabama River with only five distinct populations (ADCNR 2005). They prefer heavy flat rocks and occupy the underside where they filter feed (Christman et al. 1996, p. 28). Tulotoma snail prefer rivers and tributaries with clean water quality and moderate to strong current (Herschler et al. 1990, p. 822).

5.3.4 Critical Habitat Description

No critical habitat has been designated for the species.

5.3.4.1 Primary Constituent Elements

Not applicable.

6.0 Environmental Baseline

The environmental baseline is a "snapshot" of a species' health at a specified point in time. It does not include the effects of the proposed action, but rather provides an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species, its habitat (including designated critical habitat), and ecosystem, within the action area.

6.1 Alabama sturgeon

Based on the 5-year review of the Alabama sturgeon, the population is uncertain since no new information is available to make the determination. The Alabama sturgeon is considered to be extant within the Alabama River. The species is endemic to the Mobile River basin, however significant habitat modifications have curbed the species ability to rebound. Currently, the Mobile River contains over 25 locks and/or dams which have altered the habitat requirements and prohibit the necessary migration to complete their life cycle. These impoundments also lead to increased siltation which acts as chemical/pollutant sinks and further compounds the effects from the altered hydrology. Based on the 2010 USFWS 5-year review for the Alabama sturgeon, very few have been captured or sighted since the 1990s. In total, only 12 individuals have been recorded since that timeframe. The last recorded sighting of the species occurred in 2007; however recent studies have identified e-DNA within the river.

Factors contributing to the inability for the population to recover are the lack of uninterrupted flows over long stretches. To successfully recruit, the sturgeon requires swift unimpeded currents to allow juveniles to drift and develop. Due to the frequent and numerous locks and dams along the Alabama River, the supporting hydrology is not available.

Based on the rare documented encounters, loss of habitat, and fragmented habitat the species is highly vulnerable to extinction.

6.2 Orangenacre mucket

The orangenacre mucket population is considered stable. Where found, most pockets of orangenacre mucket are small and localized. The most robust population of the species occurs in the Sipsey Fork and its tributaries; however the mussels are also commonly found in the National Forest Service's Bankhead National Forest monitoring program. A significant drought in 2000 reduced the population density. Droughts continue to remain a threat to the species especially in shallower areas with smaller drainage as the creeks tend to experience low dissolved oxygen and warmer temperatures. Additional populations have been discovered in tributaries in Choctaw, Monroe, and Lowndes Counties Alabama. Additionally stocking efforts have occurred in the Tallatchee Creek and Locust Fork sites.

6.3 Southern clubshell

Based on the 2019 5-year review, the southern clubshell population is considered improving. The population is common to abundant and is now thought to have stronger densities than at the time of listing. The strongest populations include localized reaches of the Conasauga River, Coosa River, Big Canoe Creek, Cahaba River, Bogue Chitto Creek, Bull Mountain Cree, Buttahatchee River, and Sipsey River. The nearest known population, Bogue Chitto Creek, contained an estimated density of 0.44 individuals per square meter in 2014. The southern clubshell was (1) the most abundant mussel species collected across nine sites in Bull Mountain Creek, (2) the third most frequently encountered mussel in the Buttahatchee River drainage, and (3) had the highest densities in the Sipsey River. Combined, over 2,900 individuals were collected with densities ranging between 0.36-17.71 per square meter which suggests that the populations are increasing.

6.4 Tulotoma snail

Based on the 5-year review of the tulotoma snail, the population is considered improving. Nine streams within the Coosa and Alabama River drainages contain multiple populations of the tulotoma snail. Those streams include the Coosa River, Ohatchee Creek, Choccolocco Creek, Kelly Creek, Yellowleaf Creek, Weogufka Creek, Hatchet Creek, Weoka Creek, and the Alabama River. Prior to listing, no tulatoma snail populations had been located within the Alabama River within the previous 50 years. Between 2006 and 2008 three new populations were discovered in the Alabama River. Those locations were below Claiborne Lock and Dam, below R.F. Henry Lock and Dam, and below Millers Ferry Lock and Dam. A 2010 survey conducted by Garner et. al reconfirmed two of those sites and identified an additional three populations, all of which were located upstream and downstream of the R.F. Henry Lock and Dam.

7.0 Effects of Proposed Action

7.1 Channel Morphology

The proposed action would result in minor channel morphology. Approximately 750 linear feet of riverbed would be permanently altered through the construction of the Soldier-Pile Wall. The Soldier-Pile Wall would lie on top of existing geology and soils.

7.2 Flow Regime

The proposed action would result in a minor hydrologic change as flow would be redirected around the proposed bank stabilization structure. The Soldier-Pile Wall would be a permanent feature but would not significantly alter the hydrologic timing, duration, volume, or frequency of the Alabama River. Though flows would be diverted around the structure, no impoundment would occur. The Study Area lies between the Claiborne Lock and Dam and R.F. Henry Lock and Dam. These structures are operated by the USACE for hydropower and act as "run-of-the-river." Implementation of the Soldier-Pile Wall would not alter operation of federal structures.

The proposed Soldier-Pile Wall would span the length of approximately 750 linear feet along the Alabama River in Selma, Alabama. The Soldier-Pile Wall would be a permanent structure. Approximate width and estimated square footage will be determined prior to the Agency Decision Milestone. This location lies within the largest and healthiest population of tulotoma snail and would permanently remove approximately suitable habitat from the area.

7.3 Water Quality

Construction within the river will create some degree of turbidity in excess of the natural condition. However, impacts from sediment disturbance during construction are expected to be temporary, minimal and similar to conditions seen during high water events. It is expected during construction that suspended particles will settle within a short time frame with no measurable effects on water quality.

8.0 Species and Critical Habitat Effects Analysis

The USACE used a qualitative approach to analyze impacts to the species and critical habitat.

8.1 Alabama sturgeon

Implementation of the proposed action would require fill to be placed within the Alabama River in order to stabilize the riverbank. Efforts to collect the Alabama sturgeon have produced limited results thus leading to the critically imperiled status. Though e-DNA has been detected within the river, exact location of occurrence cannot be assumed. Thus direct mortality and/or harassment of the species during construction would be rare. Comparatively, the proposed action would occupy a relatively small percentage of the total amount of critical habitat. Additionally, no significant changes to the PCEs are anticipated. BMPs would be used to limit increased turbidity.

8.2 Orangenacre mucket and southern clubshell

The Study Area contains suitable habitat for the orangenacre mucket and southern clubshell; however no observations of the species have been documented within the Study Area. Additionally the Study Area is lacking PCE Number 1 "stable riverbank" for the critical habitat. Modifications to the PCEs are anticipated to be minor when compared against the total area within the Critical Habitat Unit.

8.3 Tulotoma snail

The proposed action would also affect suitable habitat known to be occupied by the tulotoma snail. These species spend their entire lives within the Study Area. Of the five remaining populations within the Alabama River, the location of the proposed action lies within the largest and healthiest population of tulotoma snail. Exact square footage of disturbance is not yet known; however efforts to delineate the habitat may occur at a later date.

9.0 Climate Change

Based on the literature review of relevant climate data for the southeast region, there is some consensus that there will be mild increases in the severity and frequency of storms in the region. However, there is no consensus on future changes in hydrology. Observed data from near the study area shows temperatures have been gradually rising since the 1970s, after a cooling period in the middle part of the century. Based on a few of the gages in the watershed, it is difficult to come to a conclusion on whether temperature is increasing or if this is a reoccurring pattern. Annual precipitation seems to be variable for the region. It appears there may be more extremes occurring in recent years, such as extreme low annual precipitation values; however, the overall trends appear to be constant or increasing slightly. There is some consensus on peak streamflow for the region decreasing since the middle of the century, however, the literature lacks a clear consensus. For the Alabama Basin, this decreasing streamflow could be related to the increase in flood control projects within the region since the late 1940s.

A climate change analysis was performed using stationarity assessment, the USACE Climate Hydrology Assessment Tool, Global Circulation/Climate Models. A detailed description of the climate change analysis can be found in the Engineering Appendix of the Integrated Feasibility and Environmental Assessment. Based on the results of this assessment, including considerations of observed precipitation, temperature, and streamflow in the basin, there is not strong evidence suggesting increasing peak annual streamflow will occur in for the future within the region. Furthermore, there is only some consensus the region might see a mild increase in the frequency and severity of precipitation events. This evidence, by itself does not indicate high confidence in an increase in peak flows in the Alabama basin. Based on the lack of clear evidence showing an increase in streamflow, the effects of climate change can be considered within the standard uncertainty bounds associated with the hydrologic/hydraulic analysis being conducted as part of this study.

10.0 Cumulative Effects

A thorough cumulative assessment considers past, present, and future action which affect the Study Area. Historical activities to reduce riverbank erosion repairs include lining the bank with debris. Additionally, the Federal Emergency Management Agency conducted emergency bank stabilization using concrete blocks along the downtown riverfront. Currently, the USACE is conducting a bank stabilization project within the City limits. The City of Selma had designed plans to develop the riverfront property to include a riverwalk and revitalization however no funding to complete the work has been allocated at this time.

Collectively, bank stabilization efforts have resulted in the decreased erosion in the immediate locations; however each effort in itself has not been substantial enough to reduce erosion throughout the entire reach of the Study Area.

11.0 Conservation Measures

The following conservation measures and conditions are provided for construction within the project area:

The USACE will collect and transport any federally listed threatened or endangered species present within the footprint and will provide a Translocation Scope of Work upon completion of Formal Section 7 Coordination.

All operations will abide by the terms and conditions of the U.S. Fish and Wildlife Service Biological Opinion for this project.

BMPs would be used to minimize impacts to adjacent biological resources during construction. BMPs may include but are not limited to (1) monitoring turbidity levels and (2) ensuring compliance with the Alabama Department of Environmental Management water quality permit.

12.0 Conclusions

12.1 Alabama sturgeon

Based on the effects analyses described above, the USACE has determined that the proposed action "may affect but is not likely to adversely affect" the Alabama sturgeon and "may affect and is likely to adversely affect" its critical habitat. Therefore, we request concurrence with this determination per section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq).

12.2 Orangenacre Mucket and Southern Clubshell

The Study Area contains suitable habitat for the orangenacre mucket and southern clubshell; however no observations of the species have been documented within the Study Area. The Study Area is lacking PCE Number 1 "stable riverbank" for the critical habitat. Additionally, modifications to the PCEs are anticipated to be minor when compared against the total area within the Critical Habitat Unit. Based on the effects analyses described above, the USACE determined that the TSP "may affect but is not likely to adversely affect" the orangenacre mucket and southern clubshell; and "may affect and is likely to adversely affect" their associated critical habitats. Therefore, we request concurrence with this determination per section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq).

12.3 Tulotoma snail

Based on the findings of this BA, the USACE determined that the proposed action "may affect and is likely to adversely affect" the tulotoma snail. The USACE will implement appropriate measures to minimize impacts to the species, including relocating snails within and adjacent to the immediate vicinity of the site plan. However, unavoidable adverse impacts to a few individuals may occur if some are not captured during the relocation effort. Additionally, stress inflicted during transport and relocation may cause mortal harm to certain individuals. Safe handling practices would be implemented to ensure adverse effects are minimized as much as possible. Therefore, we request concurrence with this determination per section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq).

13.0 Citations

Yeager et al. 1994; Gatenby et al. 1996

Burke and Ramsey (1985)

Mayden and Kuhajda, 1996; Williams and Clemmer, 1991; Burke and Ramsey, 1985; Haynes et al., 2005; and Keevin et al., 2007

Williams and Clemmer 1991

Kynard et al., 2005

Mayden and Kuhajda 1996

Mettee et al. 1996, p. 83; Boschung and Mayden 2004, p. 109

Rider and Hartfield 2007, p. 490

73 FR 30361

69 FR 40083

Herschler et al. 1990, p. 822

Hartfield 1991, p. 7

Christman et al. 1996, p. 28

B.4. Cultural and Historic Resources

Coordination with the State Historic Preservation Officer and federally recognized tribes is ongoing and will be included within the Final Appendix.

B.4.1. *SHPO*

B.4.2. *Tribal*

B.5. Public/Agency Comments and Responses

Public and Agency feedback will be included within the Final Appendix.

Selma, Alabama

Flood Risk Management Study

Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX C

US Army Corps of Engineers
Mobile District

September 14, 2020

The City of Selma
Alabama
Civil War to Civil Rights and Beyond

APPENDIX-C: **Economics**

Table of Contents

List of Figures

List of Tables

C.1. Introduction

This economic appendix documents the analysis of flood damage reduction for the national economic development (NED) and regional economic development (RED) undertaken for this study. Section I documents the flood damage reduction analysis, and Section II discusses the RED impact for the project alternatives.

C.2. Flood Damage Reduction

C.2.1. Study Authority

The study authority for conducting this study is contained in House Resolution No.66 adopted June 7, 1961 which states:

> *"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers arid Harbors be, and is hereby, requested to review the report on Alabama-Coosa Branch of Mobile River, Georgia and Alabama, published as House Document No. 66, Seventy-fourth Congress, first, session, with a view to determining the advisability of providing improvements for flood control on Alabama River in Dallas County, Alabama"*

The Bipartisan Budget Act of 2018 (Public Law 115-123), Division B, Subdivision 1, Title IV, appropriates funding for the study at full Federal expense. As identified under this "Supplemental Appropriation" bill, the study is subject to additional reporting requirements and is expected to be completed within three years and for $3 million dollars.

In accordance with the memorandum for the Commander dated February 25, 2020 from Headquarters (HQ) United States Army Corps of Engineers (USACE) to the South Atlantic Division (SAD), the investigation of streambank (bankline) erosion measures is being conducted under the authority of Section 1203 of America's Water Infrastructure Act of 2018 as authorized:

> *"(a) Feasibility Reports.--The Secretary shall expedite the completion of a feasibility study for each of the following projects, and if the Secretary determines that the project is justified in a completed report, may proceed directly to preconstruction planning, engineering, and design of the project: (1) Project for riverbank stabilization, Selma, Alabama."*

C.2.2. Purpose

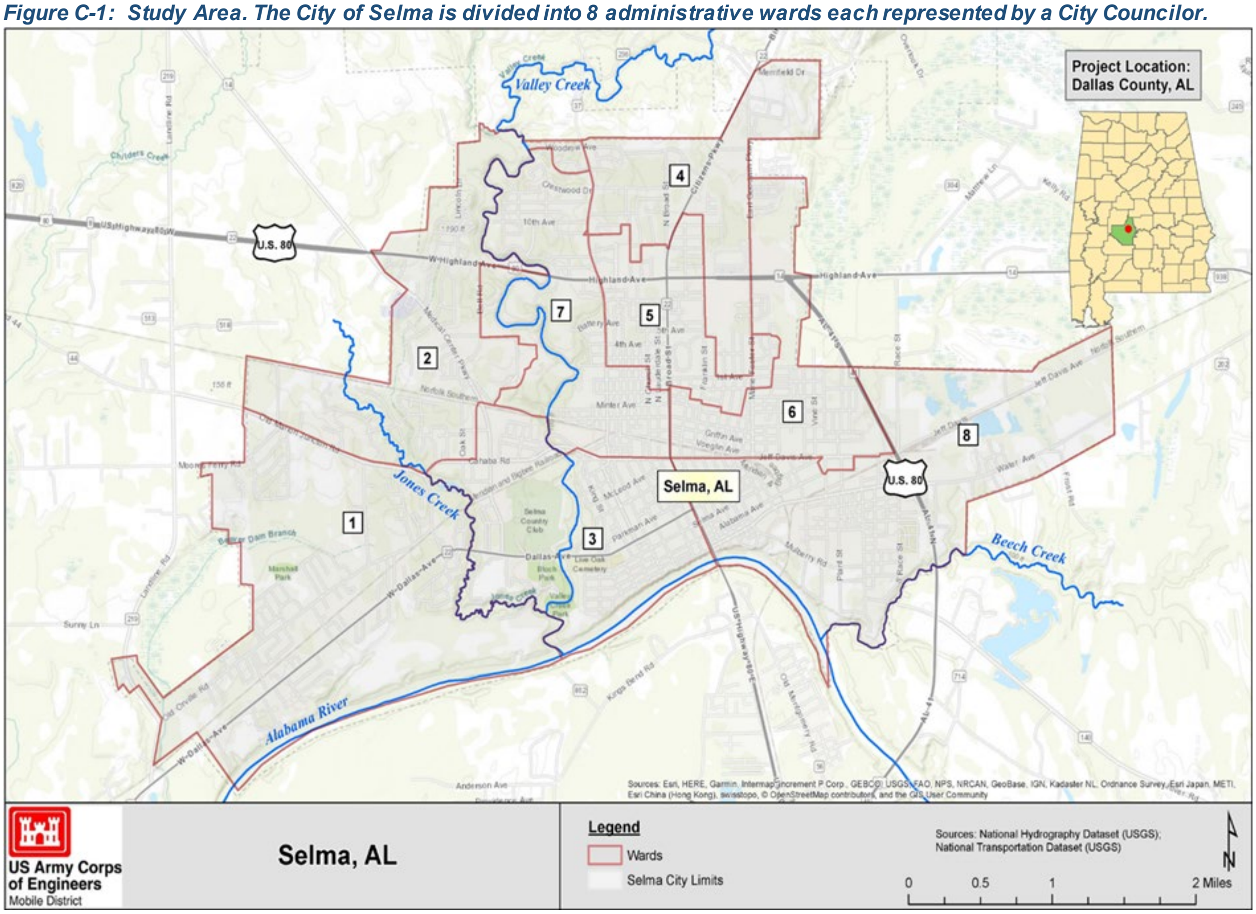
The purpose of this feasibility study is to identify and evaluate alternative plans (including the No-Action Plan) that would address damages caused by flooding in accordance with the Bipartisan Budget Act of 2018, Emergency Supplemental Studies. There is a need for this study because the City of Selma and surrounding areas have experienced 31 moderate to major floods since 1886. Sixteen (16) of the floods are considered 0.04 Annual Exceedance Probability (AEP) (25-year) or greater flood events with crests greater than 52 feet (ft). This results in increases in flood impacts to structures in a region that is one of the most economically deprived in the country. Overbank flooding is localized to Ward 8 of the City of Selma, with the most inundation seen closest to the bank of the Alabama River. Furthermore, the increased flood-induced erosion and subsequent sheer bank failures are threatening one of the last remaining historic riverfronts in the United States (U.S.). The Nationally Registered structures along this riverfront are intimately tied to the Edmund Pettus Bridge, a National Historic Landmark. Currently, eleven (11) nationally registered historic buildings risk collapse into the river under the No-Action Plan. Threats from riverine flooding and frequent high flow velocities threaten the preservation of cultural and historic values intrinsic to the City of Selma.

This document explains what is known about the study area, the floodplain characteristics, existing condition flood damages and expected future condition flood damages in the absence of flood damage reduction measures. The report then documents the procedures used to analyze various measures designed to reduce the risk of flood damages, incorporating National Economic Development (NED) guidelines, and recommends an alternative plan.

C.2.3. Study Area

The study area is located along the Alabama River in the City of Selma, approximately 50 miles west of Montgomery, Alabama via US Highway 80. The city itself is divided into wards with each ward having a representative in the city government. The wards receiving frequent flooding are identified in the Figure below and are the focused project area for this study. They include: Wards 1, 3, 6, and 8. The riverbank miles assessed for this study are from river mile 256-261 along the Alabama River.

Figure C-1: Study Area. The City of Selma is divided into 8 administrative wards each represented by a City Councilor.



Downtown Selma is architecturally unique as some of these structures date back to the 1830s, making the Selma riverfront one of the last intact historic riverfronts in the Southeast. This riverbank tells the story of America, from westward expansion, to the Civil War, to Civil Rights, and beyond. The historic structures along the Alabama River serve as the canvas backdrop to the famed Edmund Pettus Bridge and the history changing events that occurred there, much like the immediately recognizable New York City skyline. Selma's historic structures are indelibly linked to the bridge and the other historic structures that form the historic context and viewshed of this national/international landmark and are invaluable in their scope and breadth when it comes to their importance to the Nation. Fortifying Selma's riverbank foundation to protect its historic structures ensures that more than 200,000 annual world-wide visitors, can, as seven U.S. Presidents have done, walk across the famed Edmund Pettus Bridge to commemorate the brave actions taken and sacrifices made by activists to ensure the nation lives up to its guiding principles of equal rights and protections for all Americans by showcasing the republic's commitment to the Bill of Rights and the U.S. Constitution.

On March 7, 1965 Selma was the site of the first visual evidence of violent racial animus, which resulted in what is known as "Bloody Sunday", perpetrated on peaceful citizens who marched for their Constitutional civil rights. This widely viewed event galvanized the Nation to address fundamental human and civil rights for people of all colors and diverse backgrounds and led to the signing of the Civil Rights Voting Act of 1965. The events that occurred in Selma during the Spring of 1965 forever serve as an iconic depiction of the Nation's pursuit of equality for all men.

As mentioned in the purpose section, there is a need for this study because the City of Selma and surrounding area have experienced 31 moderate or major floods since 1886. Sixteen (16) of the floods are considered 0.04 AEP (i.e. 25-year) or greater flood events with crests greater than 52 feet, and the increased flood-induced erosion is threatening a nationally registered historic district along the Alabama River. Therefore, the Federal Government has an interest in reducing those losses, as doing so not only contributes to NED, but may also improve the living conditions of some minority and low-income groups. 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 statues, applicable executive orders, and other Federal planning requirements.

The flooding, and subsequent structural integrity issues in Selma have been well documented over the decades, evidenced by the 1967 USACE, Mobile District FRM Study, the USACE, Mobile District Selma, Alabama Continuing Authorities Program (CAP) Section 14 Study, and the 2016 FEMA armament of historic masonry stormwater outfall. The 1967 study highlights the overbank flooding towards the east of City, particularly in Ward 8. The FEMA armory and the current Section 14 study both highlight the continued flooding-induced erosion that significantly threaten the structural integrity of the historic Selma riverfront.

For the purposes of the economic appendix, the 'Study Area' is defined as the City of Selma. The 'Floodplain' is defined as the area in the City of Selma, extending to the boundaries of the 0.002 AEP (i.e. 500-year flood event). That floodplain will also include areas encompassing the .01 AEP (i.e. 100-year flood event) and other more frequent flood boundaries. Unless otherwise designated by its recurrence probability, the floodplain discussed in this report is the 0.002 AEP or 500-year floodplain.

C.2.3.1. *Socioeconomic Data*

Alabama's Black Belt originated as a reference to the rich fertile soil of the region, but in addition to this geologic reference the term also holds a demographic reference to the exploitation of African Americans' labor, both as enslaved populations and as sharecroppers and tenant farmers after the American Civil War. Selma, Alabama is located at the center of Dallas County, Alabama which rests in the heart of the Black Belt.

Alabama Population and Demographics: The U.S. Census Bureau estimates Alabama to have a total population of 4,878,747 as of July 1, 2017, from extrapolating the 2010 Census, which reports the State population at 4,779,736. The 2010 Census allows the U.S. Census Bureau to infer growth in the State's population by 2% with 51.6% identifying as female and 48.4% identifying as male. A strong majority of the State's population (98.3%) identify as one race alone, with 69.2% being White, 26.8% being Black or African American, 4.3% being Hispanic or Latino (of any race), 1.5% being Asian, 0.7% being American Indian and Alaska Native, and 0.1% being Native Hawaiian and Other Pacific Islander. Within Alabama there are 1,856,695 households and an average household size of 2.55.

Dallas County Population and Demographics: The U.S. Census Bureau estimates Dallas County to have a total population of 39,215 as of July 1, 2017, from extrapolating the 2010 Census, which reports the County population at 43,820. The 2010 Census allows the U.S. Census Bureau to infer a decline in the County's population by 10.5% with 53.9% identifying as female and 46.1% identifying as male. The median age within Dallas County is 39.3. A strong majority of the County's population (99.2%) identify as one race alone, with 70.5% being Black or African American, 27.9% being White, 1.1% being Hispanic or Latino (of any race), 0.5% being Asian, and 0.3% being American Indian and Alaska Native.

Selma City Population and Demographics: The U.S. Census Bureau estimates the City of Selma to have a total population of 18,310 as of July 1, 2017 from extrapolating the 2010 Census, which reports the City's population at 20,756. The 2010 Census allows the U.S. Census Bureau to infer a decline in the City's population by 11.5% with 55.7% identifying as female and 44.3% identifying as male. The median age within the City of Selma is 37.1. A strong majority of the City's population (99.1%) identify as one race alone, with 80.4% being Black or African American, 17.3% being White, 1.2% being Hispanic or Latino (of any race), 0.8% being Asian, and 0.1% being American Indian and Alaska Native.

Dallas County Industry: The U.S. Census Bureau's 2012 Economic Census reports the largest industry by number of employees to be "Manufacturing" and "Health care and social assistance" followed by "Retail trade" and "Accommodation and food services".

Dallas County Employment and Occupations: In October 2018 the Bureau of Labor Statistics reports Dallas County's unemployment rate at 6.4 percent, 2.6 percent higher than the unemployment rate for the state of Alabama. According to the U.S. Census Bureau's Quick Facts for Dallas County, Alabama, the percent of the population age 16 years and above in the civilian labor force from 2013-2017 is estimated to be 52.7%. According the U.S. Census Bureau's 2013-2017 American Community Survey 5-Year Estimates, the most common occupations within Dallas County, Alabama are "Management, business, science, and arts occupations" (27.0%), "Production, transportation, and material moving occupations" (25%), "Sales and office occupations" (21%), "Service occupations" (18%), and "Natural resources, construction, and maintenance occupations" (9%).

Dallas County Income and Poverty Status: Median household income in Dallas County is $30,065 with 27.9% of all people earning an income below the poverty level.

Social Statistics Important to City of Selma and Dallas County in Relation to Alabama and the Nation: While the subject area's population is contracting, there are thousands of citizens that continue to mark Dallas County, Alabama and observe the historic City of Selma as not only a part of their heritage but as an indelible part of our Nation's path to progress and the Voting Rights Act of 1965. Despite the difficult economic circumstances of the region, there is opportunity to strengthen the Selma Community and increase the citizen's resiliency with the mitigation of flood risk attributable to the Alabama River. The median household income is $24,223 and $30,065 for the City of Selma and Dallas County, respectively, in comparison to Alabama's median household income of $46,472 or the National median household income of $57,652 according to the U.S. Census's American Community Survey (ACS) 2013-2017 5-year estimates. The ACS estimates 38.3% and 31.9% of individuals live below the poverty level in Selma and Dallas County respectively. Additionally, 14.1% of Selma's population under the age of 65 have a disability, adding this group to the community's at risk population.

C.2.3.2. *Floodplain Characteristics*

The floodplain in the study area contains primarily residential development, with commercial structures dispersed along major thoroughfares and residential development in the surrounding area. Most of the commercial structures are slab-on-grade brick, metal, or prefabricated construction with first floor elevations of two feet or less above ground. Many of the residential structures are wood or brick construction with the first floor elevated one to two feet above ground. The residential development is typical of pre- and early post-WWII construction, having structures built on pier-type foundations. Some of the structures typifying post-WWII development have basements, and many more are slab-on-grade ranch and colonial style.

The floodplain within Selma is almost exclusively an urban area. No agricultural production is known to occur anywhere within the floodplain, with the exception of very small gardens of one acre or less. Development in the floodplain also includes the transportation, communication and utility infrastructure needed to serve the residents and businesses located in the area. This includes roads, bridges, storm-water collection and drainage structures, telephone networks and systems for water distribution, wastewater collection, natural gas, and electricity.

C.2.4. Methodology

In order to develop plans to address water resource problems within a study area, three conditions must be fully analyzed: the "existing" condition, the "future without project" condition, and the "future with project" condition.

In this analysis, the existing condition represents current floodplain conditions, which are in 2020 development and price levels. The future without project condition is the condition that would likely exist in the future without the implementation of a Federal project. This condition is evaluated for a 50-year period for urban flood control projects, and the results are expressed in terms of expected annual damages. For this study, the future without project condition is for the years 2025-2074. The future with project condition is the condition that would likely exist in the future with the implementation of a Federal project, using the same 50-year period as in the future without project condition.

The difference in expected annual flood damages to the floodplain properties between the future without and with project conditions represents the flood damage reduction benefits to the project. Economic and other significant outputs may accrue to the project as well, including recreation benefits, ecosystem restoration benefits, regional economic benefits, and other social effects. Other social effects, which often defy quantification in monetary terms, range from improvement in the quality of life within the study area to community impacts. This analysis attempts to recognize and, where possible, quantify all of the outputs of a Federal project in the study area.

C.2.4.1. *Assumptions*

This section of the analysis presents the assumptions used in computing average annual equivalent flood damages for the study area:

a. Floodplain residents will react to a floodplain management plan in a rational manner.
b. Real property will continue to be repaired to pre-flood conditions subsequent to each flood event.
c. The residential depth-percent damage relationships for structure and content contained in Economic Guidance Memorandum 01-03 and 04-01 are assumed to be representative of residential structures in the floodplain.
d. The residential depth-percent damage relationships for vehicles contained in Economic Guidance Memorandum 09-04 are assumed to be representative of vehicles in the floodplain.
e. Nonresidential depth-percent damage relationships for structure and content are from expert elicitation found in the revised 2013 draft report completed by the USACE Institute of Water Resources. Nonresidential flood depth-damage functions derived from expert elicitation are assumed to be representative of nonresidential structures in the floodplain.
f. The project's first costs and benefits will be annualized using the FY 2020 Federal discount rate of 2.75% assuming a period of analysis of 50 years.

g. All values are equivalent to 2020 dollars.
h. All project alternatives are evaluated for a 50-year period of analysis.
i. The project construction is scheduled to begin in 2025.

C.2.4.2. *Risk and Uncertainty Factors*

Risk and uncertainty are inherent in water resources planning and design. These factors arise due to errors in measurement and from the innate variability of complex physical, social, and economic situations. The measured or estimated values of key planning and design variables are rarely known with certainty and can take on a range of possible values.

C.2.4.2.1. *Modeling Description*

Risk analysis in flood damage reduction projects is a technical task of balancing risk of design exceedance with flood damage prevented; trading off uncertainty of flood levels with design accommodations; and providing for safe, reasonably predictable project performance. Risk-based analysis is therefore a methodology that enables issues of risk and uncertainty to be included in project formulation. A computerized risk-based model, Hydrologic Engineering Center-Flood Damage Reduction Analysis (HEC-FDA); version 1.4.2 (July 2017) was used in this analysis. This model is a product of the USACE and was created by the Corps' Hydrologic Engineering Center in Davis, California. HEC-FDA is a certified model used for flood damage analysis. It is a frequency-based model, relating expected flood damages to flood frequency and incorporating a multitude of variables.

C.2.4.2.2. *Modeling Variables*

Uncertainty was quantified for errors in the underlying components of the stage-damage relationship: structure values for residential and nonresidential structures, vehicle values for residential structures, depth-percent damage relationship for both residential and nonresidential structures, content to structure value ratios for residential and nonresidential structures, and first elevations for all structures.

a. Residential Structural Values - Structure values are crucial sources of uncertainty in the stage-damage relationship. Structure values play an important role in determining the dollar value of damage caused by a given depth of flooding in the structure itself, both to the structure itself and the contents of the structure. In this analysis, all of the existing condition structure values were obtained from S&W Minicomputers, Inc, which is a contractor of the Dallas County Tax Assessor's Office. S&W Minicomputers uses a computer software to derive total replacement value for a structure multiplied by a value based on "Observed Condition". This observed condition is equivalent to a depreciation factor. This derived value was exclusive of market and land values and meant to reflect an estimated replacement value estimate less depreciation for the residential structures. Furthermore, using the Marshall & Swift Residential Estimator Software Program, these values were compared to similar structures derived by the program and the results were comparable. Therefore, the residential structural values obtained from the tax assessor's contractor were verified as being reasonable estimates of replacement cost less depreciation. Moreover, in order to quantify the uncertainty surrounding the values calculated for the residential structure inventory, based on the 2019 RS Means Square Foot Costs Data catalog, the uncertainty surrounding the residential structure values was based on a triangular probability for each occupancy category. The triangular probability distributions based on the depreciation percentage associated with an observed age (determined using professional judgment) were entered into the HEC-FDA model to represent the uncertainty surrounding the structure values in each residential occupancy category.

b. Vehicle Inventory and Values - Based on 2013-2017 American Community Survey 5-year estimates for the study area, it was determined that the average household had 1 vehicle available. Economic Guidance Memorandum, 09-04, Generic Depth-Damage Relationships for Vehicles (2009) states that the average number of people who do not move vehicles to higher ground during flooding events is 26.93% (i.e. the average of the respondents who did not move vehicles given warning). That is to say, 26.93% of vehicles remain in the area of flooding and are susceptible to flood damages. According to the Edmunds 2018 Used Vehicle Market Report, the average price of a used vehicle was $19,657 at an average age of 4.5 years. Since only 26.93% of vehicles remain susceptible to damage during a flood event, a value of $5,293 (1*$19,657*0.2693) was assigned to each residential structure record in the HEC-FDA model. Vehicle damages were only calculated for residential properties, and not applied to nonresidential properties such as warehouses or offices. The Edmund's vehicle value adjusted for number of vehicles per household and for the evacuation of vehicles prior to the storm event was used as the most likely value. If an individual structure had more than one housing unit, then the adjusted vehicle value was assigned to each housing unit in a residential or multi-family structure category. Moreover, the uncertainty surrounding the values assigned to the vehicles in the inventory was determined using a triangular probability distribution function with a maximum of 168% and a minimum of 21%, the mean value in the triangular distribution is the value of the vehicle within the structure inventory. The average value of a new vehicle before taxes, license, and shipping charges was used as the maximum value. The average 10-year depreciation value of a used vehicle was used as the minimum value which is approximately 21%. These maximum and minimum percent values were entered in as the maximum and minimum values of the triangular distribution.

c. Nonresidential Structural Values – In this analysis, most of the existing condition structure values were obtained from S&W Minicomputers, Inc, which is a contractor of the Dallas County Tax Assessor's Office. S&W Minicomputers uses a computer software to derive total replacement value for a structure multiplied by a value based on "Observed Condition". This observed condition is equivalent to a depreciation factor. This derived value was exclusive of market and land values and meant to reflect an estimated replacement value estimate less depreciation for the residential structures. Furthermore, using the Marshall & Swift Nonresidential Estimator Software Program, these values were compared to similar structures derived by the program and the results were comparable. Therefore, the nonresidential structural values obtained from the tax assessor's contractor were verified as being reasonable estimates of replacement cost less depreciation. The uncertainty surrounding the nonresidential structure values was based on the 2019 RS Means Square Foot Costs Data catalog depreciation percentages. A triangular probability distribution based on the depreciation percentage associated with an observed age (determined using the professional judgment of personnel familiar with the study area) and the type of frame structure was used to represent the uncertainty surrounding the nonresidential structure values in each occupancy category.

d. Residential Depth-Damage Curves - The structure and content depth damage functions relate flood damage as a percent of the value of the structure or contents at various depths of flooding above the first floor elevation. These functions are contained in Economic Guidance Memorandum (EGM) 01-03 and EGM 04-01 and are based on surveys administered through the Corps of Engineers' Institute for Water Resources. The functions show strong correlations between depth of flooding and percent of value in structure damage. The residential structures in the Selma floodplain are represented by these curves. Moreover, both EGM contained a normal distribution function with an associated standard deviation of damage to account for uncertainty surrounding the damage percentage associated with each depth of flooding.

e. Nonresidential Depth-Damage Curves - The structure and content depth damage functions relate flood damage as a percent of the value of the structure or contents at various depths of flooding above the first floor elevation. These functions are contained in the Draft Report, Nonresidential Flood Depth-Damage Functions Derived from Expert Elicitation. These values can be found in Appendix D, Tables D-22 through D-42 for structures and Tables D-42 through D-63 for content, of the report. In 2008, the Federal Emergency Management Agency (FEMA) contracted to have an expert elicitation panel derive nonresidential content-to-structure value ratios and flood depth-damage functions for 21 of the most commonly affected categories of nonresidential properties. USACE Institute for Water Resources (IWR) fully participated in the planning, process, implementation, and analysis of the results. The functions show strong correlations between depth of flooding and percent of value in structure damage. The vast majority of the nonresidential structures in the Selma are represented by these curves. Moreover, these functions contained a triangular distribution (i.e. minimum, maximum, most likely) to account for the uncertainty surrounding the damage percentage associated with each depth of flooding.

f. Residential Content to Structure Value Ratio - The content to structure value ratios included in this report are the content depth damage curves contained in the aforementioned EGM 01-03 and EGM 04-01. Moreover, both EGMs contained guidance to account for uncertainty associated with content/structure value ratio, which implies that the uncertainty in the content-to-structure value ratio should be inherent in the content depth-damage relationship as contained in both EGMs.

g. Nonresidential Content to Structure Value Ratio - The content to structure value ratios included in this report are contained in the aforementioned draft report, Nonresidential Flood Depth-Damage Functions Derived from Expert Elicitation, specifically Appendix E, Table E-1. Moreover, these functions contained a triangular distribution (i.e. minimum, maximum, most likely) to account for the uncertainty surrounding the ratio for each nonresidential occupancy type.

h. First Floor Elevations – Topographical data obtained from the Light Detection and Ranging (LIDAR) survey with a March 2018 published date for the study area was used to determine ground elevations, in NAVD88 datum, at the centroid of each parcel where the structure is most likely located. The height above ground were estimated from windshield survey of the structures in the study area which was conducted in 2018. The sum of the ground elevation plus the finished floor height above ground elevation is the first-floor elevation. Vehicles were assigned to the ground elevation of the adjacent residential structures. A first-floor standard deviation of 0.6 feet assuming normal distribution was used to quantify uncertainty based on guidance found in Engineering Manual (EM) 1110-2-1619, Table 6-5, aerial survey, 2-ft contour interval (i.e. 0.3ft for ground elevation plus 0.3ft for foundation height). The datum used to determine first floor elevations is the same datum Hydrology and Hydraulics Engineering used to determine water surface elevations.

C.2.5. Existing Condition

In December 2018, personnel from the U.S. Army Corps of Engineers surveyed the structure inventory within the City of Selma study area. Parcel data was obtained from the Dallas County tax assessor's office and used to build a GIS database identifying which parcels fell within the FEMA 0.002 AEP floodplain. The structure inventory survey identified 1,436 structures within 1,216 parcels, not including vacant lots. Moreover, there are no structures that fell within the FEMA floodway. The inventoried structures were categorized as Residential or Nonresidential.

Structure inventory depreciated replacement values were provided by S&W Minicomputers, Inc., which is a contractor of the Dallas County Tax Assessor's Office. The generic structure to content value ratios and depth-damage relationships were used from EGM 04-01, EGM 01-03 and the Revised 2013 Draft Report: Nonresidential Flood Depth-Damage Functions Derived from Expert Elicitation.

C.2.5.1. *Reach Delineation*

The term "reach" describes a section of the stream having similar hydraulic, hydrologic, political, geographic, or economic characteristics. Dividing the floodplain into reaches facilitates evaluation of flood damages by breaking the floodplain down into several areas having some common features and analyzing them separately. The Selma floodplain consists of one reach, which is defined by specific river stations on the Alabama River from the Hydrologic Engineering Center–River Analysis System (HEC-RAS) model outputs (Engineering Appendix for more details).

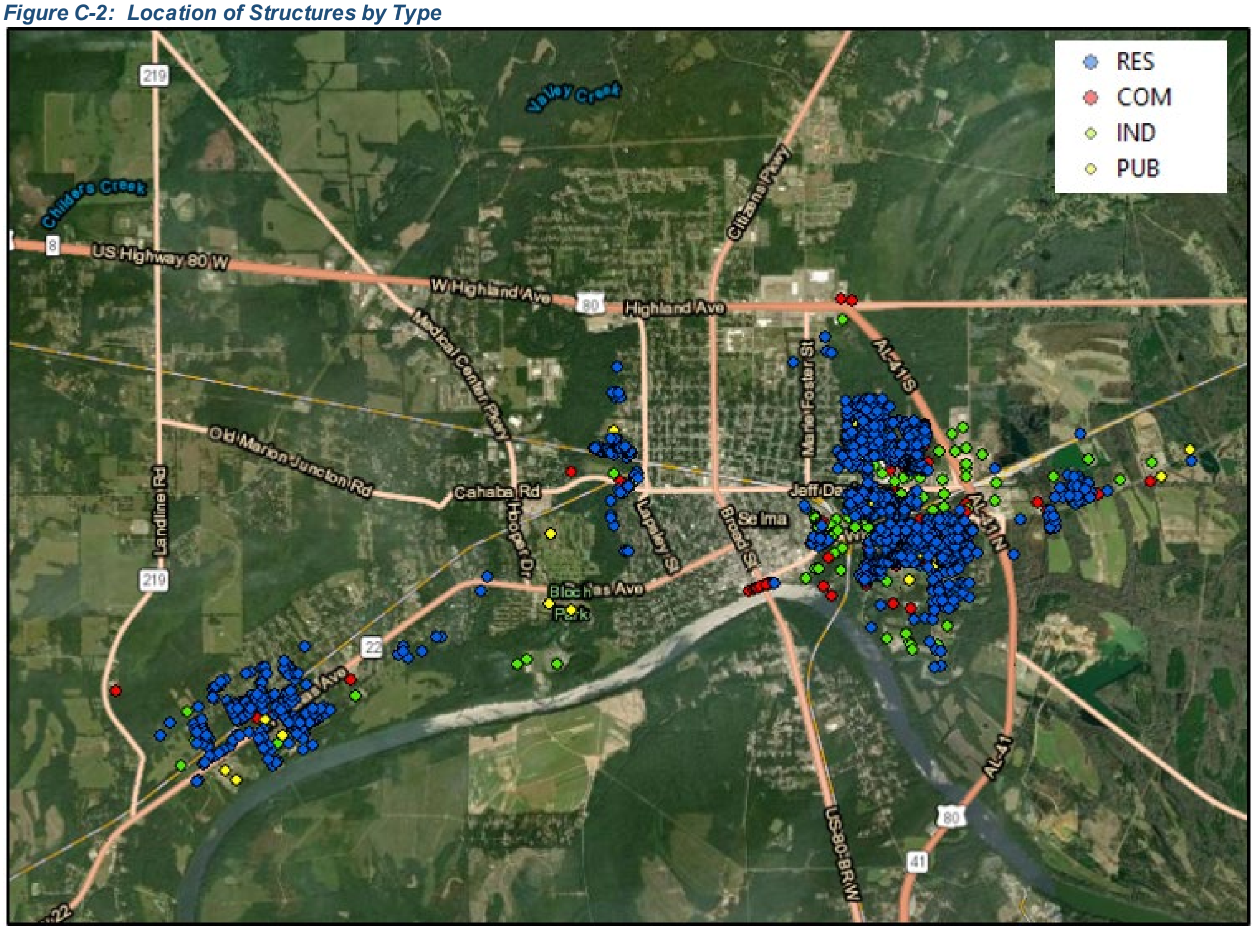
C.2.5.2. Structure Inventory Delineation

The setting of Selma is mostly urban and the floodplain itself is mostly developed. However, it is unlikely that the floodplain itself will experience significant development in the future. The structure inventory has not changed much in the last decade. Moreover, according to the U.S. Census Bureau, the City of Selma had a total population of 18,310 as of July 1, 2017 which represents decline of about 11.5% from the 2010 Census, which reported the City's population at 20,756. Currently, the Selma structure inventory contains about 1,436 structures on 1,216 parcels (i.e. those structures located in Selma within the 0.002 AEP floodplain). Residential structures accounted for 1,175 structures, with the remaining 261 being nonresidential: Public, Commercial, and Industrial. Table C-1 and Figure C-2 summarize the number of structures in the reach along with the depreciated replacement cost and vehicle depreciated replacement cost, and breakdown of the structures for the study area. Table C-1 also shows the value of the inventory for residential and nonresidential properties stated in 2020 dollars.

Table C-1: Selma (Existing Condition Structure Inventory)

Reach	Residential Structures	Non-Residential Structures	Total Structures	Total Structure Value	Total Content Value	Total Vehicle Value	Total Value
Alabama River	1,175	261	1,436	$177,479,939	$116,368,662	$11,917,727	$305,766,328

Figure C-2: Location of Structures by Type



The abovementioned structure inventory was modeled in HEC-FDA using stage-damage relationship with uncertainty, along with stage-probability relationship with uncertainty. The HEC-FDA model used the economic and engineering inputs to generate a stage-damage relationship for each structure category in each study reach in the existing and future conditions. The possible occurrences of each economic variable were derived through the use of Monte Carlo simulation and a total of 1,000 iterations were executed by the model for the Selma study. The sum of all sampled values was divided by the number of samples to yield the expected value for a specific simulation. A mean and standard deviation was automatically calculated for the damages at each stage. The HEC-FDA model used an equivalent record length of 30 years (verified with Hydrology and Hydraulic Engineer) for each study area reach to generate a stage-probability relationship with uncertainty for the existing and future without project conditions through the use of graphical method because discharge-probability was not used in the model. The model used the eight stage-probability events together with the equivalent record length to define the full range of the stage-probability or stage-probability functions by interpolating between the data points. Confidence bands surrounding the stages for each of the probability events were also provided. The eight AEPs that water surface profiles were provided for use in the damage calculations are as followed: 0.5 (2-year), 0.2 (5-year), 0.1 (10-year), 0.04 (25-year), 0.02 (50-year), 0.01 (100-year), 0.005 (200-year), and 0.002 (500-year). Table C-2 displays water surface profiles at the index location for each study area reach. The index location is a stream location within a damage reach and used to specify discharge-probability, stage-discharge, and stage-damage functions with uncertainty data for plan evaluations for that damage reach. Damages were reported at the index location for the study area reach. Following the conclusion of the Monte Carlo simulation, a mean was calculated from the observed expected annual damage calculation. Table C-3 displays the existing condition mean expected annual damages according to reach and damage category.

Table C-2: Existing Condition Water Surface Profiles

Reach	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002
Selma	105.53	110.97	114.20	116.53	118.89	120.41	121.77	124.02

Table C-3: Existing Condition Mean Expected Annual Damages within the Selma Reach ($1,000, 2020 Prices)

Damages Category	Damages
Residential	$831
Nonresidential	$920
Total	$1,751

According to Table C-3, there are about $1.75 million in expected annual flood damages under the existing condition. The existing flood damages are the potential average annual dollar damages to structures, contents, and vehicles affected by flooding at the time of the study. No projection is involved, and the existing condition encompasses relevant factors that best characterize the planning perceptions of the affected area in the situation without a plan. This existing condition provides the data from which to evaluate the condition that would likely exist in the future without the implementation of a Federal project. Under the future without project condition, which represents expected annual damages in the absence of a flood damage reduction project, damages are expected to increase, as development within the drainage area increases and contributes to higher runoff rates. Those higher runoff rates translate into higher stages in the future and correspondingly higher water surface profiles for any given flooding event.

C.2.6. Future Without Project Condition

The years 2025-2074 were selected to represent the future without project condition. No additional development within the 0.01 AEP floodplain of the study area is anticipated since the floodplain is essentially fully developed now and since the study area is a participant in the Federal Flood Insurance Program. The same 1,436 structures lying in the floodplain will continue to be affected by the risk of flooding and suffer increasing losses each year. Most of the structures in the study area are located outside the future without 0.01 AEP floodplain (reference Figure C-2) and it is not until 0.04 AEP floodplain that there are some structures located within the extent of the floodplain.

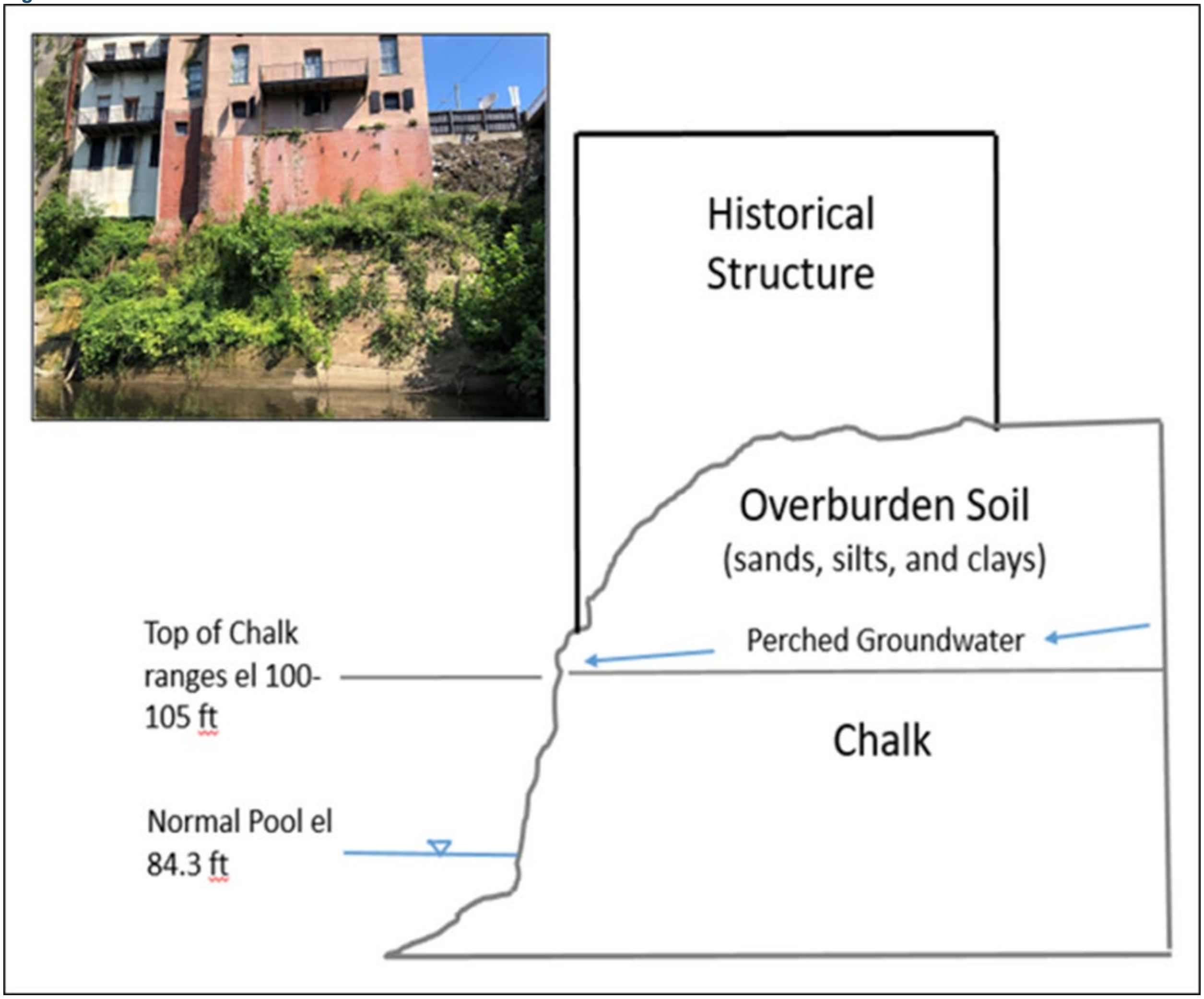
Furthermore, in the future without project condition, Water Avenue and the structures that sit along the bank of the Alabama River (see Figure below) would continue to experience structural/foundation damages that would lead to higher maintenance costs for the city and private owners and could present a life and safety risk to the public over time as the erosional conditions continue to compromise the structural integrity of the infrastructure. The employees, residents, and visitors to the historic structures along the riverbank, are exposed to life and safety threats associated with potential bank failure, caused by repetitive flooding and increased instability of substrates.

Figure C-3: Water Avenue along the Alabama River in Selma, Alabama showing Historic structures along the riverbank

The foundations of these structures appear to be set in the overburden alluvial deposits, with little to no soil coverage on the riverside of the foundation. The chalk is somewhat impervious, causing concentrated groundwater to exit the bank slopes within the overburden material as this layer becomes saturated. This continual process could potentially result in material loss beneath the building foundations which, over time, would destabilize the buildings. Figure C-4 below shows a generalized cross section of the geology of the river bank.

The interface of the overburden soils and underlying chalk fluctuates from approximate elevation 100 to 105 ft in the Study Area. When comparing this to river elevation, it puts the boundary of the two layers approximately 15 to 20 ft above the normal pool level of 84.3 ft. According to historical hydrologic data, this layer would see loading due to the river cresting at around the 0.5 AEP (2-year) flood event. This a fairly frequent loading and shows that minor flooding of the River could contribute to the building instability.

Figure C-4: Cross Section of the Downtown Selma Bluffs



Moreover, additional development within the drainage region, but at elevations beyond the 0.01 AEP, is possible. The development, consisting of a variety of commercial, industrial, and residential construction, will contribute to an increase in the land area impervious to storm water runoff. This in turn will lead to slightly higher stream inflows at any given event and somewhat higher stages at the various flood frequencies as shown in Table C-4. Table C-4 and Table C-5 display future without project condition water surface profiles at the index location for each study area reach and single event damages without uncertainty for the study area.

Table C-4: Future Without Project Condition Water Surface Profiles

Reach	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002
Selma	105.81	111.58	114.49	116.94	119.24	120.73	122.22	124.41

Table C-5: Future Without Project Condition Single Event Damages (1,000, 2020 Prices)

Event	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002
Total	$0	$0.082	$0.519	$3,989	$20,686	$35,354	$54,621	$95,848

The result is an increase in the expected annual damages for the future, meaning that the losses suffered by the affected structures will increase between 2025 and 2074. As shown in Table C-5, the single event damages reflect the fact that it is not until the 0.04 AEP and greater event that structures begin to accrue damages. Like that of the existing condition, the HEC-FDA used Monte Carlo simulation to sample from the stage-probability curve with uncertainty. For each of the iterations within the simulation, stages were simultaneously selected for the entire range of probability events. The sum of all damage values divided by the number of iterations run by the model yielded the expected value, or mean damage value, with confidence bands for each probability event. The probability-damage relationships are integrated by weighting the damages corresponding to each magnitude of flooding (stage) by the percentage chance of exceedance (probability). From these weighted damages, the model determined the expected annual damages (EAD) with confidence bands (uncertainty). For the “without project” condition, the expected annual damages (EAD) were totaled for each study area reach to obtain the total without project EAD under future (2025 and 2074) conditions as shown in Table C-6.

Table C-6: Future Without Project Condition for the Selma Reach(1,000, 2020 Prices)

Selma Reach by Year	Residential	Nonresidential	Total
Base Year 2024	$831	$920	$1,751
Future Year 2074	$960	$1,054	$2,014

Moreover, damages for each of the years during the period of analysis were computed by linear interpolation between 2025 and 2074. The FY 2020 Federal discount rate of 2.75% was used to compound the stream of expected annual damages and benefits before the project base year and to discount the stream of expected annual damages and benefits occurring after the base year to calculate the total present value of the damages over the period of analysis. The present value of the expected annual damages was then amortized over the 50-year period of analysis using the Federal discount rate to calculate the equivalent annual damages. The results are shown in Table C-7.

Table C-7: Future Without Project Equivalent Annual Damages within the Selma Reach ($1,000, 2020 Prices)

Damages Category	Damages
Residential	$880
Nonresidential	$970
Total	$1,850

The forecasted higher stages in the future, without a project in place, resulted in higher damages. According to Table C-7, the total future “without project” equivalent annual damages are approximately $1.85 million. This figure represents the maximum possible annual benefits accruable to a flood damage reduction project at Selma (i.e. with project condition). The forecast of the future without project condition reflects the conditions expected during the period of analysis and provides the basis from which alternative plans are evaluated, compared, and selected since a portion of the flood damages would be prevented (i.e. flood damages reduced) with a Federal project in place.

C.2.7. Future With Project Condition

The future with project condition is the most likely condition expected to exist in the future if a specific project is undertaken. There are as many future with project conditions as there are project alternatives. A total of ten alternatives were considered for the Selma Flood Risk Management Study. Of these, three were structural, one was nonstructural, and the remaining seven were combinations of structural plans with the nonstructural plan. The nonstructural plan did not include a recreation plan. A description of the alternatives is listed in Table C-8.

Table C-8: Initial Array of Alternatives Description

Array of Alternatives	Plan Description
No Action Alternative (NAA)	No Federal undertaking would occur and the results would be consistent with FWOP conditions.
Alt. 1: Non-Structural (A-Buyouts, B-Raise Structural Elevation, Structural move)	There are two (2) non-structural alternatives considered. Alternative 1.A includes buyouts which entails the acquisition of parcels, relocation of inhabitants, and demolition of structures. Alternative 1.B includes elevating structures or moving structures altogether out of the floodplain within Ward 8.
Alt. 2: 1967 Selma Levee	1967 Selma Levee with Selmont Levee alignment with floodgates/pumps where needed, buyout as necessary
Alt. 3: Optimized (Short) Selma Levee	Shortened/optimized levee alignment, U.S. Highway 80 tie in, floodgates/pump station where needed, buyout as necessary
Alt. 4: Bankline Stabilization	Provide bank stabilization along all or part of RM 256-261
Alt. 5: Bankline Stabilization + Buyouts	Combines Alternatives 4 & 1.A-Buyouts.
Alt. 6: Optimized Selma Levee + Buyouts + Bank Stabilization	Combines Alternatives 3 & 4 & Partial Non-Structural Alt.1 in areas not within the Optimized Levee alignment
Alt. 7: Optimized Selma Levee + Valley Creek Levee + Pump Station & Sluice Gate + Bank Stabilization	Combines Alternatives 3 & 4 & a smaller levee at Valley Creek & a pump station with a sluice gate at Beaver Dam Branch (maximum structural protection)
Alt. 8: Optimized Selma Levee + Valley Creek Levee + Buyouts + Bank Stabilization	Combines Alternative 6 plus Valley Creek levee (only purchase, relocation or raising elevation in the Ward 1 considered)

Alt. 9: Optimized Selma Levee + Valley Creek Levee + Buyouts	Combines Alternative 3, levee at Valley Creek (purchase, relocation or raising elevation in the Ward 1 considered)
Alt. 10: Optimized Selma Levee + Valley Creek Levee + Pump Station with Sluice Gate	Alternative 7 with No bankline stabilization (maximum structural protection without bank stabilization)

C.2.7.1. *Evaluation of Alternative Plans*

Table C-9 demonstrates a qualitative check to determine which of the initial alternatives met study objectives and avoided constraints. Alternatives that met a minimum of two (2) criteria were kept for further consideration. All screened alternatives are denoted in blue highlight and further discussed in the Plan Selection section of the Main Report. After further refinement and screening of the initial array, those carried became the Focused Array of Alternatives.

Table C-9: Screening of Initial Array into Focused Array of Alternatives

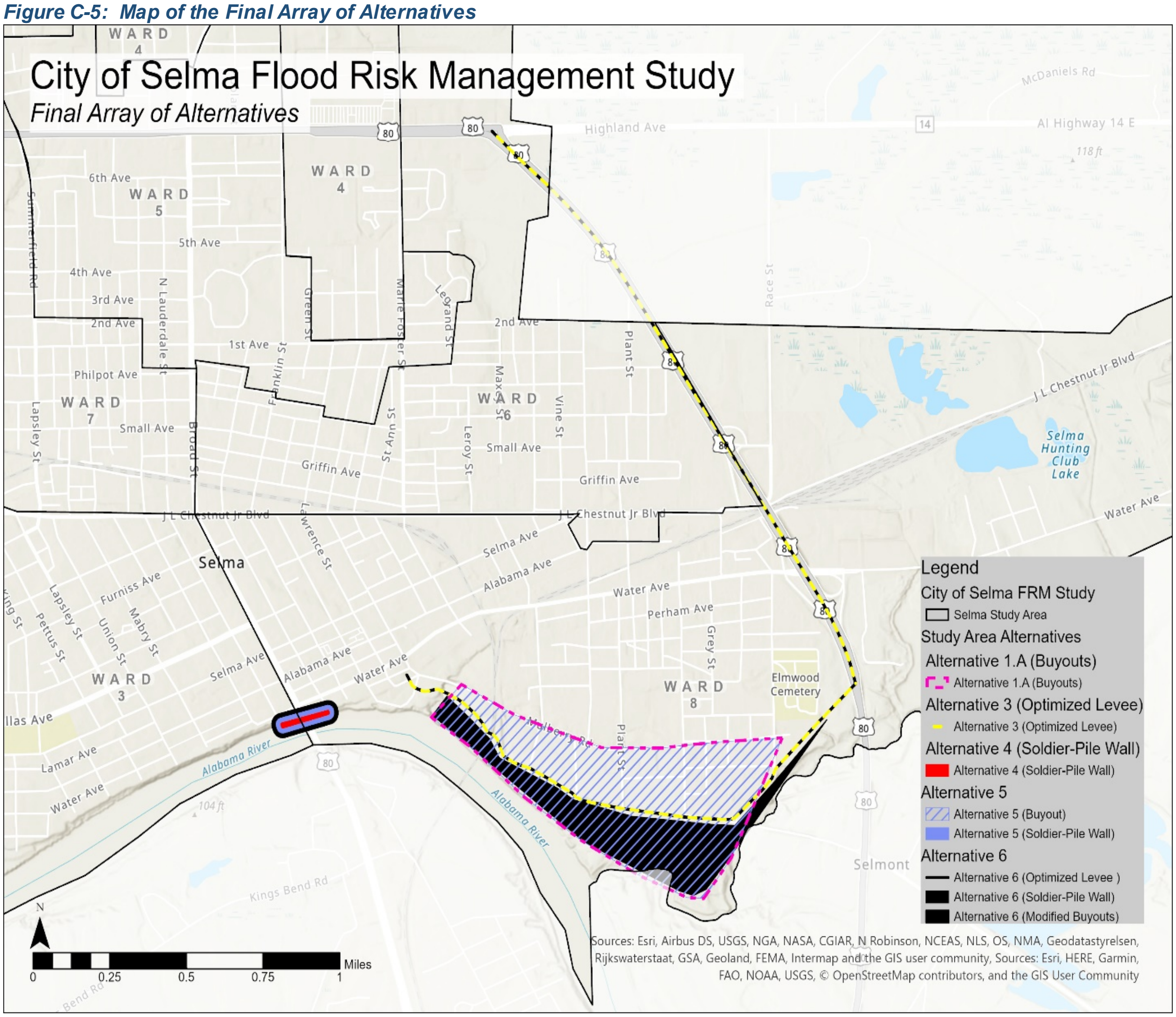
Alternative Description	Feasible	Meets Objectives	Avoids Constraints
Alt. 1.A – Buyout	Yes	Partially	Partially
Alt. 1.B – Elevation/Relocation of Structures (screened)	No	Yes	Partially
Alt. 2 – 1967 Levee	Partially	Yes	Partially
Alt. 3 – Optimized Levee	Yes	Yes	Partially
Alt. 4 – Bank Stabilization+ Rip Rap	Yes	Partially	Yes
Alt. 5 – Bank Stabilization + Buyout	Yes	Yes	Partially
Alt. 6 – Optimized Levee + Buyout + Bank Stabilization	Yes	Yes	Partially
Alt. 7 – Optimized Levee + Valley Levee + Pump Station/Gates + Bank Stabilization (screened)	No	Partially	No
Alt. 8 – Optimized Levee + Valley Levee + Buyout + Bank Stabilization (screened)	No	Yes	No
Alt. 9 – Optimized Levee + Valley Levee + Buyout (screened)	No	Partially	No
Alt. 10 – Optimized Levee + Valley Levee + Pump Station w/ Sluice Gate (screened)	No	No	No

The focused array of alternatives were screened based on their ability to meet objectives, avoid/minimize constraints, adherence to the four planning criteria, as well as their resiliency and sustainability. Bank stabilization construction methods, or "options", were evaluated based on professional judgment and engineering feasibility to inform the selection for Alternative 4. Of the entire focused array, only Alternative 2 was screened from further analysis (reference Plan Selection section of Main Report for more details).

The alternatives that were carried forward were identified as the refined final array of alternative plans:

- Alternative 1.A (Buyout);
- Alternative 3 (Optimized Levee);
- Alternative 4 (Soldier-Pile Wall);
- Alternative 5 (Soldier-Pile Wall and Buyout); and
- Alternative 6 (Combination of Alternative 1.A and 5, but with a modified buyout footprint to capture parcels within Ward 8 and outside the levee alignment).

Figure C-5: Map of the Final Array of Alternatives



Relevant data for each of the alternatives described above were entered into the HEC-FDA and potential for flood damages reduced were calculated. The modeling results for each alternative are summarized as follows:

C.2.7.1.1. *Alternative 1*

Alternative 1.A. was a nonstructural solution that entailed a buyout of structures. This plan provides for permanent evacuation and demolition of floodplain structures. Grouping for those structures identified as candidates for buyouts considered vulnerability to flood risk, location within the 0.01 AEP floodplain extent, depths of flooding, and community cohesion (reference Plan Selection section of Main Report for more details). Approximately 25 parcels were identified within the buyout footprint encompassing approximately 170 acres. Implementation of this alternative would require acquisition of structures and relocation of inhabitants. Structures would then be demolished. Staging areas for demolition would be located within each parcel. Access would be obtained using existing roads. This alternative would take approximately 18 months to complete.

Alternative 1 did not produce any reductions in water surface elevations because structures that were identified as candidates for a buyout were removed from the structure inventory. Therefore, in the model, the only difference is in the structure inventory for future with and without project conditions. The water surface elevations used in the modeling of this alternative stayed the same. A summary of the residual flood damages and flood damage reductions are shown in Table C-10 for Alternative 1.

Table C-10: Alternative 1, Buyouts Equivalent Annual Damages within the Selma Reach ($1,000, 2020 Prices)

Category	Damages	Reduced	Residual
Residential	$792	$88	90%
Nonresidential	$947	$23	98%
Total	$1,739	$111	94%[1]

In Selma, damages reduced were reflective of those structures removed from the floodplain. Since Alternative 1 is a nonstructural plan, the benefits can be evaluated using an alternative land use approach. In this approach, the candidate structures for buyouts are removed, and the land can no longer be used for urban development. An alternative land use can then be implemented such as recreation. However, the nonstructural plan did not include a recreation plan. Recreation was not considered for the buyout alternative because any propose recreational activities for the evacuated floodplain would be one of low quality passive recreation such as running, walking, and picnicking. In addition, there exist many parks in the Selma area such as Historic Riverfront Park, Phoenix Park, Lafayette Park, and Bloch Park that offer such passive recreation. Moreover, the city itself is and has experience a decline in population and has limited funds available to maintain recreational areas. Furthermore, there would be a lack of access to the areas proposed within the buyout area because of its location. The proposed buyouts area not located in the historic district nor would it offer any visitors the historical viewshed that is distinct to Selma.

[1] Residual Damages for Ward 8 only was approximately 92%.

C.2.7.1.2. *Alternative 3*

Alternative 3 is an optimized levee with two components: "new" levee construction and U.S. Highway 80 revetment and reinforcement. The full alignment would span approximately 1.6 mi of "new" levee construction across the southern portion of Ward 8 and approximately 2.0 mi of U.S. Highway 80 revetment and reinforcement for a total of 3.6 mi. The base of the "new" levee within Ward 8 would span approximately 94 ft wide, therefore the "new" levee construction would span approximately 18 acres. Two flood gates would be placed at intersections along U.S. Highway 80. Disposal areas would be required to place excavated material. Staging areas would also be required to contain all construction material necessary to build the levee and reinforce U.S. Highway 80; however potential locations for this alternative have not been identified. Access would be obtained using existing roads. This alternative would take approximately 36 months to complete.

This optimized levee alignment as modeled would reduce the majority of flooding risk in Ward 8. Therefore, the idea was that all other alignments would only accrue additional costs and not reduce any further flood damages. A summary of the residual flood damages and flood damage reductions are shown in Table C-11.

Table C-11: Alternative 3, Optimized Levee Equivalent Annual Damages within the Selma Reach ($1,000, 2020 Prices)

Category	Damages	Reduced	Residual
Residential	$694	$186	79%
Nonresidential	$795	$175	82%
Total	$1,489	$361	80%[2]

Alternative 3 reduced water surface elevation in the proposed levee area up to a level equivalent to the 0.01 AEP. However, it was shown, by modeling, to induce flooding to structures upstream, downstream, and in areas located directly opposite the levee across the Alabama River (reference Engineering Appendix for more details). These areas across from the levee included the town of Selmont, Alabama. Moreover, it was determined that in order to mitigate for this induced flooding another levee would be needed in Selmont.

C.2.7.1.3. *Alternative 4*

Alternative 4 provides bank stabilization of Selma's historic riverfront. This erosion control measure provides bank stabilization along all or part of River mile 256-261, Selma's historic riverfront, where historic structures adjacent to the Edmund Pettus Bridge are located. The majority of benefits for a FRM study using the HEC-FDA model largely accrue from inundation reduction benefits which are considered NED benefits. The HEC-FDA Model, using depth damage functions, does not capture physical damages attributable to inundation of foundations for structures sitting on a bluff, as is the case for Selma's historic riverfront. ER 1105 -2-100 defines physical damages as:

[2] Residual Damages for Ward 8 only was approximately 75%.

> *"Physical damages. Physical damages occur to residential, commercial, industrial, institutional, and public property. Damages occur to buildings, contents, automobiles, and outside property and landscaping. Physical damages include the costs to repair roads, bridges, sewers, power lines, and other infrastructure components. Physical damages also include the direct costs and the value of uncompensated hours for cleanup after the flood."(USACE, 2000, pg.3-15)"*

Therefore, residual flood damages and flood damage reductions could not be derived for a bank stabilization alternative. In the case of Selma's historic riverfront, the river bank and foundation are being inundated up to elevation of about 120 feet during a moderate flood. The historic structures' foundations and soils are being inundated while their first floor elevations are not. As the flood water recedes, shear failures occur to the foundations (reference Engineer Appendix for more details). These shear failures threaten the structural integrity of these historic structures resulting in damages.

Benefits for the bank stabilization could consider the value of the loss of the historic structures, visitation, and business along the riverbank (reference RED section of this Appendix). These historical site's structures have an estimate depreciated replacement cost of about $3.8 million or an estimated market value of $5.4 million and could be loss over time. Several structures at this location of river bank have been demolished due to the resulting instability of its foundation.

As stated in Study Authority Section, this study was granted the permission to continue evaluating bank stabilization as stated in the memorandum for the Commander dated February 25, 2020 from HQ USACE to SAD, and in accordance with Section 1203 of America's Water Infrastructure Act of 2018 as authorized. Moreover, a NED Exception was granted for the Selma Alabama FRM Study (MFR from the ASA(CW) to HQ USACE dated June 10, 2020). In support of the approval that was granted by ASA (CW) for the NED Exception, HQ, USACE, in an endorsement MFR, dated 16 July 2020, allowed for an analysis of the erosion control measure using Section 14 methodology of the Flood Control Act of 1946 (Public Law 79-526), as amended, for emergency streambank and shoreline protection for public facilities and services. This methodology calls for formulation and evaluation of an alternative using the least cost approach. The plan is justified if the total cost of the alternative is less than the costs to relocate the threatened structures as stated below:

> *"The proposed TSP includes river embankment stabilization via a retaining wall to protect historic buildings in the downtown area adjacent to the Edmund Pettus Bridge. Stream bank stabilization can be considered in the formulation of a project for Selma in accordance with Section 1203 of WRDA 2018. It needs to be demonstrated that the recommended plan is the least cost plan to mitigate the erosion. That analysis has not been completed and it was not discussed in the exception request. The approach to formulating a project under Section 14 of the Flood Control Act of 1946, as amended, could be applicable to the Selma study. For Section 14 investigations, the formulation and evaluation of alternatives focus on the least cost alternative solution. The least cost plan is justified if the total costs of the proposed alternative are less than the costs to relocate the threatened*

facility. The monetary cost of relocation of the structures, and the potential impacts to historic resources including the view shed should be analyzed at an appropriate level of detail to determine the costs of relocation."

Therefore, Alternative 4 was further refined to focus on 1500 linear ft of bankline along Water Avenue in Selma based on areas most vulnerable to erosion and sloughing. Construction methods, presented as "options", included a range of river shoreline stabilization techniques that were based on similar USACE projects.

C.2.7.1.3.1. Bank Stabilization Option 1, Sheet Pile Wall

Placement (driving) of the sheet-pile wall could affect existing structures and foundations and lead to failure of the structures. Contractors may be reluctant to assume the liability for this construction method. Because this variant of the alternative could negatively impact the stability of the historic structures along the bankline this option was screened from further evaluation and comparison.

C.2.7.1.3.2. Bank Stabilization Options 2a/b, Riprap and/or Extension

This construction method presents both constructability and aesthetic concerns. This method would require a severe setback and the toe would extend far into the Alabama River, which would cause navigation impediments. As such, this configuration was screened out from further analysis.

C.2.7.1.3.3. Bank Stabilization Option 3, Cast in Place:

This construction method is aesthetically pleasing; however, it requires coffer dams and dewatering which adds a significant amount to the cost of construction. Environmental impacts resulting from the dewatering would be substantial. Therefore, this configuration was screened out from further analysis.

C.2.7.1.3.4. Bank Stabilization Option 4, Soldier-Pile Wall and Riprap

Construction is not likely to affect existing structures and foundations. It also presents the least environmentally damaging impacts to natural resources, cultural artifacts, and Unexploded Ordnances (UXO(s)). Therefore, this configuration was selected as the Bank Stabilization structural design for Alternative 4.

Staging, construction, and access of the Soldier-Pile Wall would occur from the Alabama River. Approximately 94 H–Piles would be set at approximately 8 ft on center throughout the 750 linear ft design and would be drilled in place. Tiebacks would be required for each H-Pile. Concrete wall panels will be placed between each H-Pile and riprap would cap each end. The geotechnical investigation is tentatively scheduled to be completed in March 2021, at which time the proposed layout and footprint of the Soldier-Pile Wall would be finalized. The H-Piles would be drilled into place using equipment such as an auger, and the excavated material for each H-Pile would be graded at the location of each hole. At this phase of the study it has not been determined if clearing and grubbing of the riverbank would be required; however, the maximum potential vegetation removal would encompass eight (8) acres. In total, this alternative would take approximately 30 months to complete.

C.2.7.1.3.4.1. Soldier-Pile Wall Least Cost Analysis

The 11 structures along this bank include are nationally registered properties and part of the Water Avenue and Civil Rights Historic Districts. These structures compose the viewshed of the National Historic Landmark, the Edmund Pettus Bridge. Although the market value of these 11 structures is approximately $5.4 million or about $3.8 million in depreciated replacement cost, the historic and regional economic value of these structures and what they represent for not only the city of Selma but for the nation and the local economy cannot be overstated. The structures are the viewshed of the Edmund Pettus Bridge, one of the most recognizable Civil Rights sites in the United States and comprise the tourism hub of Selma, Alabama. Loss of these structures would be detrimental to Selma's economy and the negative economic impacts would reverberate significantly in Civil Rights tourism throughout the region of central Alabama (this is investigated more in the RED analysis).

Many of the threatened structures were constructed during the late 1800s or early 1900s making relocation exorbitantly expensive, if not impossible. Adding to the difficult nature of replacement cost is the fact that these structures were built on the edge of the bank, implying relocation would have to be carefully conducted brick by brick (i.e. deconstruction and then reconstruction). Taking these factors into account brings potential relocation costs to approximately $132.0 million[3]. Table C-12 outlines the least cost alternative method using the Section 14 methodology of the Flood Control Act of 1946 (Public Law 79-526), as amended, for emergency streambank and shoreline protection for public facilities and services in which the cost analysis utilized the relocation cost as a base comparison.

Table C-12: Bank Stabilization Least Cost Analysis

Alternative	Construction Costs	O&M Costs
Relocation (base cost)	$132,000,000	$0
Soldier-Pile Wall	$27,537,000	$4,000

C.2.7.1.3.4.2. Soldier-Pile Wall NED Benefits

As mentioned in the previous section, the structures located on Selma's Historic Riverfront compose the viewshed of Edmund Pettus Bridge; therefore, the values of these structures are not solely based on of their physical characteristics but also their cultural and historical value to the Nation. As the viewshed of the Edmund Pettus Bridge, these structures merit Federal participation to reduce flood risk to these structures. As evidence for this, a NED Exception was granted for the Selma Alabama FRM Study (MFR from the ASA(CW) to HQ USACE dated June 10, 2020). Moreover, in endorsement MFR, dated July 16, 2020 (as reference in Section 1.7.1.3), HQ USACE required that the monetary cost of relocation of the structures, and the potential impacts to historic resources including the viewshed should be analyzed at appropriate level of detail to determine the cost of relocation.

Given this guidance, for the soldier-pile wall NED analysis, it was assumed that increased flood-induced erosion and subsequent sheer bank failures are threatening the viewshed; therefore, would destabilize these structures along the historical riverfront within the 50

[3] Approximated costs are based on best professional engineering judgment.

year the period of analysis. And that the alternative to the soldier-pile wall would be the relocation of these structures. Therefore, the cost of relocation of these structures would be counted as the benefit of the soldier-pile wall (i.e. cost avoided) because the opportunity cost of constructing the soldier-pile wall to protect the viewshed would be the cost of relocating these structures.

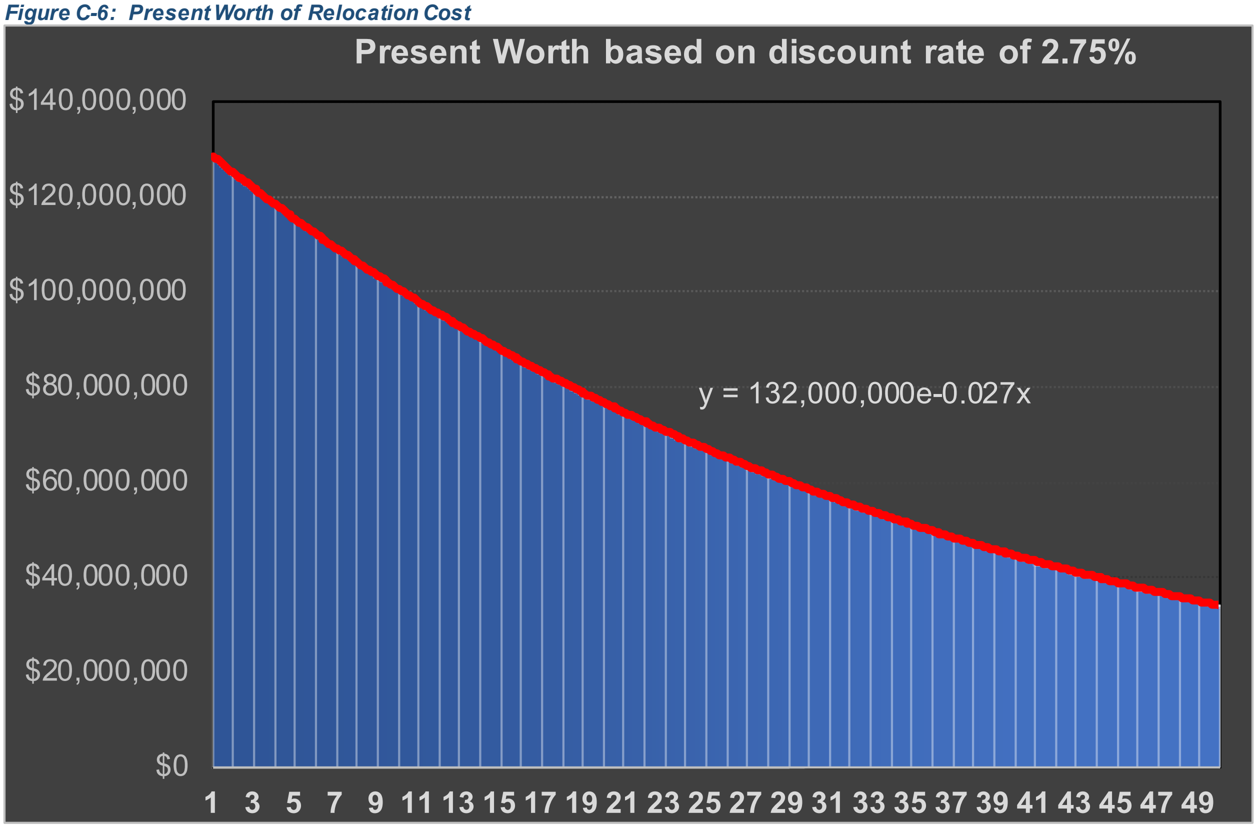
Estimated relocation costs is approximately $132 million. Based on the cost estimate of about $12 million per structure. Depending on the year of relocation (which is assume to occur within the 50 year period of analysis), the present worth of this relocation cost ranges from about $128 million in year 1, 2025, (i.e. high value) to $34 million (i.e. low value) in year 50, 2074, with an average of about $71 million based on the FY20 discount rate of 2.75% as shown in Table C-13. Moreover, Figure C-6 is a graphical representation of Table C-13 and the average was derived by taking the average of the area under the curve as shown in the figure.

Table C-13: Present Worth of Relocation Cost

Number	Year	Present Worth Factor	Relocation Cost	Present Worth
0	2024	1.0000000	$132,000,000	$132,000,000
1	2025	0.9732360	$132,000,000	$128,467,153
2	2026	0.9471883	$132,000,000	$125,028,860
3	2027	0.9218378	$132,000,000	$121,682,588
4	2028	0.8971657	$132,000,000	$118,425,877
5	2029	0.8731540	$132,000,000	$115,256,328
6	2030	0.8497849	$132,000,000	$112,171,609
7	2031	0.8270413	$132,000,000	$109,169,449
8	2032	0.8049064	$132,000,000	$106,247,639
9	2033	0.7833638	$132,000,000	$103,404,028
10	2034	0.7623979	$132,000,000	$100,636,524
11	2035	0.7419931	$132,000,000	$97,943,089
12	2036	0.7221344	$132,000,000	$95,321,741
13	2037	0.7028072	$132,000,000	$92,770,551
14	2038	0.6839973	$132,000,000	$90,287,640
15	2039	0.6656908	$132,000,000	$87,871,183
16	2040	0.6478742	$132,000,000	$85,519,399
17	2041	0.6305345	$132,000,000	$83,230,559
18	2042	0.6136589	$132,000,000	$81,002,977
19	2043	0.5972350	$132,000,000	$78,835,014
20	2044	0.5812506	$132,000,000	$76,725,075
21	2045	0.5656940	$132,000,000	$74,671,606
22	2046	0.5505538	$132,000,000	$72,673,095
23	2047	0.5358187	$132,000,000	$70,728,073
24	2048	0.5214781	$132,000,000	$68,835,108
25	2049	0.5075213	$132,000,000	$66,992,806
26	2050	0.4939380	$132,000,000	$65,199,811

27	2051	0.4807182	$132,000,000	$63,454,804
28	2052	0.4678523	$132,000,000	$61,756,500
29	2053	0.4553307	$132,000,000	$60,103,650
30	2054	0.4431442	$132,000,000	$58,495,036
31	2055	0.4312839	$132,000,000	$56,929,476
32	2056	0.4197410	$132,000,000	$55,405,816
33	2057	0.4085071	$132,000,000	$53,922,935
34	2058	0.3975738	$132,000,000	$52,479,742
35	2059	0.3869331	$132,000,000	$51,075,175
36	2060	0.3765773	$132,000,000	$49,708,199
37	2061	0.3664986	$132,000,000	$48,377,810
38	2062	0.3566896	$132,000,000	$47,083,026
39	2063	0.3471432	$132,000,000	$45,822,897
40	2064	0.3378522	$132,000,000	$44,596,493
41	2065	0.3288099	$132,000,000	$43,402,913
42	2066	0.3200097	$132,000,000	$42,241,278
43	2067	0.3114449	$132,000,000	$41,110,733
44	2068	0.3031094	$132,000,000	$40,010,445
45	2069	0.2949970	$132,000,000	$38,939,606
46	2070	0.2871017	$132,000,000	$37,897,427
47	2071	0.2794177	$132,000,000	$36,883,141
48	2072	0.2719394	$132,000,000	$35,896,001
49	2073	0.2646612	$132,000,000	$34,935,280
50	2074	0.2575778	$132,000,000	$34,000,273

Figure C-6: Present Worth of Relocation Cost



Referencing Table C-12 of the least cost analysis, the average annual cost of relocation was not evaluated; however, having derived the present worth of this relocation cost, an average annual cost can now be derived. Based on the assume year relocated and the FY20 discount rate, a range of average annual costs were derived. As mentioned earlier, the cost of relocation of these structures would be counted as the benefit of the soldier-pile wall; therefore, the average annual costs of relocation would be the average annual benefits of the soldier-pile wall as shown in Table C-14 and Table C-15.

Table C-14: Average Annual Cost of Relocation Cost

	High	**Average**	**Low**
Present Worth	$128,467,153	$71,069,239	$34,000,273
Average Annual Costs	$4,758,541	$2,632,470	$1,259,401

Table C-15: Average Annual Benefits of Soldier-Pile Wall

Average Annual Benefits
$4,758,541
$2,632,470
$1,259,401

For the purpose of evaluating the benefits, because the bank stabilization alternative would be completed by 2025 (which begins the period of analysis), it is assumed that relocation would happen by 2025 too. Reason for this assumption includes hydrologic data shows minor flooding (frequent loading) of the Alabama River could contribute to the building instability; therefore, this instability could happen around a 0.5 AEP (2-year) flood event (reference Future Without Project Condition section). Moreover, there is an increased interest to protect this historical viewshed sooner rather than later because of its historical significance and what it represents regarding the Civil Rights movement.

C.2.7.1.4. *Alternative 5*

Alternative 5 is a combination of Alternatives 1.A and 4. This alternative would take approximately 30 months to complete. Since inundation reduction benefits could not be derived for the soldier pile wall, the summary of the residual flood damages and flood damage reductions for Alternative 5 would be the same as what is shown for Alternative 1.A. However, the benefits would be sum of Alternative 1.A and Alternative 4.

C.2.7.1.5. *Alternative 6*

Alternative 6 is a combination of Alternatives 3 and 5 with the exception of buyout footprint. A total of nine (9) parcels in Ward 8 identified within the 68-acre buyout footprint for this alternative would be located outside the levee alignment. This alternative would take approximately 42 months to complete.

Alternative 6 combines an optimized levee with buyouts of structures immediately outside of the optimized leveed area, and a soldier pile wall. As mentioned in Alternative 3, the optimized levee was model to reduce the majority of flooding risk in Ward 8; therefore, the modeling of alternative 3 was inclusive of these structures, outside the immediate leveed area, being removed from the floodplain. Moreover, since inundation reduction benefits could not be derived for the soldier pile wall, the summary of the residual flood damages and flood damage reductions for Alternative 6 would be the same as what is shown for Alternative 3. However, the benefits would be sum of Alternative 3 and Alternative 4.

C.2.8. Alternative Comparison

Comparison of costs with regards to benefits was performed for each alternative. These comparisons provide the framework for completing the evaluation of alternative plans.

C.2.8.1. *Rough Order of Magnitude (ROM) Costs*

Continuing the evaluation process, first cost estimates were developed for each of the alternatives that were evaluated. The ROM costs were provided by Mobile District's Cost Engineering Section Division in 202 price levels. For comparison to the benefits, which are average annual flood damages reduced, the first costs were stated in average annual terms using the FY20 discount rate of 2.75% and a 50-year period of analysis. Interest during construction (IDC) was added to the ROM first costs assuming 18 months for Alternative 1, 48 months for Alternative 2, 36 months for Alternative 3, 30 months for Alternative 5, and 42 months for Alternative 6. In addition, annual operation and maintenance (O&M) costs were also added to the alternatives. Table C-16 displays the results of the costs calculation.

Table C-16: Project Alternative Costs

Alternative	First Cost	IDC	O&M	Average Annual Cost
1.A	$4,950,000	$102,000	-	$187,000
3	$74,040,000	$4,167,000	$ 27,000	$2,924,000
4	$27,537,000	$955,000	$4,000	$1,059,000
5	$32,400,000	$1,124,000	$4,000	$1,246,000
6	$104,860,000	$5,140,000	$29,500	$4,104,000

C.2.8.2. *Comparison of Benefits to Costs*

The equivalent annual benefits were then compared to the average annual cost to develop net benefits and a benefit-to-cost ratio (BCR) for each alternative. The net benefits for each alternative were calculated by subtracting the average annual costs from the equivalent average annual benefits, and a BCR was derived by dividing average benefits by average annual costs. Net benefits were used for identification of the NED plan in accordance with the Federal objective. For comparative purposes, Table C-17 summarizes the equivalent annual damages (benefits), average annual costs, first cost, net benefits, and BCR for each alternative.

Table C-17: Comparison of Benefits and Costs

Alternative	Average Annual Benefits	Average Annual Costs	First Cost	Net Benefits	Benefit-to-Cost Ratio
1.A	$111,000	$187,000	$4,950,000	($76,000)	0.59
3	$361,000	$2,924,000	$74,040,000	($2,563,000)	0.12
4	$4,759,000-$36,000	$1,059,000	$27,537,000	$3,700,000-($1,023,000)	4.50-0.03[4]
5	$4,870,000-$147,000	$1,246,000	$32,400,000	$3,624,000-($1,099,000)	3.91-0.12
6	$5,120,000-$397,000	$4,104,000	$104,860,000	$1,016,000 ($3,707,000)	1.25-0.1

As a result of the comparison of the alternatives, no alternatives could be clearly identified as the NED Plan in accordance with the Federal objective. Based on the results of this analysis, USACE, Mobile District requested an exception to the standard identified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, specifically that the selected plan should have "…the greatest net economic benefit (the NED Plan) consistent with protecting the Nation's environment, unless the Secretary… grants an exception to this rule." This exception was granted in the Memorandum for Record from the Assistant Secretary of the Army (Civil Works) (ASA(CW)) to HQ USACE dated June 10, 2020.

C.2.8.3. *Economic Risk*

Risk-informed planning should incorporate transparency in the estimation of benefits. The primary role in dealing with risk and uncertainty is to characterize to the extent

[4] Includes uncertainty. Reference Economic Risk Section.

possible the different degrees of risk and uncertainty and to describe them clearly so that decisions can be based on the best available information. For Alternative 4, which is the soldier-pile wall, a case could be made that the most likely alternative with the least cost is not to stabilize the bank which would lead to the eventual failure of the structures along the historical riverfront. These 11 structures have a market value of approximately $5.4 million or about $3.8 million in depreciated replacement cost and the same methodology that was done for the relocation cost could be applied to the depreciated replacement cost.

Therefore, depending on the year of failure (which is assume to occur within the 50 year period of analysis), the present worth of this depreciated replacement cost ranges from about $3.7 million in year 1, 2025, (i.e. high value) to $0.979 million (i.e. low value) in year 50, 2074, with an average of about $2 million based on the FY20 discount rate of 2.75% as shown in Table C-18. Moreover, Table C-18, Table C-19, and Table C-20 display the subsequent average annual cost for the structures which would then translate to the average annual benefits for the soldier-pile wall.

Table C-18: Present Worth of Relocation Cost

Number	Year	Present Worth Factor	Depreciated Cost	Present Worth
1	2025	0.97323601	$3,800,000	$3,698,297
2	2026	0.947188331	$3,800,000	$3,599,316
3	2027	0.921837791	$3,800,000	$3,502,984
4	2028	0.897165734	$3,800,000	$3,409,230
5	2029	0.873153999	$3,800,000	$3,317,985
6	2030	0.849784914	$3,800,000	$3,229,183
7	2031	0.827041278	$3,800,000	$3,142,757
8	2032	0.804906354	$3,800,000	$3,058,644
9	2033	0.783363848	$3,800,000	$2,976,783
10	2034	0.762397906	$3,800,000	$2,897,112
11	2035	0.741993095	$3,800,000	$2,819,574
12	2036	0.722134399	$3,800,000	$2,744,111
13	2037	0.702807201	$3,800,000	$2,670,667
14	2038	0.683997276	$3,800,000	$2,599,190
15	2039	0.66569078	$3,800,000	$2,529,625
16	2040	0.647874238	$3,800,000	$2,461,922
17	2041	0.630534538	$3,800,000	$2,396,031
18	2042	0.613658918	$3,800,000	$2,331,904
19	2043	0.597234957	$3,800,000	$2,269,493
20	2044	0.581250566	$3,800,000	$2,208,752
21	2045	0.565693982	$3,800,000	$2,149,637
22	2046	0.550553754	$3,800,000	$2,092,104
23	2047	0.535818738	$3,800,000	$2,036,111
24	2048	0.521478091	$3,800,000	$1,981,617
25	2049	0.507521256	$3,800,000	$1,928,581

26	2050	0.493937962	$3,800,000	$1,876,964
27	2051	0.480718211	$3,800,000	$1,826,729
28	2052	0.467852274	$3,800,000	$1,777,839
29	2053	0.45533068	$3,800,000	$1,730,257
30	2054	0.443144214	$3,800,000	$1,683,948
31	2055	0.431283907	$3,800,000	$1,638,879
32	2056	0.419741029	$3,800,000	$1,595,016
33	2057	0.408507084	$3,800,000	$1,552,327
34	2058	0.397573804	$3,800,000	$1,510,780
35	2059	0.386933143	$3,800,000	$1,470,346
36	2060	0.376577268	$3,800,000	$1,430,994
37	2061	0.366498558	$3,800,000	$1,392,695
38	2062	0.356689594	$3,800,000	$1,355,420
39	2063	0.347143157	$3,800,000	$1,319,144
40	2064	0.337852221	$3,800,000	$1,283,838
41	2065	0.328809947	$3,800,000	$1,249,478
42	2066	0.320009681	$3,800,000	$1,216,037
43	2067	0.311444945	$3,800,000	$1,183,491
44	2068	0.303109436	$3,800,000	$1,151,816
45	2069	0.294997018	$3,800,000	$1,120,989
46	2070	0.28710172	$3,800,000	$1,090,987
47	2071	0.279417733	$3,800,000	$1,061,787
48	2072	0.271939399	$3,800,000	$1,033,370
49	2073	0.264661216	$3,800,000	$1,005,713
50	2074	0.257577826	$3,800,000	$978,796

Table C-19: Average Annual Cost of Depreciate Replacement Cost

	High	**Average**	**Low**
Present Worth	$3,698,297	$2,045,933	$978,796
Average Annual Costs	$136,988	$75,783	$36,255

Table C-20: Average Annual Benefits of Soldier-Pile Wall

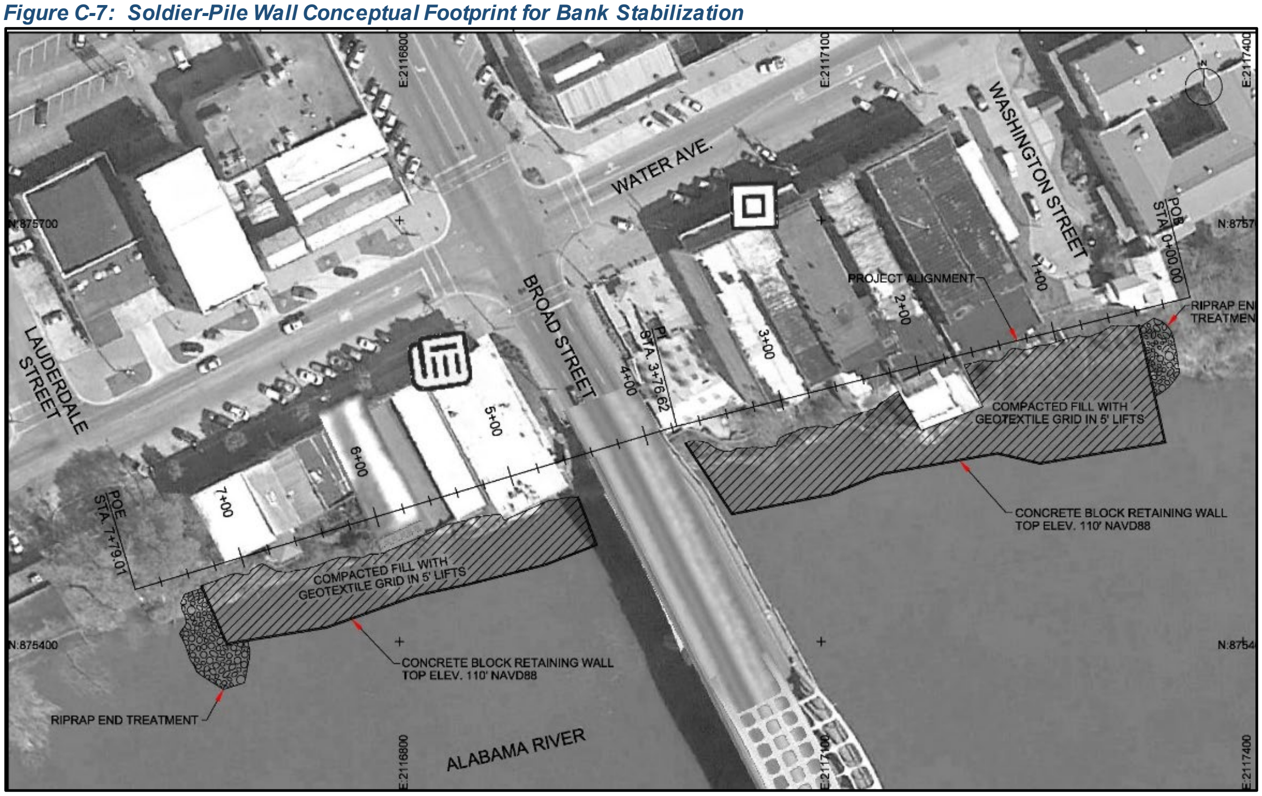
Average Annual Benefits
$136,988
$75,783
$36,255

However, as described in section 1.7.1.3.4.2, these structures located on Selma's Historic Riverfront compose the viewshed of Edmund Pettus Bridge; therefore, the values of these structures should not be solely based on of their physical characteristics but also their cultural and historical value to the Nation (i.e. the viewshed). Therefore, it was assumed that value of the viewshed is at least the cost of relocating these structures if not more.

C.2.9. Recommended Plan (TSP)

The TSP (recommended plan) for this study is Alternative 4 in conjunction with a floodplain management/emergency evacuation plan (FMEEP) measure that was identified during the Alternative Mile Meeting (AMM). Figure C-7 depicts the conceptual design and footprint for the Soldier-Pile Wall. The FMEEP will identify hazards within the city limits, discuss effects of flooding and provide recommendation for addressing flood risk through responsible future development of the floodplain. The FMEEP would also provide a detailed plan for the City to implement the use of emergency notification and evacuation of flood prone areas in the event of an approaching flood event. Additionally, because a FMEEP could be combined with any alternative, it was not incorporated into each alternative description.

Figure C-7: Soldier-Pile Wall Conceptual Footprint for Bank Stabilization



As stated, the TSP identified for this study is Alternative 4 which includes a soldier pile wall that provides bank stabilization. For more information regarding this plan selection, reference Plan Selection section of the Main Report. The first costs estimated for the TSP were stated in average annual terms using the FY20 discount rate of 2.75% and a 50-year period of analysis. Interest during construction and annual operation and maintenance (O&M) costs were also included. Table C-21, Table C-22, and Table C-23 summarize the equivalent annual damages reduced (benefits), average annual costs, first cost, net benefits, and BCR for the TSP.

Table C-21: Investment Costs

Cost	Amount
Project First Cost	$27,537,000
Interest During Construction	$953,000

Table C-22: Average Annual Cost

Cost	Amount
Average Annual First Cost	$1,055,000
Annual O&M Cost	$4,000
Average Annual Annualized Costs	$1,059,000
Average Annualized Benefits	$4,759,000 - $36,000

Table C-23: Benefits

Benefits	Amount
Net Benefits	$3,700,000
BCR	4.50

C.3. Regional Economic Development (RED)

When the economic activity lost in the flooded region can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts on the employment, income, and output of the regional economy are considered part of the Regional Economic Development (RED) account.

C.3.1. Background

Despite Selma, Alabama's turbulent and pivotal history to the Republic, the progress achieved through Civil Rights demonstrators, activists and organizers in the 1960s, it was not until March 11, 2013 that the site secured its status as a National Historic Landmark, 48 years after becoming indelibly linked to the Nation's history. It was not until 2014 that Paramount Pictures released *Selma,* the film, yet Selma's story transcends the struggles and triumphs achieved in passing the Voting Rights Act in 1965. Selma's place in Civil Rights History serves as a turning point in the continuing quest for democracy and justice around the globe.

The USACE South Atlantic Division endorses Mobile District's proposal, Alternative 4, the Soldier-Pile Wall along the historic downtown riverfront in the area adjacent to the Edmund Pettus Bridge in an effort to maintain heritage tourism to the region.

C.3.2. Impacts of Recommended Plan

HERITAGE TOURISM: COMPARISON TO MONTGOMERY, AL AND WILLIAMSBURG, VA

Dallas County's 2018 Gross Domestic Product (GDP) was $1,174,931,000 according to the Bureau of Economic Analysis (BEA). The Alabama Department of Tourism reported Dallas County generated $75,781,018 in tourism revenue in 2018, notching a 7.1 percent increase over 2017 and supported 1,028 jobs.

In 2018, tourism increased by a healthy 8.5 percent in Alabama. Dallas County's tourism increased 7.1 percent with Selma as its hub, meanwhile Montgomery County's tourism growth increased by 12.6 percent. Some of Montgomery's increase in tourism can be traced to a 2004 revitalization initiative including the construction of a riverfront park along the Alabama River and a new minor league baseball stadium.

If the Soldier-Pile Wall is not supported, the structures along Selma's Historic Riverfront will be condemned, since it can determine that within the 50 year period of analysis these structures will be designated structurally unsound. This scenario would not only reduce property tax revenues but also weaken Selma's appeal for heritage tourism and puts $75 million in annual tourism at risk.

For a comparison to another heritage tourism destination look to Colonial Williamsburg, found in the Williamsburg City, Virginia, which supported 6,019 jobs through tourism during 2018 according to the Virginia Tourism Corporation. Another reference point: travelers spent more than $612 million in Williamsburg City, VA in 2018. To be clear, tourism in Williamsburg City supports nearly 5,000 more jobs and generates $536 million more in tourism than did Selma, AL in 2018. However, while heritage tourism contributes to both of these localities' economies, Williamsburg benefits from 50 additional years of national recognition. To reiterate, Williamsburg, VA was listed in 1966 in the National Register of Historic Places, whereas the City of Selma was listed in 2016. Both localities serve as integral pieces to the Nation's history.

Civil Rights heritage tourism draws visitors to Selma and its sister cities of Montgomery and Birmingham, a notion supported from the identification of a $12.6 million grant to the preservation and rehabilitation of Civil Rights sites in 24 states, of which, over $2 million was allocated to Alabama sites in 2018 by the Department of Interior's Historic Preservation Fund.

C.3.3. Additional Red Benefit Category: Real-Estate Values

Indirect benefits may also accrue from Alternative 4's Soldier-Pile Wall on Selma's Historic Riverfront. According to data from U.S. Federal Housing Finance Agency as obtained through the St. Louis Federal Reserve (FRED) Economic Data; the House Price Index for Dallas County, AL declined 9.2% from 2013 to 2018. Meanwhile home prices maintained their value over the same period in Montgomery County, AL and home prices appreciated by 9.4 percent in Williamsburg, VA as indicated by their respective House Price Indices over the same period. Stabilization of home prices in Montgomery might be attributable to recent revitalization projects and a causal link can be drawn from the prospect of losing Selma's Historic District, which could lead to the dissolution of the city, heightened by the prospect of condemnation on Selma's anchor properties to residential real-estate value declines in Dallas County, Alabama. Fortifying the Historic Riverfront will not only support heritage tourism but also may subsequently lead to property values stabilizing or increasing in the City of Selma and Dallas County, AL.

C.3.4. Recons Methodology

When the economic activity lost in the study area can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts of the employment, income, and output of the regional economy are considered part of the RED account. The input-output macroeconomic model RECONS was used to address the impacts of the construction spending associated with Alternative 2, Alternative 3, Alternative 4 and Alternative 6 (results displayed in section 2.7 below).

The RECONS Core-based Statistical Area (CBSA) of Selma, AL was selected using an expenditure year of 2022.

This RED analysis, using RECONS, employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a region's economy to predict the effect of changes, the implementation of a project of a specific USACE Business Line, to the various industries that would be impacted. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending drive the input-output model to project new levels of sales (output), value added (Gross Regional Product or GRP), employment, and income for each industry.

The specific input-output model used in this analysis is RECONS (Regional Economic System). This model was developed by the Institute for Water Resources (IWR), Michigan State University, and the Louis Burger Group. RECONS uses industry multipliers derived from the commercial input-output model IMPLAN to estimate the effects that spending on USACE projects have on a regional economy. The model is linear and static, showing relationships and impacts at a certain fixed point in time. Spending impacts are composed of three different effects: direct, indirect, and induced.

Direct effects represent the impacts the new federal expenditures have on industries which directly support the new project. Labor and construction materials can be considered direct components to the project. Indirect effects represent changes to secondary industries that support the direct industries. Induced effects are changes in consumer spending patterns caused by the change in employment and income within the industries affected by the direct and induced effects. The additional income workers receive via a project and spent on clothing, groceries, dining out, and other items in the regional area are secondary or induced effects.

The inputs for the RECONS model are expenditures that are entered by work activity or industry sector, each with its own unique production function. The Flood Risk Management production function of "Flood Risk Management General" was selected to gauge the impacts of the construction of the Soldier-Pile Wall. The baseline data used by RECONS to represent the regional economy of Selma, AL are annual averages from the Bureau of the Census, the Bureau of Labor Statistics, and the Bureau of Economic Analysis for the year 2019. The model results are expressed in 2022 dollars.

C.3.5. Assumptions

Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if inputs are to increase, output will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all of its commodities. Finally, since the model is static, it is assumed that the economic conditions of 2019, the year of the socio-economic data in the RECONS model database, will prevail during the years of construction.

C.3.6. Description of Metrics

"Output" is the sum total of transactions that take place as a result of the construction project, including both value added and intermediate goods purchased in the economy. "Labor Income" includes all forms of employment income, including employee compensation (wages and benefits) and proprietor income. "Gross Regional Product (GRP)" is the value-added output of the study region. This metric captures all final goods and services produced in the study areas because of the project's existence. It is different from output in the sense that one dollar of a final good or service may have multiple transactions associated with it. "Jobs" is the estimated worker-years of labor required in full time equivalent units to build the project.

C.3.7. Recons Results for Array of Alternatives

Since the RECONS model has constant returns to scale, it is expected that Alternative 2, with the highest first cost of any alternative, would generate the highest simulative impact on the region, as displayed in Table C-24. Again, however, this alternative was screened out due to its exorbitant operations and maintenance costs and the deleterious responsibilities it would pose to the local sponsor.

Table C-24: Regional Economic System Model for Alternative 2

Factors ($000)	Alt. 2 - 1967 Levee
First Costs	$297,070
Local Capture	$176,172
Output	$216,799
Jobs	1,249*
Labor Income	$64,527
Value Added	$91,070
Results Discussion	*Jobs generated are short-term resulting from construction spending.

A summary of the RECONS results for Alternative 4, the recommended plan, is juxtaposed to Alternative 3 and Alternative 6 within Table C-25. Alternative 5 is not displayed within the table since it is a combination of Alternative 1.A and Alternative 4, and using the first cost of Alternative 1.A (a buyout or acquisition measure) is not a suitable input to the RECONS model. That is, only demolition costs are suitable inputs to RECONS for this alternative due to current constraints on the availability of housing in the City of Selma and other factors. Thus, in connection to the transitive property, so too would it be inappropriate to use the sum of the first costs for Alternative 1.A and Alternative 4 as an input for the first cost of Alternative 5.

Table C-25: Regional Economic System Model for Array of Alternatives

Factors ($000)	Alt. 1.A. Buyouts	Alt. 3 Optimized Leve	Alt. 4 Soldier Pile Wall	Alt. 6. Opt. Levee/Wall/Buyouts

First Costs	$4,950	$74,040	$27,537	$104,860
Local Capture	N/A	$43,908	$16,283	$62,185
Output	N/A	$54,034	$20,038	$76,526
Jobs Labor Income	N/A	311*	115*	440*
Value Added	N/A	$16,082	$5,964	$22,777
Results Discussion	Buyout costs may not be appropriate inputs to RECONS.	*Jobs generated are short-term resulting from construction spending.	*Jobs generated are short-term resulting from construction spending.	*Jobs generated are short-term resulting from construction spending.

C.3.8. Recons Results for Selected Plan

For the Selma, Alabama Core Based Statistical Area, the construction stimulus of $27.457 million would generate 115.4 full-time equivalent jobs, $5.964 million in labor income, and $20.038 million in output. For the state of Alabama, as a whole, the construction stimulus would generate 227.2 full-time equivalent jobs, $12.679 million in labor income, and $36.480 million in output. For the Country, as a whole, the construction stimulus would generate 354.6 full-time equivalent jobs, $21.521 million in labor income, and $62.596 million in output (see Table C-22).

Table C-26: RECONS Overall Summary for Alternative 4

Area	Local Capture ($000)	Output ($000)	Jobs*	Local Income ($000)	Value Added ($000)
Local					
Direct Impact		$16,118	82.9	$4,789	$6,279
Secondary Impact		$4,009	32.6	$1,175	$2,138
Total Impact	$16,283	$20,038	115.4	$5,964	$8,417
State					
Direct Impact		$22,956	136.6	$8,417	$10,597
Secondary Impact		$13,524	90.6	$4,263	$7,385
Total Impact	$22,956	$36,480	227.2	$12,679	$17,982
US					
Direct Impact		$26,406	167.8	$10,088	$13,046
Secondary Impact		$36,190	186.9	$11,433	$19,260
Total Impact	$26,406	$62,596	354.6	$21,521	$32,305

*Jobs are presented in full-time equivalence (FTE)

The impact area captures about 59% of the direct spending on the project. About 24% of the spending leaks out into other parts of the state of Alabama. The rest of the nation captures about 13%.

The secondary impacts, the combined indirect and induced multiplier effects, account for approximately 20% of the total output in the local area, about 28% of employment and nearly 20% of labor income in the local area.

Selma, Alabama

Flood Risk Management Study
Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX D

US Army Corps of Engineers
Mobile District

September 14, 2020

Appendix-D. Real Estate Plan

Table of Contents

List of Figures

List of Tables

D.1. Preamble

D.1.1. Study Authorization

This feasibility study is authorized by House Resolution No. 66, June 7, 1961:

> *Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors be, and is hereby, requested to review the report on Alabama-Coosa Branch of Mobile River, Georgia and Alabama, published as House Document No. 66, Seventy-fourth Congress, first, session, with a view to determining the advisability of providing improvements for flood control on Alabama River in Dallas County, Alabama."*

The Bipartisan Budget Act of 2018 (Public Law (P.L.) 115-123), Division B, Subdivision 1, Title IV, appropriates funding for the study at full Federal expense. As identified under this "Supplemental Appropriation" bill, the study is subject to additional reporting requirements and is expected to be completed within three years and for $3 million dollars.

In accordance with the memorandum for the Commander dated February 25, 2020 from Headquarters (HQ) United States Army Corps of Engineers (USACE) to the South Atlantic Division (SAD), the investigation of streambank (bankline) erosion measures is being conducted under the authority of Section 1203 of America's Water Infrastructure Act of 2018 as authorized:

> *"(a) Feasibility Reports.--The Secretary shall expedite the completion of a feasibility study for each of the following projects, and if the Secretary determines that the project is justified in a completed report, may proceed directly to preconstruction planning, engineering, and design of the project: (1) Project for riverbank stabilization, Selma, Alabama."*

D.1.2. Official Project Designation

Selma Flood Risk Management Study

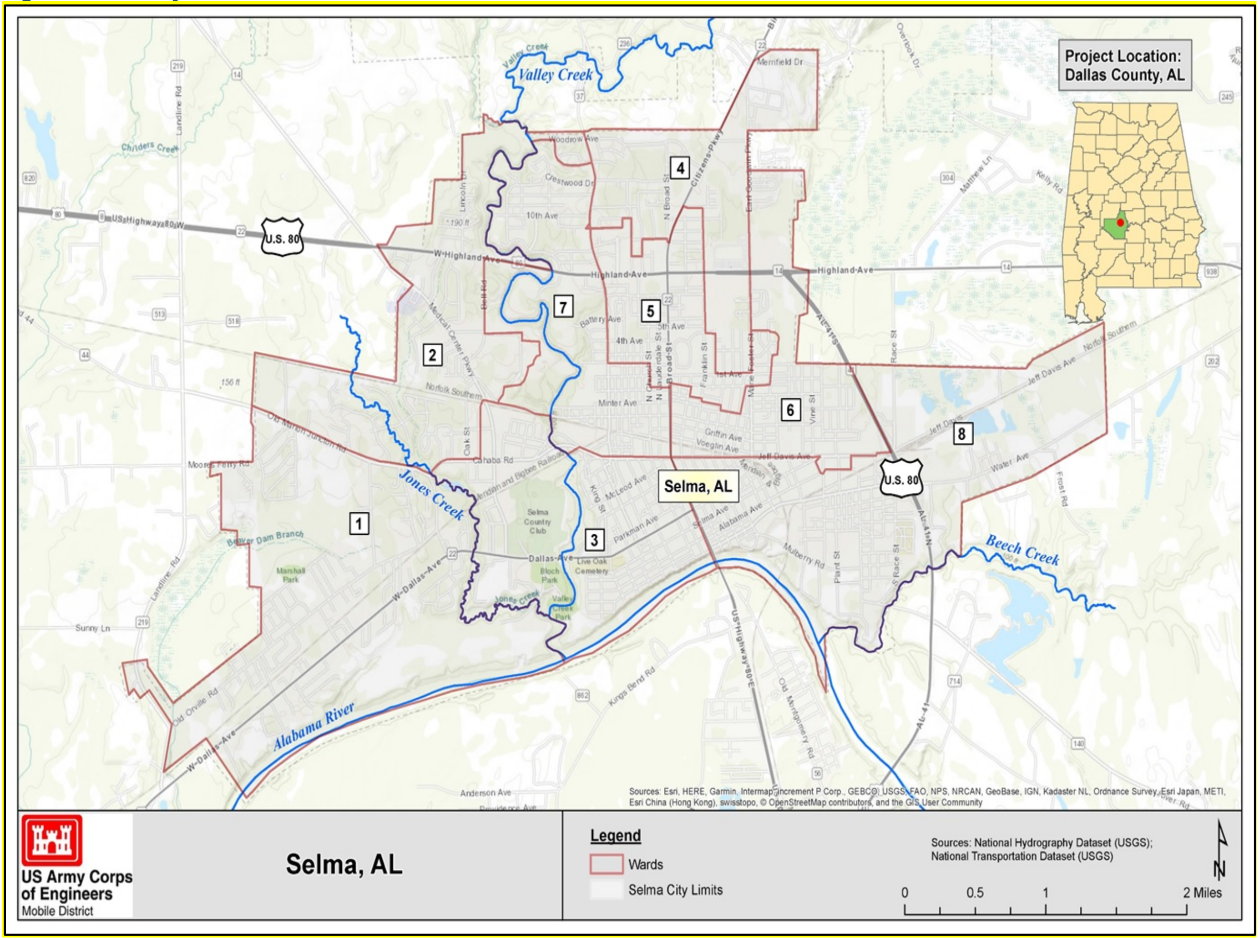
D.1.3. Study Area

Selma, the seat of Dallas County, is located in central Alabama a distance of 88 miles south of Birmingham, Alabama, and 50 miles west of Montgomery. It is situated on high bluffs on the right bank of the Alabama River about 215 miles above its mouth.

D.1.4. Reach Delineation

The Study Area is located along the Alabama River in the City of Selma, Alabama. The city itself is divided into wards with each having a representative in the city government. The wards receiving frequent flooding are identified and are the focused project area for this study. They include Wards 1, 3, 6 and 8. River Mile(s) (RM) 256 through 261 have been assessed for this study.

Figure D-1: Study Area



D.1.5. Non-Federal Sponsor

The Non-Federal Sponsor is the City of Selma (the “Sponsor” or “the City”). If approved and appropriated, the project will be cost-shared in accordance with the terms of the PPA, 33 U.S.C. § 2213, OMB Circular A-87 and Chapter 12, ER 405-1-12.

D.2. Statement of Purpose

The purpose of this Real Estate Plan (REP) is to present the overall plan describing the minimum real estate requirements for the construction, operation, maintenance, repair and rehabilitation herein referred to as the Tentatively Selected Plan (TSP). This Real Estate Plan (REP) is tentative in nature and is to be used for planning purposes only in order to support the ongoing study of proposed flood risk management measures for the City of Selma. Although this report is written based on specific data research prepared by the Project Delivery Team (PDT), modifications to the proposed plan could occur during the review phase thus changing the final acquisition areas and/or administrative and land costs. Furthermore, due to the nature of this study, the level of detail provided herein is understood to be equivalent to the main report.

D.3. Project Description

D.3.1. Plan of Improvements

The current proposed non-structural measures for the Selma study area are listed below. Please reference the main report and other appendices for information on the screening criteria utilized in the development of the TSP.

D.3.1.1. *Alternative 4 - Soldier Pile Wall Bankline Stabilization + Floodplain Management & Emergency Evacuation Plan (FMEEP):*

The TSP (recommended plan) for this study is a combination of the proposed improvements of Alternative 4 in conjunction with the FMEEP. The FMEEP will identify hazards within the city limits, discuss effects of flooding and provide recommendation for addressing flood risk through responsible future development of the floodplain. The plan would also provide a detailed plan for the City to implement the use of emergency notification and evacuation of flood prone areas in the event of an approaching flood event. The details of the FMEEP are pending further deliberation by the PDT, and are not anticipated to have considerable LERRD implications at this time. However, it is duly noted that subsequent iterations of this Appendix will need to fully factor in the proposed project features of the FMEEP.

Structural Component: Soldier pile wall improvements have been proposed along the bank of the Alabama River in Selma, Alabama commencing at Washington Street to a point paralleling with Lauderdale Street, divided in two roughly equal segments by the Edmund Pettis Bridge. Further Engineering design refinements are anticipated which will have bearing on the LERRD footprint. The lands described in Section 4.0 detail the land acquisition requirements for the soldier pile wall.

D.4. Required Lands, Easements, and Rights-of Way (LER)

The parcel data for the required LER is contained in **Exhibit B** and a synopsis of the project real estate requirements follows.

1. For the soldier pile wall features, 14 parcels are situated within the proposed construction area, and a preliminary acquisition estimate of 0.3 +/- of an acre will be required in Perpetual Bank Protection Easement (Standard Estate #21), as outlined in **Exhibits A** and **B**.
2. In addition to lands noted above, a portion of the soldier pile wall construction estimated at 0.08 +/- of an acre is situated within the City of Selma's right-of-way for Washington Street. At the current level of Engineering design (minimal), project footprint is not expected to extend into the State right-of-way for U.S. Hwy 80 Business/Edmund Pettis Bridge. If unidentified impacts were to occur, coordination with Alabama Department of Transportation would be required, with the most probable outcome being a license agreement for the small portion of project area within State right-of-way.
3. It is duly noted that Unexploded Ordnance (UXO) neutralization site potentially required for the soldier pile wall construction has not been factored into the required LER or included in the BCERE. The Project Delivery Team was unable to determine a site pursuant to ongoing coordination with the Explosive Ordnance Disposal (EOD) authorities. Please reference the main report and cultural resources section for further information. From a real estate perspective, the outcome of this discussion could lead to additional land acquisition needs.

4. All access and staging requirements have been accounted for as construction is anticipated by barge on the Alabama River. Additional access is available via public right-of-way (Washington St and Broad St).

D.4.1. Appraisal Information

A gross appraisal estimate for LERRD requirements was completed on December 3, 2019, with review date of December 4, 2019. The estimated market value for the TSP is outlined in Section 12. Furthermore, the current state of housing availability was taken into consideration in a market survey analysis, provided under separate cover.

D.5. Non-Federal Sponsor Owned Land

For the soldier pile wall features, Parcels 1107364002071000 and 1107364002062001, adjacent to the Alabama River, are vested in the Non-Federal Sponsor as of the date of this report.

D.6. Recommended Estates

There are no proposed non-standard estates for the plan.

D.6.1. Standard Estate for Structural Plan (Estate No. 21 – Bank Protection Easement)

> *"A perpetual and assignable easement and right-of-way in, on, over and across the land hereinafter described for the location, construction, operation, maintenance, alteration, repair, rehabilitation and replacement of a bank protection works, and for the placement of stone, riprap and other materials for the protection of the bank against erosion; together with the continuing right to trim, cut, fell, remove and dispose therefrom all trees, underbrush, obstructions, and other vegetation; and to remove and dispose of structures or obstructions within the limits of the right-of-way; and to place thereon dredged, excavated or other fill material, to shape and grade said land to desired slopes and contour, and to prevent erosion by structural and vegetative methods and to do any other work necessary and incident to the project; together with the right of ingress and egress for such work; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however to existing easements for public roads and highways, public utilities, railroads and pipelines."*

D.7. Existing Federal Projects

The William Bill Dannelly Reservoir (USACE Full Federal) project is within Dallas County, and perpetual flowage easements exist up to contour elevation 98 (primarily downstream of the railroad bridge) and up to contour elevation 99 (primarily upstream of the railroad bridge). On the west end of Selma downstream of Jones/Valley Creek, the flowage easements include the area up to contour elevation 97. None of the easements or fee lands for this project or other Federal projects are currently anticipated to be impacted by the TSP.

D.8. Federally-owned Lands

There are no Federally-owned lands included as part of the LER required for the TSP.

D.9. Navigational Servitude

Federal Navigational Servitude will be utilized in the construction of the proposed soldier pile wall bankline stabilization features lying below the mean high water mark. Federal Navigational Servitude is defined as "the dominant right of the Government under the Commerce Clause of the U.S. Constitution (U.S. CONST. art.I, Section 8, cl.3) to use, control and regulate the navigable waters of the United States and the submerged lands thereunder for various commerce-related purposes including navigation and flood control. In non-tidal areas, the servitude extends to all lands within the bed and banks of a navigable stream that lie below the ordinary high water mark." We anticipate the majority of construction to take place below the ordinary high water mark.

D.10. Maps

The preliminary real estate maps for the TSP are provided in **Exhibit A.**

D.11. Induced Flooding

There is no induced flooding which has been identified associated with the TSP.

D.12. Baseline Cost Estimate for Real Estate

Table D-1 is the total estimated 01-Lands and Damages costs for the TSP, which is further delineated in **Exhibit D**:

Table D-1: Lands and Damages Costs for the TSP

Item	Cost
Estimated Land Payments Costs	$7,227
Estimated P.L. 91-646 Relocation Assistance	$0
Estimated Administrative Cost / Eminent Domain	$321,000
Contingency (15%)	$49,234
Total Estimated Lands and Damages	**$377,461 or $380,000 (rounded)**

D.13. Compliance with Public Law 91-646

At this time, no land acquisition is expected which would trigger Public Law 91-646 Relocation Assistance payments. In the event of project approval, authorization, and appropriation, any approved relocation assistance requirements for the proposed plan and general acquisition requirements will be governed by the provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act (P.L. 91-646), as amended, 49 Code of Federal Regulations Part 24, and applicable laws and regulations.

D.14. Minerals and Timber Activity

There are no known present or anticipated mineral extraction or timber harvesting activities within the proposed project footprint. Existing geological data graphically depicted in Figure 2 in the vicinity of Selma indicates an abundance of flood plain deposits, clay and other deposits. Based on research into current mineral exploitation endeavors in the area, the risk of third-party development of mineral activities is considered negligible, and is not expected to impact any proposed project features.

During site visits, no mineral activity was observed, and no known exploratory activity is underway in this area.

D.15. Land Acquisition Experience and Capability of the Non-Federal Sponsor

USACE-RE personally met with City of Selma officials and coordination regarding the assessment of the Sponsor's land acquisition experience and capabilities has been completed and is attached hereto as **Exhibit C subpart 1**.

D.16. Zoning

For the proposed non-structural FMEEP, further details regarding recommendations are pending further PDT deliberation. Existing City ordinances are in place to review and/or address structures with unduly hazardous physical conditions. The existing City Ordinances at Section 6-104 through 6-106 (provide the process for review by the City's Building Inspector, which is recommended to be considered in conjunction with the City's Ordinance, Sec. 11½-8 which mandates the granting of a development permit in conformance with the provisions of this ordinance prior to the commencement of any development activities:

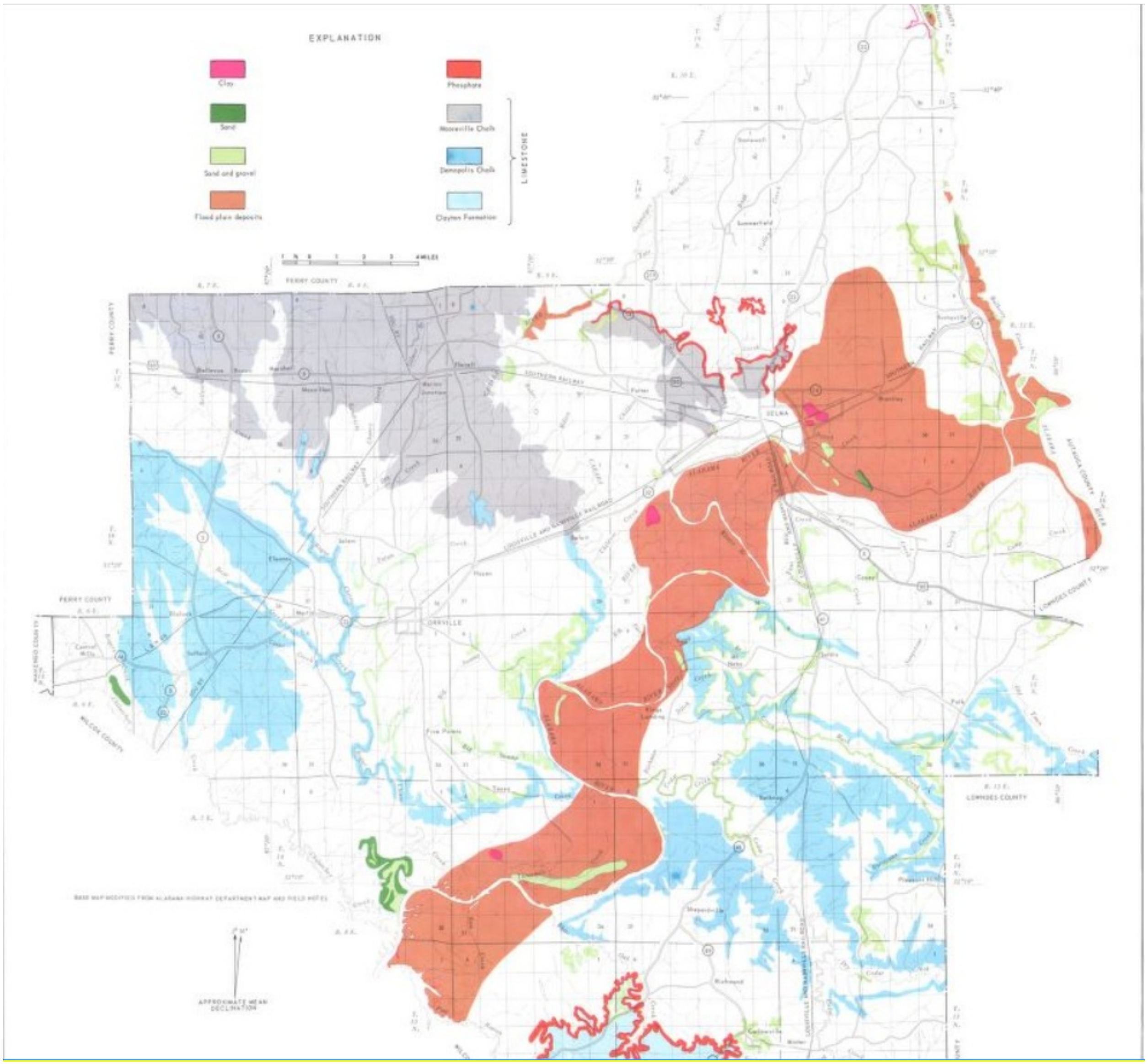
- Selma City Ordinances, Section 6-104 - "Abatement—Determination of necessity; serving notice, form of notice. Whenever the building inspector, the fire chief, police chief or the health officer shall be of the opinion that any building or structure in the city is a "dangerous building" he shall file a written statement to this effect with the city clerk. The city clerk shall thereupon cause written notice to be served upon the owner thereof and upon the occupants thereof, if any, by registered mail, or certified mail, return receipt requested, or by personal service. Such notice shall state that the building has been declared to be in a dangerous condition and that such dangerous condition must be removed or remedied by repairing or altering the building or demolishing it; and that the condition must be remedied at once or within a specified time not exceeding ninety (90) days. Such notice may be in the form specified in the Code of Ordinances of the City of Selma.

D.17. Acquisition Schedule

The acquisition schedule is to be determined, pending project approval and appropriations, albeit the schedule below is preliminary. Furthermore, all provisions of the Uniform Relocation Act, and all procedural requirements govern, including statutory notice to displaced persons and identification of Decent, Safe, and Sanitary dwellings.

- Structural: Soldier pile wall bankline stabilization – Real Estate Certification – 6 mos after completion of 100% EN design

Figure D-2: Geologic Data for the Selma Area (Source: University of Alabama)



D.18. Facility and/or Utility Relocations

Coordination with the City of Selma Engineering Department is recommended for soldier pile wall features to avoid unidentified drainage and/or water line impacts. At this time, no known utility or facility impacts have been identified with conceptual design.

D.19. Hazardous, Toxic, and Radioactive Waste (HTRW)

There is no known HTRW contamination within the proposed footprint of the TSP at this time, albeit Phase I and Phase II assessment may be necessary. Reference HTRW section of the report for further information on Environmental considerations.

D.20. Attitude of Property Owners

The Non-Federal Sponsor has been supportive of the aforementioned structural and non-structural measures to support community resiliency along the Alabama River in Selma.

Pursuant to the requirements set forth in the Land Acquisition Policy Act of 1960, Public Law 86-645 (33 U.S.C. § 597), mandates landowner notification within six months after authorization, and "a reasonable time after initial appropriations."

> *Within six months after the date that Congress authorizes construction of a water resource development project under the jurisdiction of the Secretary of the Army, the Corps of Engineers shall make reasonable effort to advise owners and occupants in and adjacent to the project area as to the probable timing for the acquisition of lands for the project and for incidental rights-of-way, relocations, and any other requirements affecting owners and occupants. Within a reasonable time after initial appropriations are made for land acquisition or construction, including relocations, the Corps of Engineers shall conduct public meetings at locations convenient to owners and tenants to be displaced by the project in order to advise them of the proposed plans for acquisition and to afford them an opportunity to comment. To carry out the provisions of this section, the Chief of Engineers shall issue regulations to provide, among other things, dissemination of the following information to those affected: (1) factors considered in making the appraisals; (2) desire to purchase property without going to court; (3) legal right to submit to condemnation proceedings; (4) payments for moving expenses or other losses not covered by appraised market value; (5) occupancy during construction; (6) removal of improvements; (7) payments required from occupants of Government acquired land; (8) withdrawals by owners of deposits made in court by Government, and (9) use of land by owner when easement is acquired. The provisions of this section shall not subject the United States to any liability nor affect the validity of any acquisitions by purchase or condemnation and shall be exempt from the operations of subchapter II of chapter 5, and chapter 7, of title 5. (Land Acquisition Policy Act of 1960, Public Law 86-645, 33 U.S.C. § 597)*

D.21. Notifications to Non-Federal Sponsor

The Non-Federal Sponsor has been made aware of the risks of acquiring real estate interests required for the project prior to the signing of the PPA. In accordance with paragraph 12-31, Chapter 12, ER 405-1-12, Real Estate Handbook, a formal written notice identifying the risks associated with acquiring the LER for the project prior to the full execution of the PPA was provided to the Sponsor, and is attached hereto in **Exhibit C subpart 2**.

The City of Selma is the Non-Federal Sponsor (NFS) for the proposed project. Upon receipt of the formal notice to proceed with acquisition, the NFS has the responsibility to acquire all real estate interests required for the project. The NFS shall accomplish all alterations and relocations of facilities, structures and improvements determined by the government to be necessary for construction of the project.

Title to any acquired real estate will be retained by the NFS and will not be conveyed to the United States Government. The government will require access rights be provided by the NFS for entry to the project. Prior to advertisement of any construction contract, the NFS shall furnish to the government an Authorization for Entry for Construction (**Exhibit E**) to all lands, easements and rights-of-way, as necessary. The NFS will also furnish to the government evidence supporting their legal authority to grant rights-of-way to such lands.

During the acquisition process, the NFS shall comply with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, approved January 2, 1971, and amended by Title IV of the Surface Transportation Uniform Relocation Assistance Act of 1987, Public Law 100-17, effective April 2, 1989, in acquiring real estate interests for the proposed project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said Act(s).

LERRD credit will be determined in accordance with the terms of the PPA, OMB Circular A-87, Chapter 12, ER 405-1-12, and applicable laws and regulations.

D.22. Other Issues

As aforementioned, UXO neutralization site is not yet identified by the PDT, and therefore cannot be expounded upon herein.

D.23. Recommendations:

This report has been prepared in accordance with Paragraph 12-16 of Chapter 12 of the Real Estate Handbook, Corps of Engineers Regulation (ER) 405-1-12. It is recommended that this report be approved.

Karen M. Kennedy
District Chief of Real Estate
Real Estate Contracting Officer
U.S. Army Corps of Engineers, Mobile District

Prepared by:

John J. Tetreau
Realty Specialist
CESAM-RE (Acquisition Branch)

Exhibit D-A


Exhibit A
Streambank Stabilization
Downtown Selma, AL
Preliminary Footprint
To be refined further with
detailed Engineering Design
WATER AVE.
WASHINGTON STREET
BROAD STREET
PROJECT ALIGNMENT
COMPACTED FILL WITH
GEOTEXTILE GRID IN 5' LIFTS
CONCRETE BLOCK RETAINING WALL
TOP ELEV. 110' NAVD88
ALABAMA RIVER
200 ft
N

Exhibit D-B: Parcel Data – Bank Stabilization (Construction area)

PARCEL NO	JURISDICTION	LOCATED WITHIN PLSS LINES	ESTATE	ACRES
1107364002062001	Selma	Sec. 36, T17N, R10E	Bank Protection Easement (NFS-owned)	0.03
1107364002063000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.02
1107364002064000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002066000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002067000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002067001	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002068000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002071000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement (NFS-owned)	0.02
1107364002069000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364002070000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.02
1107364001012000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.02
1107364001013000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.01
1107364001014000	Selma	Sec. 36, T17N, R10E	Bank Protection Easement	0.02
ROW (Washington St)	Selma	Sec. 36, T17N, R10E	Bank Protection Easement / License	0.08

Exhibit D-C: Assessment of NFS RE Acquisition Capability
Subpart 1

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

CESAM-RE-A

31 May 2019

SELMA FLOOD RISK MANAGEMENT STUDY
CITY OF SELMA, ALABAMA

CITY OF SELMA, ALABAMA – NON FEDERAL SPONSOR

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

1. **LEGAL AUTHORITY:**

a. **Does the sponsor have legal authority to acquire and hold title to real property for project purposes?**

Yes. Per Code of Alabama § 11-47-170(a), "Except as otherwise provided in subsection (b), whenever in the judgment of the council, commission, or other governing body of a city or town it may be necessary or expedient for the carrying out and full exercise of any power granted by the applicable provisions of this title or any other applicable provision of law, the town or city shall have full power and authority to acquire by purchase the necessary lands or rights, easements, or interests therein, thereunder, or thereover or, for the purposes for which private property may be acquired by condemnation, may proceed to condemn the same in the manner provided by this article, or by the general laws of this state governing the taking of lands or the acquiring of interests therein for the uses for which private property may be taken, and such proceedings shall be governed in every respect by the general laws of this state pertaining thereto or by the provisions on the subject contained in this article when the same are followed."

b. **Does the sponsor have the power of eminent domain for this project?**

Yes. Code of Alabama §18-1A-1 promulgates Alabama Eminent Domain Code and provides standards for the acquisition of property by condemnors, the conduct of condemnation actions, and the determination of just compensation. It does not confer the power of .

eminent domain, and does not prescribe or restrict the purposes for which or the persons by whom that power may be exercised. Procedures relating to the acquisition of property for public use, a condemnor, when acquiring property, shall comply with applicable provisions of Sections 18-1A-21 through 18-1A-30.

c. Does the sponsor have "quick-take" authority for this project?

No. The State of Alabama does not authorize "quick take" condemnation. An owner shall not be required to surrender possession of property before the condemnor: (1) Pays the agreed purchase price; or (2) Pays, or deposits in accordance with this chapter, the amount awarded by the condemnation order. Except in an emergency, a condemnor may not require a person lawfully occupying property to move from a dwelling, nor to move his business or farm operation, unless he has received written notice from the condemnor at least 90 days before the date by which the move is required.

A condemnation action is commenced by filing a complaint for condemnation with the probate court in the county in which the property or any part thereof sought to be taken is located. (Acts 1985, No. 85-548, p. 802, §402.)

Service of process. (a) On the filing of the complaint, the probate court must enter an order appointing a day for the hearing thereof and must issue to the defendants a copy of the complaint and notice of the day set for the hearing unless such notice is waived. (b) Service upon a defendant of the notice with a copy of the complaint may be made in accordance with Rule 4 of the Alabama Rules of Civil Procedure.

d. Are any of the lands/interests in land required for the project located outside the sponsor's political boundary?

Tentatively Selected Plan has not been finalized as of the date of this assessment. The potential exists that certain project features will extend into State-owned lands or may require acquisition of property within the jurisdiction of the County.

All the beds and bottoms of the rivers, bayous, lagoons, lakes, bays, sounds and inlets within the jurisdiction of the State of Alabama are the property of the State of Alabama to be held in trust for the people thereof. The Alabama Department of Conservation and Natural Resources manages all submerged lands within the State of Alabama including navigable water bottoms, coastal bays and offshore state waters for a distance of three miles.

2

e. **Any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn?**

i. **Private Property:** None identified. Property within unincorporated Dallas County is outside of the jurisdiction of the City of Selma.

ii. **State-Owned Property:** Lands lying within the State rights-of-way including U.S. Highway 80 are outside of the Condemnation authority of the City. As aforementioned, all the beds and bottoms of the rivers, bayous, lagoons, lakes, bays, sounds and inlets within the jurisdiction of the State of Alabama are the property of the State of Alabama to be held in trust for the people thereof. Parcels arising from a tax delinquent status may be outside of the immediate condemnation authority of the Sponsor.

2. **HUMAN RESOURCE REQUIREMENTS:**

a. **Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended?** Yes - the level of P.L. 91-646 familiarity will be contingent on the scope of the recommended plan. The City has not undertaken a major Federally-funded acquisition/relocation effort within the parameters of P.L. 91-646 in a number of years, and would require direction in implementation phase (if project approved and appropriated for construction). Further, the Sponsor has not executed the Real Estate requirements for a USACE project in recent history. If the project entails a minor land acquisition effort, the City may be able to carry out Real Estate obligations by familiarization with Federal policies. If a major land acquisition effort is required, the Sponsor would require intensive training in the provisions of P.L. 91-646. Non-Federal Sponsor Acquisition Guide & Uniform Act Resources from FHWA provided to City, https://www.fhwa.dot.gov/pec/index.cfm?ddisc=100&dsub=1212. Training courses in the provisions of P.L. 91-646 are also available from various private vendors.

b. **If the answer to 2(a) is "yes", has a reasonable plan been developed to provide such training?** No - a path forward for training has not been developed to date inasmuch as a Tentatively Selected Plan has not been finalized.

c. **Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project?**

No, not at this time.

d. **Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule?**

No, not at this time.

3

e. **Can the sponsor obtain contractor support, if required, in a timely fashion?** Per Code of Alabama § 18-4-8, State Agencies are authorized to acquire contractor support to support compliance with Federal programs (namely, P.L. 91-646, 49 CFR Part 24, Uniform Relocation Act). Code of Alabama § 18-4-8 states "In order to prevent unnecessary expense and duplication of functions, and to promote uniform and effective administration of relocation assistance programs for displaced persons, a state agency may enter into contracts with any individual, firm, association, or corporation for service in connection with the programs, or may carry out its functions under this chapter through any federal or state agency or instrumentality having an established organization for conducting relocation assistance programs."

f. **Will the sponsor likely request USACE assistance in acquiring real estate? (If "yes", provide description).** Depending on the degree or scope of recommended plan, USACE can provide assistance, at the request of the Sponsor and at the option of USACE Real Estate Division, provided all fiscal obligations are met as forth in the Project Partnership Agreement (PPA).

3. **OTHER PROJECT VARIABLES:**

a. **Will the sponsor's staff be located within reasonable proximity to the project site?** Yes

b. **Has the sponsor approved the project/real estate schedule milestones *(answer is contingent upon whether the real estate milestones have been defined at this point in the project)*?** To be determined based on anticipated approvals, project approval, appropriations.

4. **OVERALL ASSESSMENT:**

a. **Has the sponsor performed satisfactorily on other USACE projects (if applicable)?** N/A

b. **With regard to this project, the sponsor is anticipated to be: Highly capable; Fully capable; Moderately capable; Marginally capable; Insufficiently capable. (If sponsor is believed to be insufficiently capable, please provide explanation).**

4

5. COORDINATION:

a. **Has this assessment been coordinated with the sponsor?** Yes

b. **Does the sponsor concur with this assessment?**
Yes. This concurrence is not to be considered an obligation for the sponsor to take any action or commit any resources at this time.

Accepted by Non-Federal Sponsor:

Darrio Melton **(Signature)**

Mayor **(Title)**

Prepared by:

(Signature)
RUSSELL W. BLOUNT, III
ACTING CHIEF
TECHNICAL SERVICES BRANCH
REAL ESTATE DIVISION
U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

Reviewed and Approved by:

(Signature)
DERRICK D. MOTON
DEPUTY CHIEF
REAL ESTATE DIVISION
U.S. ARMY CORPS OF ENGINEERS
MOBILE DISTRICT

5

Subpart 2

-----Original Message-----
From: Tetreau, John J CIV USARMY CESAM (USA)
Sent: Wednesday, October 9, 2019 7:50 AM
Subject: RE: Assessment of NFS RE Acq Capability Selma (City of Selma)

Good morning,

We appreciate the City's coordination and endorsement of the Non-Federal Sponsor Real Estate Acquisition Capability checklist, and we concur with assessment, and look forward to discussing with City further after our vertical chain reviews the study recommendations. We should have a countersigned copy returned to you as soon as possible. The City is not expected to acquire any real estate interests at this time. As a matter of fact, it is advisable for the City's interest to not acquire any Real Estate interests until an official Project Partnership Agreement is agreed to and endorsed by the City and USACE, which would be after the study is approved/appropriated and PED phase.

In line with the previous statement, the other document we sent advises the City of the risks of acquiring real estate prior to the joint execution of the Project Partnership Agreement. The City previously signed the risk notification for the Sec. 14 study at the historic Rail Depot back in 2018.

Thanks for all of your assistance,

John J. Tetreau
Realty Specialist
U.S. Army Corps of Engineers, Mobile District Real Estate Division (CESAM-RE)
109 Saint Joseph Street, Rm 7000
Mobile, Alabama 36602

CITY OF SELMA

DARRIO MELTON
MAYOR

October 8, 2019

Attn: USACE-SAM-RE-A
Department of the Army
Mobile District, Corps of Engineers
P.O. Box 2288
Mobile, AL 36628-0001

RE:Selma Flood Risk Management Study
Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability

Dear Sir or Madam:

Enclosed/attached with this letter is the Assessment of Non-Federal Sponsor's Real Estate Acquisition Capability signed by Mayor Darrio Melton on behalf of the City of Selma, Alabama. Please understand that while the City has reviewed the contents of this assessment, it has not agreed or otherwise obligated itself to take any action nor commit any resources to the proposed Flood Risk Management Study at the present time.

Regards,

Darrio Melton
Mayor Darrio Melton

POST OFFICE BOX 450 * 222 BROAD STREET * SELMA, ALABAMA 36702 * PHONE: 334-874-2101 * FAX: 334-874-2402 * WWW.SELMA-AL.GOV

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

USACE-SAM-RE 17 July 2018

City of Selma
Planning Department
ATTN: Mr. Henry Thompson
P.O. Box 450
Selma AL 36702

Subject: Selma Sec. 14 Emergency Bank Stabilization Study – Formal Risk Notification Letter to Non-Federal Sponsor

Dear Mr. Thompson,

The intent of this letter is to formally advise the City of Selma, as non-Federal Sponsor for the proposed project, of the risks associated with land acquisition prior to the execution of a Project Partnership Agreement (PPA) or prior to the Government's formal notice to proceed with acquisition. If a Non-Federal Sponsor deems it necessary to commence acquisition prior to an executed PPA for whatever reason, the Non-Federal Sponsor assumes full and sole responsibility for any and all costs, responsibility, or liability arising out of the acquisition effort.

While we acknowledge that no land acquisition is expected for the subject project based on the latest engineering designs, we are still required by regulation to notify the non-Federal Sponsor of the inherent risks associated with a cost-shared project of this nature.

Generally, these risks include, but may be not be limited to, the following:

(1) Congress may not appropriate funds to construct the proposed project:

(2) The proposed project may otherwise not be funded or approved for construction:

(3) A PPA mutually agreeable to the non-Federal sponsor and the Government may not be executed and implemented;

(4) The non-Federal sponsor may incur liability and expense by virtue of its ownership of contaminated lands, or interests therein, whether such liability should arise out of local, state, or Federal laws or regulations including liability arising out of CERCLA, as amended;

1

(5) The non-Federal sponsor may acquire interests or estates that are later determined by the Government to be inappropriate, insufficient, or otherwise not required for the project;

(6) The non-Federal sponsor may initially acquire insufficient or excessive real property acreage which may result in additional negotiations and/or benefit payments under P.L. 91-646 as well as the payment of additional fair market value to affected landowners which could have been avoided by delaying acquisition until after PPA execution and the Government's notice to commence acquisition and performance of Lands, Easements, Rights-of-way, Relocations, Disposal Areas and/or Borrow Areas (LERRD);

(7) The non-Federal sponsor may incur costs or expenses in connection with its decision to acquire or perform LERRD in advance of the executed PPA and the Government's notice to proceed which may not be creditable under the provisions of Public Law 99-662 or the PCA. Reference ER 405-1-12 (Change 31; 1 May 98) Section 12-31 Acquisition Prior to PCA Execution.

Please acknowledge that the Non-Federal Sponsor for the proposed project accepts these terms and conditions.

Accepted on behalf of the Non-Federal Sponsor:

Darrio Melton (Signature)

mayor (Title)

Prepared by:

Russell W. Blount III
Section Chief
Acquisition Branch
Real Estate Division
Mobile District
U.S. Army Corps of Engineers

2

Exhibit D-D: Baseline Cost Estimate for Real Estate (BCERE)

Baseline Cost Estimate for Real Estate (BCERE)
Selma, AL Flood Risk Management Study
City of Selma, Dallas County, Alabama
Exhibit D

	#	$/per	Req
0102------ ACQUISITIONS			
010201--- By Government			
010202--- By Non-Federal Sponsor (NFS)			
01020201 Survey and Legal Descriptions	14	500	7,000
01020102 Title Evidence	14	1,000	14,000
01020203 Negotiations	14	1,500	21,000
010203--- By Government on Behalf of NFS			
010204--- Review of NFS			
0103------ CONDEMNATIONS			
010301--- By Government			
010302--- By Non-Federal Sponsor (NFS)	7	15,000	210000
010303--- By Government on Behalf of NFS			
010304--- Review of NFS			21,000
0105------ APPRAISALS			
010501--- By Government			
010502--- By Non-Federal Sponsor (NFS)	14	1,500	21,000
010503--- By Government on Behalf of NFS			
010504--- Review of NFS	14	500	7000
0106------ PL 91-646 ASSISTANCE			
010601--- By Government			

010602---	By Non-Federal Sponsor (NFS)		
010603---	By Government on Behalf of NFS		
010604---	Review of NFS		
0107------	**TEMPORARY PERMITS/LICENSES/RIGHTS-OF-WAY**		
	SUBTOTAL		301000
	CONTINGENCY 15%		45150
	TOTAL - ADMINISTRATIVE COSTS		346150
0115------	**REAL ESTATE PAYMENTS**		
011501---	Land Payments		
01150101	By Government		
01150102	By Non-Federal Sponsor (NFS)	14	7,227
01150103	By Government on Behalf of NFS		
01150104	Review of NFS (credit review)		20000
011502---	PL 91-646 Assistance Payments		
01150201	By Government		
01150202	By Non-Federal Sponsor (NFS)		
01150203	By Government on Behalf of NFS		
01150204	Review of NFS (credit review)		
011503---	Damage Payments		
01150301	By Government		
01150302	By Non-Federal Sponsor (NFS)		
01150303	By Government on Behalf of NFS		
01150304	Review of NFS		

SUBTOTAL		27227
	CONTINGENCY (15%)	4084
	TOTAL - REAL ESTATE PAYMENTS	31311

Account 02 Facility/Utility Relocations (Construction cost only) 0

TOTAL LERRD	**$377,461**
	$380,000 (ROUNDED)

Exhibit D-E: Authorization for Entry for Construction and Attorney's Certificate of Authority

Exhibit E

AUTHORIZATION FOR ENTRY FOR CONSTRUCTION AND ATTORNEY'S CERTIFICATE OF AUTHORITY

I, *(name of accountable official)* , _____*(title)*_____________ for *(name of non-Federal sponsor)*___, do hereby certify that the *(name of non-Federal sponsor)* has acquired the real property interests required by the Department of the Army, and otherwise is vested with sufficient title and interest in lands to support construction of *(project name, specifically identified project features, etc.)* . Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon *(identify tracts)* to construct *(project name, specifically identified project features, etc.)* as set forth in the plans and specifications held in the U. S. Army Corps Engineers' Mobile District Office, Mobile, Alabama.

WITNESS my signature as _____*(title)*_ for _*(name of non-Federal sponsor)*
this ________ day of ________________, 20___.

BY: ______*(name)*______________________________

______*(title)*______________________________

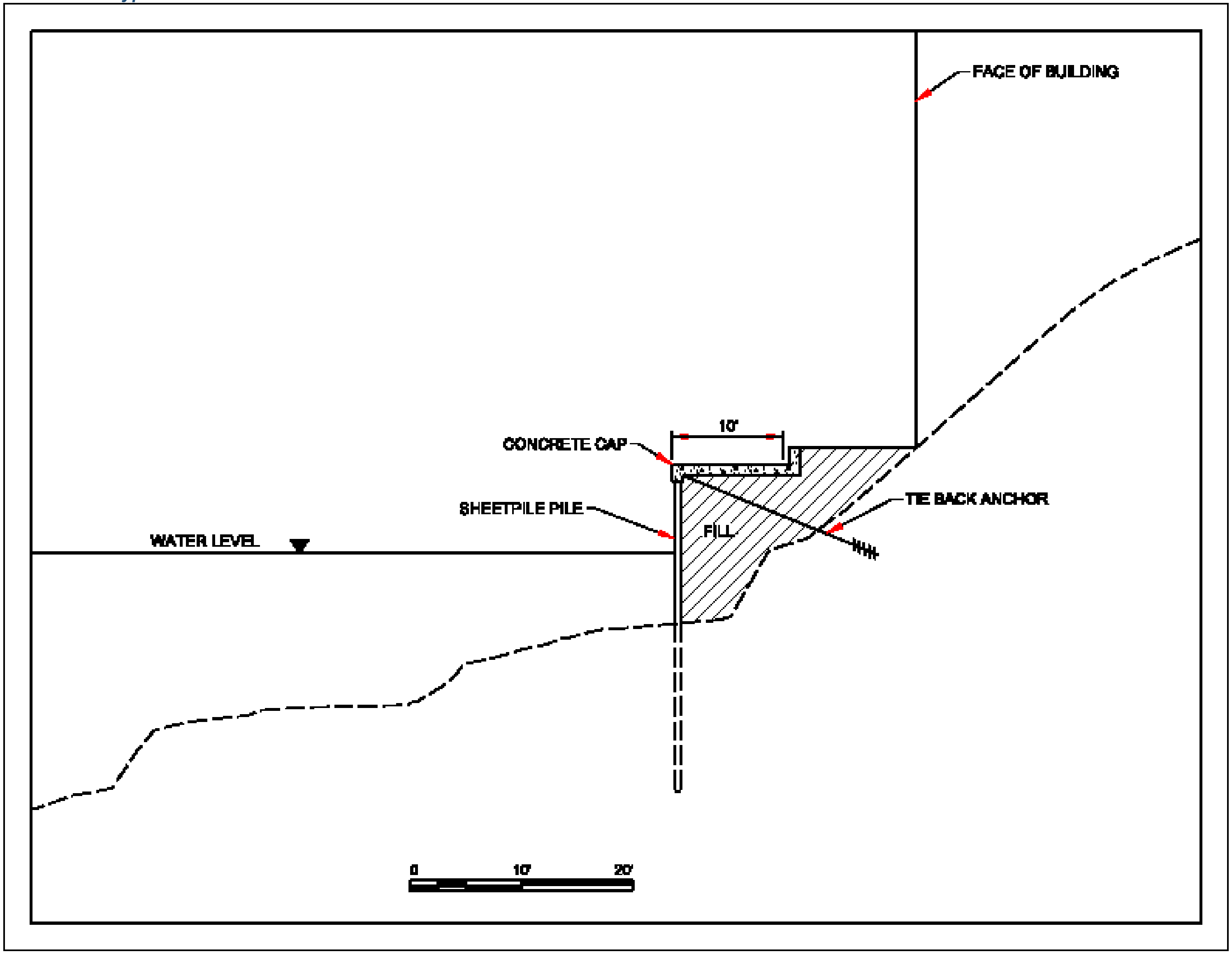
I, ____*(name)*_________________ , ____*(title of legal officer)*____ for *(name of non-Federal sponsor)*______, certify that __*(name of non-Federal sponsor)*_____ has authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

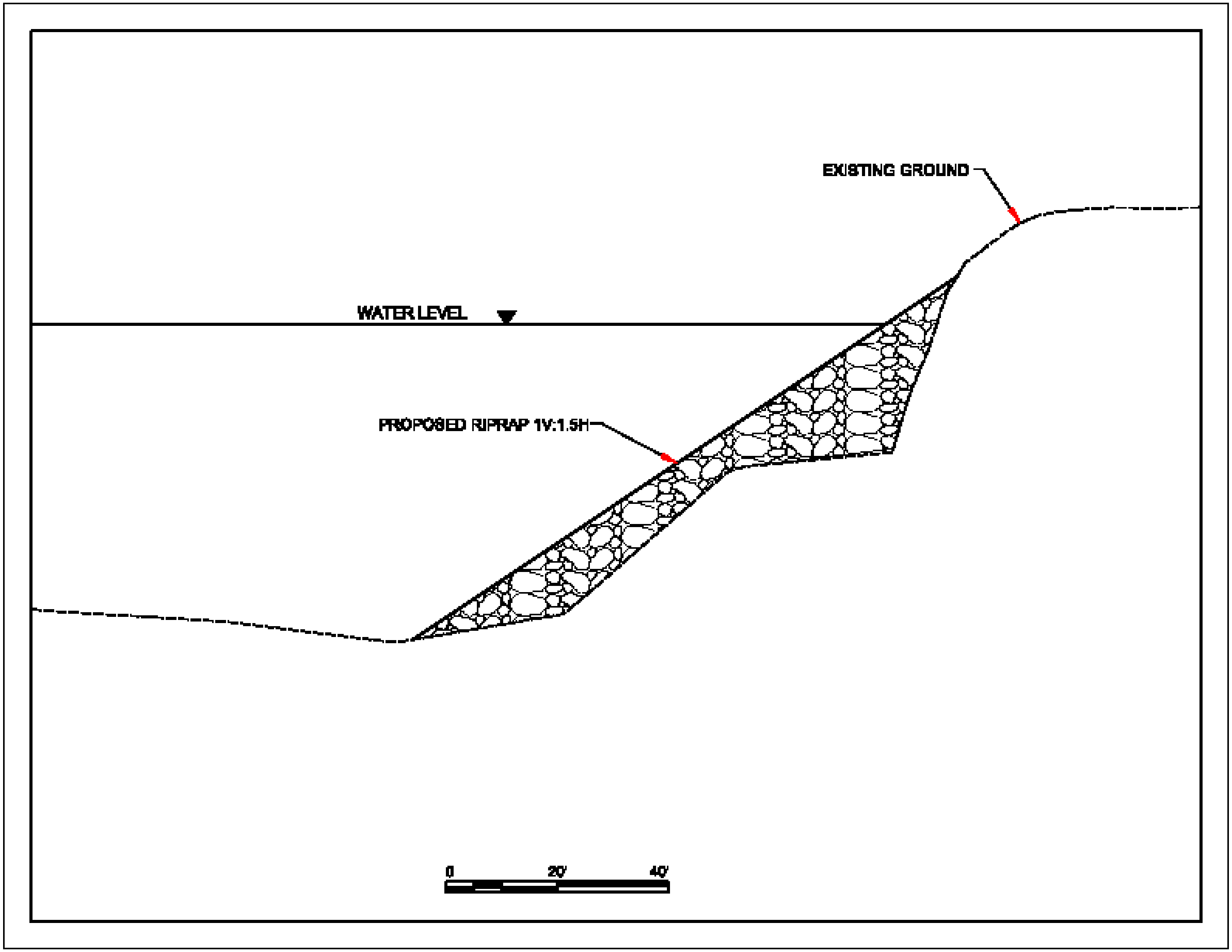
WITNESS my signature as ________*(title)*_____ for ___*(name of non-Federal sponsor)*, this _________day of_________________, 20__.

BY: ______*(name)*______________________________

______*(title)*______________________________

Exhibit D-F: Typical Cross Sections for Streambank Stabilization Feature




EXISTING GROUND
WATER LEVEL
PROPOSED RIPRAP 1V:1.5H
0
20'
40'

Selma, Alabama

Flood Risk Management Study
Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX E

US Army Corps
of Engineers
Mobile District

September 16, 2020

APPENDIX-E: System of Accounts

Table of Contents

List of Figures

List of Tables

E.1. Introduction

This system of accounts appendix documents the analysis of the National Economic Development (NED), Environmental Quality (EQ), Other Social Effects (OSE), and Regional Economic Development (RED) accounts as established in the 1983 Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. Based on the results of this analysis, USACE, Mobile District requested an exception to the standard identified in the P&G, specifically that the selected plan should have "…the greatest net economic benefit (the NED Plan) consistent with protecting the Nation's environment, unless the Secretary… grants an exception to this rule." This exception was granted in a Memorandum for Record (MFR) from the Assistant Secretary of the Army (Civil Works) (ASA(CW)) to HQ USACE dated June 10, 2020. The unique nationally historically significant landscape, the socially vulnerable population, and the vital regional and national tourism industry of the study area warranted an in-depth analysis of the OSE and RED accounts. This more robust system of accounts analysis then produced a least cost analysis further evaluated under the NED account.

E.1.1. References

Economic and Environmental Principles and Guidelines for Water and Related

Land Resources Implementation Studies, March 1983.

Engineering Regulation 1105-2-100: Planning Guidance Notebook, April 2000.

Memorandum for Major Subordinate Commands and Districts, Subject: Further

Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works, 21 June 2017.

Director's Policy Memorandum Civil Works Program 2018-05, Subject:

Improving Efficiency and Effectiveness in USACE Civil Works Project Delivery (Planning Phase and Planning Activities), 3 May 2018.

Institute for Water Resources Report 2013-R-02, Other Social Effects: A Primer, April 2013.

Institute for Water Resources Report 2013-R-03, Applying Other Social Effects in Alternatives Analysis, April 2013.

Institute for Water Resources Report 2009-R-4, Handbook on Applying "Other

Social Effects" Factors in Corps of Engineers Water Resources Planning, December 2009.

Institute for Water Resources (IWR) Report 2011-RPT-01, Regional Economic

Development Procedures Handbook, March 2011.

Memorandum For Commander South Atlantic Division, Subject: Approval for the Selma, Alabama, Flood Risk Management Study, National

Economic Development (NED) Exception Request, July 16, 2020

E.2. National Economic Development

E.2.1. Methodology

In order to develop plans to address water resource problems within a study area, three conditions must be fully analyzed: the "existing" condition, the "future without project" condition, and the "future with project" condition.

In this analysis, the existing condition represents current floodplain conditions, which are in fiscal year 2019 development and price levels. The future without project condition is the condition that would likely exist in the future without the implementation of a Federal project. This condition is evaluated for a 50-year period for urban flood control projects, and the results are expressed in terms of expected annual damages. For this study, the future without project condition begins approximately in year 2024. The future with project condition is the condition that would likely exist in the future with the implementation of a Federal project using the same 50-year period as in the future without project condition.

The difference in expected annual flood damages to the floodplain properties between the future without and with project conditions represents the flood damage reduction benefits to the project. Other economic and other significant outputs may accrue to the project as well, including recreation benefits, ecosystem restoration benefits, regional economic benefits, and other social effects. Other social effects, which often defy quantification in monetary terms, range from improvement in the quality of life within the study area to community impacts. This analysis attempts to recognize and, where possible, quantify all of the outputs of a Federal project in the study area.

E.2.1.1. *Least Cost Analysis*

In the Selma, Alabama, FRM Study, an NED Exception Request (June 16, 2020), was granted to allow for a formulation analysis and evaluation of an erosion control measure using Section 14 methodology of the Flood Control Act of 1946 guidelines. This methodology calls for formulation and evaluation of an alternative using the least cost approach. The plan is justified if the total cost of the proposed alternative is less than the costs to relocate the threatened structures.

In the case of the Selma FRM study, the proposed control measure that reduces flood induced erosion is a Soldier-Pile Wall with approximate length of 750 ft with rip rap end caps and seeks to stabilize a portion of the northern bank of the Alabama River in Selma, Alabama. The 11 structures currently assessed under this analysis along this bank are nationally registered properties and part of the Water Avenue and Civil Rights Historic

Districts. These structures compose the viewshed of the National Historic Landmark, the Edmund Pettus Bridge. Although the market value of these 11 structures is approximately $5.4 million, the historic and regional economic value of these structures and what they represent for not only the city of Selma but for the nation and the local economy cannot be overstated. The structures are the viewshed of the Edmund Pettus Bridge, one of the most recognizable Civil Rights sites in the United States and comprise the tourism hub of Selma, Alabama. Loss of these structures would be detrimental to Selma's economy and the negative economic impacts would reverberate significantly in Civil Rights tourism throughout the region of central Alabama (this is investigated more in the RED analysis).

Many of the threatened structures were constructed during the late 1800s or early 1900s making relocation exorbitantly expensive, if not impossible. Adding to the difficult nature of replacement cost is the fact that these structures were built on the edge of the bank, implying relocation would have to be carefully conducted brick by brick (i.e. deconstruction and then reconstruction). Taking these factors into account brings potential relocation costs to approximately $132.0 million[1]. This relocation effort would also reduce the historic integrity of these structures, making them ineligible for listing on the National Register of Historic Places, in addition to irrevocably altering the viewshed for the Edmund Pettus Bridge. **Table E-1** outlines the least cost alternative method using the Section 14 methodology in which the cost analysis utilized the relocation cost as a base comparison.

Table E-1: Bank Stabilization Least Cost Analysis

Alternative	Construction Costs	O&M Costs	Average Annual Cost
Relocation (base cost)	$132,000,000	$0	Not evaluated
Soldier-Pile Wall	$27,537,000	$4,000	$1,059,000

E.2.1.2. *Assumptions/Risk/Uncertainty*

This section of the analysis presents the assumptions/risks used in analyzing the least coat approach for the study area:

1) All project alternatives are evaluated for a 50-year period of analysis.
2) The project construction is scheduled to begin in 2024.
3) Cost are based on best professional judgement.

E.2.2. Existing Condition

It has been demonstrated through geotechnical analysis that structures along bank are under direct threat from severe erosion and sloughing. Additional structural analysis has

[1] Approximated costs are based on best professional engineering judgment.

also determined that relocation of these structures would be difficult, if not impossible, comprising the structural and historical integrity of the structures.

E.2.3. Future Without Project Condition

The years 2024-2074 were selected to represent the future without project condition. No additional development within the 1% annual chance exceedance floodplain of the study area is anticipated since the floodplain is essentially fully developed now and since the study area is a participant in the Federal Flood Insurance Program. The structures lying in the floodplain will continue to be affected by the risk of flooding and suffer increasing losses each year. Most of the structures in the study area are located outside the future without 10% annual chance exceedance floodplain and it is not until 4% annual chance exceedance floodplain that there are some structures located within the extent of the floodplain.

Furthermore, in the future without project condition, Water Avenue and the structures that sit along the bank of the Alabama River would continue to experience structural/foundation damages that would lead to higher maintenance costs for the city and private owners and present a life and safety risk to the public over time as the erosional conditions continue to compromise the structural integrity of the infrastructure. The employees, residents, and visitors to the historic structures along the riverbank, are exposed to life and safety threats associated with potential bankline failure, caused by repetitive flooding and increased instability of substrates.

Due to the construction method and historic nature of the structures along the bank, it would be extremely difficult and costly to relocate. Moreover, additional development within the drainage region, but at elevations beyond the 1% annual chance exceedance, is possible. The development, consisting of a variety of commercial, industrial, and residential construction, will contribute to an increase in the land area impervious to storm water runoff. This in turn will lead to slightly higher stream inflows at any given event and somewhat higher stages at the various flood frequencies as shown in the table below. Table E-2 and Table E-3display future without project condition water surface profiles at the index location for each study area reach and single event damages without uncertainty for the study area.

Figure E-1: Water Avenue along the Alabama River, Selma, Alabama. Historic structures along the riverbank.

Table E-2: Future Without Project Condition Water Surface Profiles

Reach	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002
Selma	105.81	111.58	114.49	116.94	119.24	120.73	122.22	124.41

Table E-3: Future Without Project Condition Single Event Damages (x1,000, 2019 Prices)

Event	0.5	0.2	0.1	0.04	0.02	0.01	0.005	0.002
Total	$0	$0.082	$0.519	$3,989	$20,686	$35,354	$54,621	$95,848

The result is an increase in the expected annual damages for the future, meaning that the losses suffered by the affected structures will increase between 2024 and 2074. As shown in the table, the single event damages reflect the fact that it is not until the 4% annual chance exceedance and greater event that structures really begin to get flood damages. Like that of the existing condition, the HEC-FDA used Monte Carlo simulation to sample from the stage-probability curve with uncertainty. For each of the iterations within the simulation, stages were simultaneously selected for the entire range of probability events. The sum of all damage values divided by the number of iterations run by the model yielded the expected value, or mean damage value, with confidence bands for each probability event. The probability-damage relationships are integrated by weighting the damages corresponding to each magnitude of flooding (stage) by the percentage chance of exceedance (probability). From these weighted damages, the model determined the expected annual damages (EAD) with confidence bands (uncertainty). For the "without project" condition, the expected annual damages (EAD) were totaled for each study area reach to obtain the total without project EAD under future (2024 and 2074) conditions as shown in **Table E-4** and **Table E-5**.

Table E-4: Future Without Project Condition for Base Year 2024 (x1,000, 2019 Prices)

Reaches	Residential	Nonresidential	Total
Selma	$831	$920	$1,751

Table E-5: Future Without Project Condition for Future Year 2074 (x1,000, 2019 Prices)

Reaches	Residential	Nonresidential	Total
Selma	$960	$1,054	$2,014

Moreover, damages for each of the years during the period of analysis were computed by linear interpolation between 2024 and 2074. The FY 2020 Federal discount rate of 2.75% was used to compound the stream of expected annual damages and benefits before the project base year and to discount the stream of expected annual damages and benefits occurring after the base year to calculate the total present value of the damages over the period of analysis. The present value of the expected annual damages was then amortized over the 50-year period of analysis using the Federal discount rate to calculate the equivalent annual damages. The results are shown in **Table E-6**.

Table E-6: Future Without Project Equivalent Annual Damages in the Selma Reach (x $1,000, 2019 Prices)

Damages	Amount
Residential	$880
Nonresidential	$970
Total	$1,850

The forecasted higher stages in the future, without a project in place, resulted in higher damages. According to the table above, the total future "without project" equivalent annual damages are approximately $1.85 million. This figure represents the maximum possible annual benefits accruable to a flood damage reduction project at Selma (i.e. with project condition). The forecast of the future without project condition reflects the conditions expected during the period of analysis and provides the basis from which alternative plans are evaluated, compared, and selected since a portion of the flood damages would be prevented (i.e. flood damages reduced) with a Federal project in place.

E.2.4. Comparison of Alternatives

A total of ten alternatives were considered for the Selma Flood Risk Management Study. Of these, three were structural, one was nonstructural, and the remaining seven were combinations of structural plans with the nonstructural plan. The nonstructural plan did not include a recreation plan. A description of the alternatives are listed in the table below.

E.2.4.1. *Evaluation of Alternative Plans*

Relevant data for each of the alternatives described above were entered into the HEC-FDA and potential for flood damages reduced were calculated. The modeling results for each alternative are summarized in **Sections E.2.4.1.1** thru **E.2.4.1.4**:

E.2.4.1.1. *Alternative 1*

Alternative 1 was a nonstructural solution that entailed a buyout of structures. This plan provides for permanent evacuation and demolition of floodplain structures. Grouping for those structures identified as candidates for buyouts considered vulnerability to flood risk, location within the 1% annual chance exceedance floodplain extent, depths of flooding, and community cohesion (reference Plan Formulation section of Main Report for more details). The buyout included 3 options depending on the amount structures: Buyout 1 was the buyout of about 300 parcels, Buyout 2 was the buyout of about 157 parcels, and Buyout 3 was the buyout of about 31 parcels.

Alternative 1 did not produce any reductions in water surface elevations because structures that were identified as candidates for a buyout were removed from the structure inventory. Therefore, in the model, the only difference is in the structure inventory for future with and without project conditions. The water surface elevations used in the modeling of this alternative stayed the same. A summary of the residual flood damages and flood damage reductions are shown in **Table E-7**, **Table E-8**, and **Table E-9**.

Table E-7: Alternative 1, Buyout 1 – Equivalent Annual Damages in the Selma Reach (x $1,000, 2019 Prices)

Category	Damages	Reduced	Residual
Residential	$477	$403	54%
Nonresidential	$878	$92	91%
Total	**$1,355**	**$495**	**73%**

Table E-8: Alternative 1, Buyout 2, Equivalent Annual Damages in Selma Reach (x $1,000, 2019 Prices)

Category	Damages	Reduced	Residual
Residential	$595	$285	68%
Nonresidential	$888	$82	92%
Total	**$1,483**	**$367**	**80%**

Table E-9: Alternative 1, Buyout 3, Equivalent Annual Damages in Selma Reach (x $1,000, 2019 Prices)

Category	Damages	Reduced	Residual
Residential	$792	$88	90%
Nonresidential	$947	$23	98%
Total	**$1,739**	**$111**	**94%**

In Selma, damages reduced were reflective of those structures removed from the floodplain. Since Alternative 1 is a nonstructural plan, the benefits can be evaluated using an alternative land use approach. In this approach, the candidate structures for buyouts are removed, and the land can no longer be used for urban development. An alternative land use can then be implemented such as recreation. However, the nonstructural plan did not include a recreation plan. Recreation was not considered for the buyout alternative because any propose recreational activities for the evacuated floodplain would be one of low quality passive recreation such as running, walking, and picnicking. In addition, there exist many parks in the Selma area such as Historic Riverfront Park, Phoenix Park, Lafayette Park, and Bloch Park that offer such passive recreation. Moreover, the city itself is and has experience a decline in population and has limited funds available to maintain recreational areas. Furthermore, there would be a lack of access to the areas proposed within the buyout area because of its location. The proposed buyouts area not located in the historic district nor would it offered any visitors the historical viewshed that is distinct to Selma.

E.2.4.1.2. *Alternative 2*

Alternative 2 was a minimum levee located in Ward 8 of Selma. This minimum levee alignment as modeled would reduce the majority of flooding risk in Ward 8. Therefore, the idea was that any other alignment would only be additional costs and not reduce any further flood damages. A summary of the residual flood damages and flood damage reductions are shown in **Table E-10**.

Table E-10: Alternative 1, Buyout 3, Equivalent Annual Damages (x $1,000, 2019 Prices)

Category	Damages	Reduced	Residual
Residential	$694	$186	79%
Nonresidential	$795	$175	82%
Total	**$1,489**	**$361**	**80%**

Alternative 2 reduced water surface elevation in the proposed levee area up to a level equivalent to the 1% annual chance exceedance event. However, it was shown, by modeling, to induce flooding to structures upstream, downstream, and in areas located directly opposite the levee across the Alabama River (reference Engineering Appendix for more details). These areas across from the levee included the town of Selmont, Alabama. Moreover, it was determined that in order to mitigate for this induced flooding another levee would be needed in Selmont. Therefore, Alternative 2 was screened out because it did not meet the planning constraint of avoiding induced flooding and mitigation for the levee would be of great costs. Since Alternative 2 was screened out, Alternatives that included a levee were also removed from further analysis (i.e. Alternatives 3, 6, 7, 8, 9, and 10).

E.2.4.1.3. *Alternative 4*

Alternative 4 provides bank stabilization along all or part of River mile 256-261, Selma's historic riverfront, where historic structures adjacent to the Edmund Pettus Bridge are located. The bank stabilization included 4 options depending on the construction method:

Option 1 was sheet pile wall, Option 2 was rip rap, Option 3 was cast in place, and Option 4 was soldier pile wall. The majority of benefits for from an FRM study using the HEC-FDA model largely accrue from inundation reduction benefits which are considered NED benefits. The HEC-FDA Model, using depth damage functions, does not capture physical damages attributable to inundation of foundations for structures sitting on a bluff, as is the case for Selma's historic riverfront. ER 1105 -2-100 defines physical damages as:

"Physical damages. Physical damages occur to residential, commercial, industrial, institutional, and public property. Damages occur to buildings, contents, automobiles, and outside property and landscaping. Physical damages include the costs to repair roads, bridges, sewers, power lines, and other infrastructure components. Physical damages also include the direct costs and the value of uncompensated hours for cleanup after the flood." (USACE, 2000, pg.3-15)

Therefore, residual flood damages and flood damage reductions could not be derived for Alternative 4.

In the case of Selma's historic riverfront, the riverbank and foundation are being inundated up to elevation of about 120 feet during a moderate flood. The historic structures' foundations and soils are being inundated while their first floor elevations are not. As the flood water recedes, shear failures occur to the foundations (reference Engineer Appendix for more details). These shear failures threaten the structural integrity of these historic structures resulting in damages and also introduce life-safety risk to the structures' visitors and occupants.

Benefits for Alternative 4 could consider the value of the loss of the historic structures, visitation, and business along the riverbank (reference RED section of this Appendix). These historical site's structures have an estimate depreciated replacement cost of about $3.5 million and could be loss over time. Several structures at this location of riverbank have been demolished due to the resulting instability of its foundation.

Another alternative to estimate benefits for Alternative 4 would be to consider the cost of relocating these historic structures. The assumption is given the 50-year period analysis, over time, erosional condition would continue to a point where the structures are threatened and need to be demolished or relocated. The cost of relocating these threatened historic structures would be very costly assuming this can be done without compromising the structural integrity. It was estimated that the cost to relocate these could have a first cost between $100 to $150 million. However, for this analysis because inundation reduction benefits could not be determined, no NED benefits were evaluated for Alternative 4.

E.2.4.1.4. *Alternative 5*

Alternative 5 combines Alternatives 1 and 4 which are buyouts and provides bank stabilization of Selma's historic riverfront. Since NED benefits could not be derived for

Alternative 4, the summary of the residual flood damages and flood damage reductions for Alternative 5 would be the same as what is shown for Alternative 1.

Table E-11: Final Array Comparison of Benefits and Costs

Alternative	Average Annual Benefits	Average Annual Costs	First Cost	Net Benefits	Benefit-to-Cost Ratio
1.A	$111,000	$187,000	$4,950,000	($76,000)	0.59
3	$361,000	$2,924,000	$74,040,000	($2,563,000)	0.12
4	$4,759,000-$36,000	$1,059,000	$27,457,000	$3,700,000-($1,023,000)	4.50-0.03
5	$4,870,000-$147,000	$1,246,000	$32,400,000	$3,624,000-($1,099,000)	3.91-0.12
6	$5,120,000-$397,000	$4,104,000	$104,860,000	$1,016,000-($3,707,000)	1.25-0.1

E.2.5. Future With TSP Conditions

E.2.5.1. Rough Order of Magnitude (ROM) Costs

Continuing the evaluation process, preliminary ROM first cost estimates were developed for each of the alternatives that were evaluated. These preliminary ROM costs were provided by Mobile District's Cost Engineering Section and Real Estate Division in 2019 price levels. For comparison to the benefits, which are average annual flood damages reduced, these preliminary first costs were stated in average annual terms using the FY20 discount rate of 2.75% and a 50-year period of analysis. Interest during construction was not included nor was the annual operation and maintenance included for these preliminary first costs. The estimated ROM first cost as well as the average annual cost are shown in **Table E-11**.

Table E-12: Project Alternative Costs

Alternative	First Cost	Average Annual Cost
1 (Buyout 1)	$28,000,000	$1,037,146
1 (Buyout 2)	$16,000,000	$592,655
1 (Buyout 3)	$4,000,000	$148,164
4 (Pile)	$31,450,000	$1,164,937
4 (Rip Rap)	$19,640,000	$727,484

It is important to note that Alternative 1 costs, for all 3 options, were based solely on real estate cost estimates which included buyout of structures and relocation assistance. Engineering costs were not included such as demolition for Alternative 1. The assumption was buyouts options within Alternative 1 could still be compared and as costs are refined further for the tentatively selected plan, any added costs would be proportion to the amount of structures. Moreover, costs for Alternative 4 was presented as a range because Alternative 4 would be either pile, rip rap, or some components of both; therefore, the cost for this alternative would be in the range presented in the above table (i.e. the costs between pile and rip rap).

E.2.5.2. *Comparison of Benefits to Costs*

The equivalent annual benefits were then compared to the average annual cost to develop net benefits and a benefit-to-cost ratio (BCR) for each alternative. The net benefits for each alternative were calculated by subtracting the average annual costs from the equivalent average annual benefits, and a BCR was derived by dividing average benefits by average annual costs. Net benefits were used for identification of the NED plan in accordance with the Federal objective. For comparative purposes, **Table E-12** summarizes the equivalent annual damages (benefits), average annual costs, first cost, net benefits, and BCR for each alternative.

Table E-13: Comparison of Benefits and Costs

Alternative	Average Annual Benefits	Average Annual Costs	First Cost	Net Benefits	Benefit-to-Cost Ratio
1 (Buyout 1)	$495,000	$1,037,146	$28,000,000	($542,146)	0.48
1 (Buyout 2)	$367,000	$592,655	$16,000,000	($225,655)	0.62
1 (Buyout 3)	$111,000	$148,164	$4,000,000	($37,164)	0.75
3 (Pile)	N/A	$1,164,937	$31,450,000	N/A	N/A
3 (Rip Rap)	N/A	$727,484	$19,640,000	N/A	N/A

As a result of the comparison of the alternatives, no alternatives could be identified as the NED Plan in accordance with the Federal objective. No alternative plan had positive net benefits; therefore, all alternatives were determined to have benefit-to-cost ratio of less 1 and would not yield an economically justified project. Based on the results of this analysis, Mobile District is requesting an exception to the standard identified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, specifically that the selected plan should have "…the greatest net economic benefit (the NED Plan) consistent with protecting the Nation's environment, unless the Secretary… grants an exception to this rule."

E.2.5.3. *Recommended Tentatively Selected Plan*

The tentatively selected plans (TSP) identified for this study is Alternative 4: Bank Stabilization (Soldier Pile Wall and Rip Rap). For more information regarding this plan selection, reference Plan Formulation section of the Main Report. The first costs estimated for the TSP were stated in average annual terms using the FY20 discount rate of 2.75% and a 50-year period of analysis. Interest during construction and annual operation and maintenance (O&M) costs were also included. **Table E-14** summarizes the equivalent annual damages (benefits), average annual costs, first cost, net benefits, and BCR for the TSP.

Table E-14: TSP Benefits and Costs Comparison ($000) using December 2019 Price Levels

TSP	Bank Stabilization	Buyout	Bank Stabilization and Buyout
Project First Cost	$21,408	$5,800	$27,208
Interest During Construction	$441	$160	$601
Average Annual First Cost	$809	$220	$1,030
Annual O&M Cost	$8	$0	$8
Average Annualized Costs	$817	$221	$1,038
Average Annualized Benefits	N/A	$111	$111
Net Benefits	N/A	($110)	($927)
BCR	N/A	0.5	0.1

E.3. Environmental Quality

E.3.1. Methodology

For the Environmental Quality assessment, the team assessed a number of environmental factors and evaluated the impacts (beneficial, adverse, or no change) of each alternative based on modeling, background research, and best professional judgment. Although there are dozens of elements that compose the environment of the study area, the EQ analysis address the eight that were determine to undergo significant change whether in the FWOP condition or one of the proposed alternatives. These included Geology, Hydrology, Hazardous, Toxic, and Radiological Waste (HTRW), Fish and Wildlife Resources, Wetlands, Endangered Species, Cultural and Historic Preservation, and Aesthetics. Direct and indirect impacts to each of these factors are addressed.

E.3.2. Existing Condition

Existing Conditions for all factors are further explained in their respective report sections and associated appendices. To summarize the potential impacted environment of the study area, Selma, Alabama is a river town, adjacent to the Alabama River, and prone to high water events. The geology of the area is unique, consisting primarily of Mooreville Chalk. The area consists of a large number of historic residential and commercial structures, in addition to several industrial sites, increasing the likelihood of occurrence of HTRW materials. Alabama consists of a large number of diverse species and habitats and Selma is no exception. Included in the study area are a number of federally protected and endangered species. Wetlands are not extremely prevalent throughout the study area but any impacts to existing wetlands can be detrimental to the existing habitats. Selma is a significant historic area with the largest number of historic properties in the state of Alabama. These historic properties, coupled with the significance of several historic events that have occurred in the study area, play a large part into the aesthetics of the area.

E.3.3. Future Without Project Condition

It was determined through modeling, research, and best professional judgment that a number of factors, including frequent high-water events, contribute to soil saturation and erosion, particularly along the northern bank line and this sloughing and erosion phenomenon would continue. Although the area is prone to frequent high-water events, these events occur slowly, with minimal flooding depths and therefore inundation impacts are minimal throughout the study area. The erosion and sloughing directly threaten the historic structures along the northern bank, resulting in their demolition, condemnation, and loss of structural and historic integrity. These structures contribute greatly to the aesthetics of the Selma riverfront, a major draw for recreation and tourism in the area, thus their loss would significantly impact the environment and socioeconomics of the area.

E.3.4. Comparison of Alternatives

Table E-15: Summary of Environmental Impacts of the Final Array of Alternatives

Resources	No Action (FWOP)	Alternative 1.A Buyouts	Alternative 3 (Optimized Levee)	Alternative 4 (Soldier-Pile Wall)	Alternative 5 (Alt 1.A+4)	Alternative 6 (Combination)
Hydrology	not significant	not significant	adverse	not significant	not significant	adverse
Water Quality	slight adverse	not significant	slight adverse	not significant	not significant	slight adverse
Geology and Soils	slight adverse	slight adverse	slight adverse	not significant	not significant	slight adverse
Prime and Unique Farmlands	not significant	not significant	slight adverse	not significant	not significant	slight adverse

Resources	No Action (FWOP)	Alternative 1.A Buyouts	Alternative 3 (Optimized Levee)	Alternative 4 (Soldier-Pile Wall)	Alternative 5 (Alt 1.A+4)	Alternative 6 (Combination)
Climate	not significant	not significant	not significant	not significant	not significant	not significant
Air Quality and Greenhouse Gasses	not significant	not significant	not significant	not significant	not significant	not significant
HTRW	not significant	not significant	not significant	benefit	benefit	benefit
Vegetation	not significant	slight benefit	slight adverse	not significant	slight benefit	not significant
Aquatic Species	slight adverse	not significant	not significant	not significant	slight benefit	slight benefit
Terrestrial Species	not significant	slight benefit	adverse	not significant	slight benefit	adverse
T&E Species and Critical Habitat	not significant	slight benefit	slight adverse	Likely to adversely affect	adverse	adverse
Wetlands	not significant	slight benefit	adverse	not significant	not significant	adverse
Migratory Birds	not significant	not significant	not significant	slight adverse	slight adverse	slight adverse
Bald and Golden Eagles	not significant	not significant	not significant	not significant	not significant	not significant
Architectural	adverse	slight adverse	slight adverse	benefit	slight adverse	slight adverse
Cultural and Archaeological Resources	adverse	slight adverse	slight adverse	slight adverse	slight adverse	slight adverse
Land Use	adverse	not significant	not significant	beneficial	slight benefit	slight benefit
Noise	not significant	not significant	not significant	not significant	not significant	not significant
Aesthetics	adverse	adverse	adverse	benefit	benefit	slight adverse
Recreation	adverse	adverse	adverse	benefit	benefit	slight benefit

Resources	No Action (FWOP)	Alternative 1.A Buyouts	Alternative 3 (Optimized Levee)	Alternative 4 (Soldier-Pile Wall)	Alternative 5 (Alt 1.A+4)	Alternative 6 (Combination)
Industry	adverse	adverse	adverse	benefit	benefit	slight benefit
Demographics	not significant	adverse	adverse	benefit	not significant	adverse
Public Safety	adverse	not significant	slight adverse	beneficial	slight benefit	slight adverse
Traffic and Navigation	not significant	not significant	adverse	slight benefit	slight benefit	slight adverse

E.3.5. Future With TSP Condition

The Environmental Quality analysis shows no significant impacts with the future with TSP conditions, with potential to adversely impact T&E species, migratory birds, and cultural resources. These impacts can be mitigated. Overall, impacts to environmental factors are mostly beneficial.

E.4. Other Social Effects

E.4.1. Methodology

An Other Social Effects (OSE) Analysis was conducted to assess the impacts to existing social factors in the study area. After inventory of existing conditions, approximately 36 metrics were determined to be of consequence to the social fabric of the study area. These metrics were then consolidated into four Social Factor categories: Historic Importance, Life and Safety, Community Resiliency and Cohesion, and Social Vulnerability.

Table E-16: OSE Metrics

SOCIAL FACTORS	METRIC
Historic Importance/Identity	
National Identity	Number of Nationally Registered Historic Properties
	Number of out of state tourist or revenue (tourism dollars in millions)
Community Identity	Number of historic districts
	Amount of community involvement
	Volunteer participation in community events
	Number of public servants
Health and Safety	
Physical Safety	Access to emergency services (miles or routes available to hospital and or EMS)
	Evacuation Routes

SOCIAL FACTORS	METRIC
	Possible structural damage
Physical Health (Infectious Diseases, e.g. cholera) Lowndes County	Logistics after a flood event (food, shelter, clean water)
	Access to emergency services (miles to hospital, EMS, roads available)
	Sewage treatment plant susceptibility
	Percentage of Population on variant of Goyt Funded Healthcare
	Food deserts
Social Connectedness	
Community Cohesion	Educational Attainment (distance to school, number of schools)
	Number of public spaces
	Number of recreational activities
	Impacts of heritage tourism to economy
	Number of employment opportunities (Increased labor associated w/ O&M)
Community Resiliency	Population Growth/Decline/Stability (resident retainment)
	Investment Opps
	Flood Insurance
	Access to transportation (public transit/carpooling)
	Impacts of tourism to economy
	Ability to benefit agriculturally; Fresh Food- Urban Farming (acreage); Food desert (Provision of reserve food production potential)
	Percentage of population on government assistance
	average household utility usage measured in gigawatts and gallons of water (provision of critical water, power, and gas/fuels)
Social Vulnerability	
Residents of the Study Area	Per Capita Income
	Public Housing - Selma Housing Authority (HUD partnership)
	Retirement Homes (Skilled Nursing Facilities)
	business climate
	employment opportunities
	food deserts
	evacuation limitations
	Percentage of population on government assistance

SOCIAL FACTORS	METRIC
	Percentage of population considered vulnerable / at-risk (low-income, disabled, minority, elderly)

E.4.2. Existing Condition

Historic Importance takes into account the rare cultural and historic significance showcased within the City of Selma including but not limited to the largest concentration of nationally registered historic properties in the state of Alabama, the national historic landmark known as the Edmund Pettus Bridge, and the Nationally Registered Selma to Montgomery Voting Rights Trail. Life and Safety was assessed to capture concerns regarding threats to life and safety introduced by varying water resources issues throughout Selma and Selmont. Community Cohesion took into account recent population declines for City of Selma and factors contributing to the decline. Community Resiliency assessed the City of Selma's ability to "bounce back" after a major high-water event and associated property damages, a factor that is negatively impacted by another social factor addressed in the analysis, Social Vulnerability. Social Vulnerability was a key factor in the OSE analysis as it was found that Selma is the poorest city in the state of Alabama and one of the poorest in the Nation, the population largely composed of minority communities, and there are few large employers in the city contributing to higher unemployment rates and exacerbating the issue of population retention.

E.4.3. Future Without Project Condition

The Future Without Project Conditions exacerbates the existing threats to all four Social Factor categories. Nationally Registered historic properties and sites would be threatened by bank failure. Life and safety concerns would be intensified due to potential bank failure and subsequent infrastructure failure. Community Resiliency would be significantly reduced due to needed continuous repairs and replacement of infrastructure in Ward 8 and along the riverfront. Community Cohesion would continue to decline as the City would not be able to prioritize retention of business and residents. Social Vulnerability would intensify as threats to community cohesion and resiliency continue.

E.4.4. Comparison of Alternatives

E.4.4.1. *No Action Alternative*

The analysis found that a No Action alternative would have negative impacts on all social factors and threats outlined in the FWOP condition would continue.

E.4.4.2. *Buyout Alternative*

For a non-structural alternative (buyouts/relocation), since the proposed buyouts are outside of a known historic district, there are no anticipated impacts for Historic Importance. However, removing residents from the floodplain creates a beneficial impact in the Life and Safety Social Factor. Even still, Buyouts/Relocation, regardless of the magnitude, is also a beneficial impact to Community Resiliency as it lessens the burden of the City to repair and maintain structures within the floodplain. A buyout/relocation would have adverse impacts on the Community Cohesion and Social Vulnerability, as the City would lose a large amount of residents and thus a significant percentage of the city's tax base. Also, with respect to Community Cohesion and Social Vulnerability in terms of buyouts/relocation, many residents in the proposed buyout are low-income and due to Selma's limited housing market, many of these residents would be displaced outside of Selma and possibly outside of Dallas County. Their relocation implies a significant increase to their cost of living.

E.4.4.3. *Bank Stabilization Alternative*
A bank stabilization alternative produces positive benefits for all Social Factors assessed, particularly Historic Importance and Community Resiliency. Stabilizing the failing northern bank of the Alabama River will protect Nationally Registered properties, thus eliminating the city's burden of repairing and replacing infrastructure and preserving its commercial property tax base along Water Avenue. This alternative also reduces Life and Safety concerns associated with roadway cave-ins and structure condemnations. This alternative will have more indirect impacts to Social Factors such as Community Cohesion and Social Vulnerability as it can be reasonably assumed that the City of Selma would be able to prioritize resident and business retention and attraction due to the revitalization of one of the top tourist destinations in the region.

E.4.4.4. *Levee Alternative*
A levee alternative produces mostly positive social benefits as well, with one significant negative impact in regards to Life and Safety concerns. A levee alignment would induce flooding in the neighboring town of Selmont, directly impacting life and safety in that area. And while it immediately reduces life and safely risk from inundation with its protection, it also introduces new life and safety risk associated with failure potential. The alternative could have significant impact on any unknown cultural resources sites within the proposed alignment but these impacts can be mitigated. The alternative would have positive impacts on Community Resiliency, Cohesion, and Social Vulnerability, as it would reduce the burden of repairs on the City and the homeowners in Ward 8.

E.4.5. Future with TSP Condition

E.5. Regional Economic Development

E.5.1. Methodology
The RED analysis utilized historical data, background research, best professional judgment, and the USACE-certified regional economic model (RECONS) to assess economic impacts to the study area and the surrounding region.

E.5.1.1. *RECONS*
When the economic activity lost in the study area can be transferred to another area or region in the national economy, these losses cannot be included in the NED account. However, the impacts of the employment, income, and output of the regional economy

are considered part of the RED account. The input-output macroeconomic model RECONS was used to address the impacts of the construction spending associated with the Tentatively Selected Plan (TSP) of Bankline Stabilization.

For this Regional analysis, the regional economic development (RED) effects of implementing the Final Array of Alternatives will be estimated. The RECONS Core-based Statistical Area (CBSA) of Selma, Alabama was selected using an expenditure year of 2022.

This RED analysis, using RECONS, employs input-output economic analysis, which measures the interdependence among industries and workers in an economy. This analysis uses a matrix representation of a region's economy to predict the effect of changes, based on the implementation of a project under a specific USACE Business Line, to the various industries that would be impacted. The greater the interdependence among industry sectors, the larger the multiplier effect on the economy. Changes to government spending amounts with respect to each Alternative drive the input-output model to project new levels of sales (output), value added (Gross Regional Product or GRP), employment, and income for each industry.

The specific input-output model used in this analysis is RECONS (Regional Economic System). This model was developed by the Institute for Water Resources (IWR), Michigan State University, and the Louis Burger Group. RECONS uses industry multipliers derived from the commercial input-output model IMPLAN to estimate the effects that spending on USACE projects have on a regional economy. The model is linear and static, showing relationships and impacts at a certain fixed point in time. Spending impacts are composed of three different effects: direct, indirect, and induced.

Direct effects represent the impacts the new federal expenditures have on industries which directly support the new project. Labor and construction materials can be considered direct components to the project. Indirect effects represent changes to secondary industries that support the direct industries. Induced effects are changes in consumer spending patterns caused by the change in employment and income within the industries affected by the direct and induced effects. The additional income workers receive via a project and spent on clothing, groceries, dining out, and other items in the regional area are secondary or induced effects.

The inputs for the RECONS model are expenditures corresponding to project first costs that are entered by work activity, each with a unique production function used to generate industry specific outputs. The Flood Risk Management production function of "Flood Risk Management General" was selected to gauge the impacts of the construction of the Riverbank Stabilization. The baseline data used by RECONS to represent the regional economy of Selma, Alabama are annual averages from the Bureau of the Census, the Bureau of Labor Statistics, and the Bureau of Economic Analysis for the year 2019. The model results are expressed in 2022 dollars.

E.5.1.1.1. *Assumptions/Risk/Uncertainty*

Input-output analysis rests on the following assumptions. The production functions of industries have constant returns to scale, so if inputs are to increase, output will increase in the same proportion. Industries face no supply constraints; they have access to all the materials they can use. Industries have a fixed commodity input structure; they will not substitute any commodities or services used in the production of output in response to price changes. Industries produce their commodities in fixed proportions, so an industry will not increase production of a commodity without increasing production in every other commodity it produces. Furthermore, it is assumed that industries use the same technology to produce all of its commodities. Finally, since the model is static, it is assumed that the economic conditions of 2019, the year of the socio-economic data in the RECONS model database, will prevail during the years of the construction process.

E.5.1.2. *Heritage Tourism*

A significant amount of economic product for the study area is attributable to heritage tourism. Background research including Selma and its sister cities of Montgomery and Birmingham, in combination with the grant applications, Alabama Dept. of Tourism reports, etc, was conducted to determine tourism revenue dollar amounts and percentages of tourism to the overall revenue of not only the city of Selma but the region.

E.5.2. Existing Condition

To assess RED the team considered a range of economic commodities that would potentially contribute to additional benefits. An assessment of regional industry benefits, tourism and recreation, and income shared between Selma and local towns with any Federal interest in the region and tie to significant national historic sites (i.e. Maxwell/Gunter AFB, U.S. Civil Rights Trail). There are a limited number of large employers in Selma and the surrounding area. Some to note are: International Paper Company, Honda Lock-America, and Bush Hog, with International Paper being the only local business to employ more than 500 people. Despite this lack of substantial industry in the study area, it was found that regionally, Selma contributes and benefits from a fairly robust tourism industry focused around the Civil Rights Movement.

The Civil Rights Movement occurred during the 1950s and 1960s with the majority of pivotal events occurring in Alabama, particularly in the towns of Birmingham, Montgomery, and Selma. Today, historic and cultural sites in these cities serve as memorials to the historic events that unfolded in these areas, events that impact our nation to this day. Capitalizing on regional, national, and international interest of this region, commonly referred to as the Civil Rights Triangle, many of these sites have been woven into the cities' and the state's heritage tourism plans and contribute significantly to their overall tourism revenue.

In 2018, the Department of Interior and National Park Service through the Historic Preservation Fund, granted \$12.6 million to the preservation and rehabilitation of Civil Rights sites in 24 states. Over \$2 million of those funds went to Alabama sites. In 2019, the same fund granted $12.2 million for the same purpose with $1.8 million going towards sites in the city of Selma, Alabama. The amount of federal funds being focused in the region and the city of Selma itself displays the federal interest in the preservation of Civil Rights historic sites in and around the city of Selma.

Tourism increased by a healthy 8.5 percent in Alabama from 2017 to 2018. While data is not available for Selma, Alabama by itself, Selma is the largest tourism destination located within Dallas County, Alabama. Tourism increased by 7.1 percent in Dallas County, Alabama from 2017 to 2018. Tourism for Selma's sister city, Montgomery, the capital of Alabama, registered 12.6 percent growth for the same year, reported by the Alabama Department of Tourism 2018 Annual Report. The 2018 U.S. Civil Rights Trail Initiative, a federal, state, and privately funded collaboration aimed at preserving and commemorating over a hundred civil rights sites across the nation, with nearly a quarter of the sites located in Alabama, could be recognized as the catalyst for Montgomery and Dallas Counties tourism growth. The U.S. Civil Rights Trail Initiative estimates that its heritage tourism amounts to $1.62 billion dollars generated from roughly 13 million travelers in 2018 alone. The Alabama Department of Tourism reported Dallas County generated $76 million in tourism revenue in 2018, notching a 7.1 percent increase over 2017 and supported 1,028 jobs.

E.5.3. Future Without Project Condition

In the FWOP condition, the structures along Selma's Historic Riverfront will be condemned, since it can determined that within the 50 year period of analysis these structures will be designated structurally unsound, and not only reduce property tax revenues but also weaken Selma's appeal for heritage tourism. This leaves more than $75 million in annual tourism at risk. The City of Selma would also see continued and increased repair cost to infrastructure along Water Avenue associated with decreased bank stability overtime. Flood inundation in Ward 8 could hamper development and population retention, thus potential decrease in tax base and community cohesion.

E.5.4. Comparison of Alternatives

E.5.4.1. *No Action Alternative*

Same as FWOP condition

E.5.4.2. *Buyout Alternative*

Three buyout levels were assessed during analysis. The RED analysis demonstrated that The larger two buyouts at 300 parcels and 157 parcels could have negative impacts on the City of Selma due to such a substantial decrease in tax base.

E.5.4.3. *Bank Stabilization Alternative*

The RED analysis found that Dallas County generates approximately $76 million dollars in tourism annually. Because of the rural setting of Dallas County, it can be inferred that the majority of these tourism dollars are accrued in the City of Selma. Selma, Alabama tourism industry is focused around HWY 80, the Edmund Pettus Bridge, and Downtown

Selma, particularly Water Avenue. The potential of bank destabilization and failure presents a direct threat to the tourism revenue of the City of Selma and Dallas County. The bank stabilization alternative would serve to protect this vital industry that supports more than 1,000 jobs.

E.5.4.4. *Levee Alternative*

Temporary job production (Stephen is conducting RECON)

With the economic vulnerability of Selma, it is crucial that city expenditures be in at a sustainable level. With an operation and maintenance cost of over $180,000 for the 1967 levee alignment and an O&M cost of approximately $27,000 for the optimized levee alignment, a levee alignment could potentially have a negative impact on the City of Selma's overall annual budget.

economic impact of potential induced flooding in Selmont (EN and Econ working on inundation levels and structures impacted)

Table E-17: Comparison of Alternatives

Factors ($000)	Alt. 1.A Buyouts	Alt. 3 Optimized Levee	Alt. 4 Soldier-Pile Wall	Alt. 6 Opt. Levee & Wall & Buyouts
First Costs	$4,950	$74,040	$27,457*	$104,860
Local Capture	N/A	$43,908	$16,283	$62,185
Output	N/A	$54,034	$20,038	$76,526
Jobs	N/A	311**	115**	440**
Labor Income	N/A	$16,082	$5,964	$22,777
Value Added	N/A	$22,698	$8,417	$32,146
Results Discussion	Buyout costs may not be appropriate inputs to RECONS.	**Jobs generated are short-term resulting from construction spending.	*Excludes Buyouts **Jobs generated are short-term resulting from construction spending.	**Jobs generated are short-term resulting from construction spending.

E.5.5. *Future with TSP Condition*

The Tentatively Selected Plan is Alternative 4 which is Bank Stabilization. The Selma riverfront constitutes a significant portion of the city's tourism revenue and the threats introduced by bankline instability directly impact this revenue. The proposed TSP would significantly reduce this threat and could protect approximately $70 million in revenue for the City of Selma and Dallas County.

Selma, Alabama

Flood Risk Management Study
Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX F

US Army Corps
of Engineers
Mobile District

September 14, 2020

APPENDIX-F: Cost

Table of Contents

List of Tables

F.1. Introduction

F.1.1. *Study Area*

The Alabama River passes through Selma, Alabama on its journey to the Gulf Coast. Selma itself is a largely historic town known for its significance during the Civil Rights Movement. At the city of Selma the Alabama River is characterized by sheer banks made of chalky clay material. The riverfront of Selma parallels the main historical reach of Selma's downtown area.

Due to its higher elevation along the riverbank the downtown ward of Selma (ward 8) is not directly impacted by water during major flood events. While direct water damage is not typical during these events, flood stage water levels tend to increase the speed of erosion along these waterfront properties. These primary waterfront properties are historic structures and there is an imminent threat to their stability. The bank line of Selma is in need of protection from these high water events in order to stabilize the bank erosion and prevent further damage to these structures and their foundations.

F.1.2. *Purpose*

The purpose of this study is to quantify the risk of flood and the related flood damages in the city of Selma which are associated with the Alabama River. It is then necessary to evaluate potential alternatives that will aid in reducing flood associated risks within the city of Selma. This cost appendix serves as a summary of the Selma FRM study cost estimate documents. The final estimate is intended to provide a basis of comparison for the various alternatives chosen by the project development team and to provide for the authorization and budgeting of the project recommended plan. The construction cost estimates for the final array of alternatives were developed to class 4 based on the level of design presented for the alternatives as required by ER 1110-2-1302.

F.2. Development and Description of Alternatives

F.2.1. *Development of Alternatives*

Many alternatives and measures were developed and screened out prior to development of any reliable cost estimates. The initial array of alternatives presented at the Alternatives Milestone Meeting (AMM) included 10 types of measures as presented in Table F-1 along with the screening status. These alternatives were screened based on factors other than cost, so a complete description of the measures and explanation of the screening is available in other parts of this report.

Table F-1: Initial Array of Alternatives

Measure	Screened out / Carried Forward
No Action Alternative	
Alt. 1: Non-Structural (A-Buyouts, B-Raise Structural Elevation, Structural Move)	Carried Forward Alt. 1.A Screened Out Alt. 1.B
Alt. 2: 1967 Selma Levee	Carried Forward
Alt. 3: Optimized (Short) Selma Levee	Carried Forward
Alt. 4: Bankline Stabilization	Carried Forward
Alt. 5: Bankline Stabilization + Buyouts	Carried Forward

Alt. 6: Optimized Selma Levee + Buyouts + Bank Stabilization	Carried Forward
Alt. 7: Optimized Selma Levee + Valley Creek Levee + Pump Station & Sluice Gate + Bank Stabilization	Screened Out
Alt. 8: Optimized Selma Levee + Valley Creek Levee + Buyouts + Bank Stabilization	Screened Out
Alt. 9: Optimized Selma Levee + Valley Creek Levee + Buyouts	Screened Out
Alt. 10: Optimized Selma Levee + Valley Creek Levee + Pump Station with Sluice Gate	Screened Out

The focused array of alternatives, including site specific options, was developed after the AMM. The focused array of alternatives includes one non-structural alternative and five structural and/or combination alternatives. The complete list is included in Table F-2.

Table F-2 - Focused Array of Alternatives

List of Final Alternatives	Screened Out / Carried Forward
No Action Alternative	
Alt. 1: Non-Structural (A-Buyouts)	Carried Forward
Alt. 2: 1967 Selma Levee	Screened Out due to Partial/ROM estimates being much greater than ROM benefits
Alt. 3: Optimized (Short) Selma Levee	Carried Forward
Alt. 4: Bankline Stabilization	Carried Forward
Alt. 5: Bankline Stabilization + Buyouts	Carried Forward
Alt. 6: Optimized Selma Levee + Buyouts + Bank Stabilization	Carried Forward

F.2.2. *Screening of Focused Array*

This array of alternatives was analyzed for both feasibility and economic benefits and the Alternative 2: 1967 Levee was screened out prior to assessing the final array of alternatives. This alternative was screened in part due to the overwhelming cost of construction, the resulting O&M cost, the and the constructability.

F.3. Development of Alternative Estimates for Final Array

F.3.1. *Price Level*

The total estimated cost for each of the final alternatives consists of the estimated construction cost, the demolition cost, the real estate cost, the Planning, Engineering and Design (PED) cost, the Construction Management (CM) cost, and a contingency developed using an Abbreviated Risk Analysis (ARA). Each estimate has been performed to a class 3 level estimate per ER 1110-2-1302.

F.3.2. *Cost Estimate Structure*
The cost estimate was developed using a collaboration of several components. The various components used in creating the total project cost estimates may be seen in the below paragraph.

The construction cost estimates were prepared using MCACES 2nd generation software (MII). Prices used in developing the construction estimates have been found in the 2016 MII Cost library. The MII equipment library was set to the 2016 Region III Equipment Library which captures equipment rates in the southeast United States. Labor rates were modified per the local labor rates in Dallas County Alabama. Project markups were included in the MII estimate as appropriate with the exception of escalation which was applied in the TPCS documentation. PED and CM costs were developed using typical rates from previous civil works project studies completed in Mobile District. Rates were validated by the project development team and changes were made as necessary to reflect accurate PED and CM costs. An Abbreviated Risk Analysis (ARA) was conducted for each of the study alternatives to provide a basis for carrying contingency forward as appropriate. These contingency rates were included in the Total Project Cost Summaries (TPCS). Real estate costs and their respective contingency and administrative costs were provided by real estate division and included for each alternative.

F.3.3. *Risk Analysis and Contingency*
For the analysis, an ARA was prepared for each alternative. The ARAs were prepared with input from the PDT on developing the risks and assigning likelihood and impact of each risk. The risk register and results of the ARA for each alternative is included as an attachment to this appendix.

F.3.4. *Cost Estimate Presentation*
A Total Project Cost Summary (TPCS) was prepared for each alternative. The TPCS combines the RE costs, construction costs, Contingency, PED, and CM, and applies escalation factors to calculate a first cost and total project cost for each alternative. The First Cost is used for the Economics analysis in conjunction with the damage reduction estimates to determine net benefits for each alternative. Table 5 shows the First Costs, estimated operations and maintenance (O&M) costs, and estimated durations for each of the final array of alternatives.

Table F-3: First Costs and Durations of Final Array

Alternative	First Cost	Annual O&M	Construction Duration
Alt 1. Acquisition and Buy-Out	$4,950,000	$0	2.7 Months
Alt 3. Optimized Levee Alignment	$74,040,000	$27,000	21.5 Months

Alt 4. Soldier Pile Retaining Wall and Flood Management Plan	$27,537,000	$4,000	15.6 Months
Alt 5. Soldier Pile Retaining Wall and Buy-Out	$32,400,000	$4,000	18.3 Months
Alt 6. Combination Alternative	$104,860,000	$29,500	26.9 Months

F.4. Development of the Estimated Schedule
The estimated construction durations have been developed based on the anticipated project requirements from "notice to proceed" through to construction completion. The projected project construction durations may be seen in table 3.

F.5. Selection of the TSP
The estimates of the final array of alternatives were used to perform an economics analysis of the alternatives. It was determined through analysis that the TSP alternative has the best economic impact on the community. In addition to the economic analysis results it was determined by the PDT that the construction of the TSP alternative would benefit the community through extensive "OSE" benefits (Other Social Effects). Due to the perceived benefits the PDT has chosen the Soldier Pile Retaining Wall and Flood Management Plan as the TSP Alternative.

F.6. Operations and Maintenance Estimates
Operations and maintenance costs of the final array of alternatives, although not a part of the TPCS, are used in the economics analysis. To support that, an O&M estimate was prepared for each alternative in MII. The O&M costs for the levee alignments consist of mowing and land maintenance costs in accordance with USACE levee maintenance guidelines. The retaining wall alternatives consist of minor landscaping costs in order to maintain an aesthetically please project. The TSP alternative consists of a soldier pile retaining wall and a flood management plan for the community. The O&M cost totals may be seen in table 5 of the report.

F.7. Recommended Plan
It is recommended that as the study continues cost is further refined in accordance with additional project surveys and design guidance from the PDT. The current working estimate for the TSP is at a level 4. This estimate will be refined as will the risk analysis based contingency levels for this estimate.

F.8. Exhibits
1) MII Summary of the TSP
2) Abbreviated Risk Analysis for Each Alternative
3) TPCS Sheets for Each Alternative

Exhibit F-1: MII Summary of the TSP

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES
Job Breakdown Report

Time 14:06:39

Title Page

Soldier-Pile Wall - MCACES

Estimated by
Designed by
Prepared by Timothy (Jay) Caldwell

Preparation Date
Effective Date of Pricing
Estimated Construction Time

This report is not copyrighted, but the information contained herein is For Official Use Only.
This report reflects project markups, overhead costs, and incurred costs identical to the alternative options in the cost package. Variable costs are limited to materials, equipment, and labor for each of the respective cost options: 1, 2, and 3.

Currency in US dollars

TRACES MII Version 4.4

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES - IPR - 10.04.2019
Job Breakdown Report

Time 14:06:39

Project Total Page 1

Description	UOM	Quantity	ContractCost	ProjectCost
Project Total			**16,063,706.71**	**16,063,706.71**
			16,063,706.7112	*16,063,706.7112*
Soldier Pile Wall	EA	1.0000	**16,063,706.71**	**16,063,706.71**
			150,009.9494	*150,009.9494*
General Project Requirements	EA	1.0000	**150,009.95**	**150,009.95**
			5,000.3316	*5,000.3316*
Boundary & survey markers, crew for roadway layout, 4 person crew	DAY	30.0000	150,009.95	150,009.95
			2,300,114.5860	*2,300,114.5860*
UXO/Cultural Surveys and Mitigation	EA	1.0000	**2,300,114.59**	**2,300,114.59**
UXO Mitigation, Surveys, Soil Sampling, Disposal of Live Ordinance	LS	1.0000	1,840,091.67	1,840,091.67
(Note: Assume that this item includes all costs for surveying and mitigation of the UXO and Live Ordinance located within the project boundaries of the Alabama River. This is intended as a placeholder based on ROM costs provided by Omaha District on 6/17/2019 via teleconference.)				
Cultural mitigation via archaelogical measures	LS	1.0000	460,022.92	460,022.92
(Note: Assume that this item includes all costs surveying and clearing the project area of archaeological and cultural finds)				
			5,125,485.6721	*5,125,485.6721*
Equipment	EA	1.0000	**5,125,485.67**	**5,125,485.67**
			4,134,094.6670	*4,134,094.6670*
Water Based	EA	1.0000	**4,134,094.67**	**4,134,094.67**
			884,729.1643	*884,729.1643*
Barges	EA	1.0000	**884,729.16**	**884,729.16**
			909.8375	*909.8375*
MARINE EQUIPMENT, WORK BARGE, SECTIONAL, MEDIUM DUTY, 40' X 12' X 5', 51 TON	MO	6.0000	5,459.03	5,459.03
			909.8375	*909.8375*
MARINE EQUIPMENT, WORK BARGE, SECTIONAL, MEDIUM DUTY, 40' X 12' X 5', 51 TON	MO	6.0000	5,459.03	5,459.03
			4,841.7685	*4,841.7685*
WORK BARGE, FLAT DECK, 1000 TON	MO	6.0000	29,050.61	29,050.61
			2,798.0354	*2,798.0354*
WORK BARGE, FLAT DECK, 500 TON	MO	6.0000	16,788.21	16,788.21
			137,995.3818	*137,995.3818*
BARGE MOUNTED CRANE, 100 TON, 150' BOOM, FOR LIFTING	MO	6.0000	827,972.29	827,972.29
			2,790,911.5213	*2,790,911.5213*
Tugs	EA	1.0000	**2,790,911.52**	**2,790,911.52**
			82,175.3518	*82,175.3518*
WORK TUG, under 500 HP	MO	6.0000	493,052.11	493,052.11
			210,472.5167	*210,472.5167*
TOWING VESSEL TUG, 1500 HP	MO	6.0000	1,262,835.10	1,262,835.10

Currency in US dollars

TRACES MII Version 4.4

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES - IPR - 10.04.2019
Job Breakdown Report

Time 14:06:39

Project Total Page 2

Description	UOM	Quantity	ContractCost	ProjectCost
			82,175.3518	*82,175.3518*
WORK TUG, under 500 HP	MO	6.0000	493,052.11	493,052.11
			541,972.2000	*541,972.2000*
Operator	EA	**1.0000**	**541,972.20**	**541,972.20**
			30,021.8101	*30,021.8101*
Tugs/Tending- Tug Master	MO	6.0000	180,130.86	180,130.86
(Note: Davis Bacon Dredging: Group 5: Leverman. ENGI0302-030. General Decision Number: WA150105 03/20/2015 WA105)				
			30,857.4055	*30,857.4055*
Tugs/Tending- Engineer	MO	6.0000	185,144.43	185,144.43
(Note: Davis Bacon Dredging: Group 4: Craneman, Engineer, Welder. ENGI0302-030. General Decision Number: WA150105 03/20/2015 WA105)				
			29,449.4844	*29,449.4844*
Tugs/Tending- Deckhand	MO	6.0000	176,696.91	176,696.91
(Note: Davis Bacon Dredging: Group 1: Assistant Mate or Deckhand.ENGI0302-030. General Decision Number: WA150105 03/20/2015 WA105)				
			458,453.9814	*458,453.9814*
Mobilization/Demobilization	EA	**1.0000**	**458,453.98**	**458,453.98**
			114,613.4954	*114,613.4954*
Mobilization, set up and remove, mobilization by water for barge driving rig, maximum	EA	4.0000	458,453.98	458,453.98
			991,391.0051	*991,391.0051*
Land Based	EA	**1.0000**	**991,391.01**	**991,391.01**
			6,454.8751	*6,454.8751*
LOADER, FRONT END, CRAWLER, 2.60 CY (2.0 M3) BUCKET	MO	6.0000	38,729.25	38,729.25
			211.2642	*211.2642*
LOADER, FRONT END, CRAWLER, 2.60 CY (2.0 M3) BUCKET	HR	6.0000	1,267.58	1,267.58
			4,719.5066	*4,719.5066*
HYDRAULIC EXCAVATOR, CRAWLER, 53,400 LBS, 0.63 CY BUCKET, 39' MAX DIGGING DEPTH, LONG REACH BOOM	MO	6.0000	28,317.04	28,317.04
			26,526.2401	*26,526.2401*
HYDRAULIC EXCAVATOR, CRAWLER, 49,000 LBS, 0.80 CY BUCKET, 39.0' MAX DIGGING DEPTH, LONG REACH BOOM	MO	6.0000	159,157.44	159,157.44
			726,169.9213	*726,169.9213*
Operator	EA	**1.0000**	**726,169.92**	**726,169.92**
			30,257.0801	*30,257.0801*
Equip. Operators, Medium	MO	6.0000	181,542.48	181,542.48
(Note: Davis Bacon Power Equip. Operators: Group 2. ENGI0302-003. General Decision Number: WA150001 04/03/2015 WA1 Wdol.gov AL21)				
			30,257.0801	*30,257.0801*
Equip. Operators, Medium	MO	6.0000	181,542.48	181,542.48

Currency in US dollars

TRACES MII Version 4.4

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES - IPR - 10.04.2019
Job Breakdown Report

Time 14:06:39

Project Total Page 3

Description	UOM	Quantity	ContractCost	ProjectCost
(Note: Davis Bacon Power Equip. Operators: Group 2. ENGI0302-003. General Decision Number: WA150001 04/03/2015 WA1 Wdol.gov AL21)				
Equip. Operators, Medium	MO	6.0000	*30,257.0801* 161,542.48	*30,257.0801* 161,542.48
(Note: Davis Bacon Power Equip. Operators: Group 2. ENGI0302-003. General Decision Number: WA150001 04/03/2015 WA1 Wdol.gov AL21)				
Equip. Operators, Medium	MO	6.0000	*30,257.0801* 161,542.48	*30,257.0801* 161,542.48
(Note: Davis Bacon Power Equip. Operators: Group 2. ENGI0302-003. General Decision Number: WA150001 04/03/2015 WA1 Wdol.gov AL21)				
Mobilization/Demobilization	**EA**	**1.0000**	*37,749.7683* **37,749.77**	*37,749.7683* **37,749.77**
Mobilization or demobilization, delivery charge for equipment, hauled on 50-ton capacity towed trailer	EA	6.0000	*6,291.6280* 37,749.77	*6,291.6280* 37,749.77
Soldier Pile Retaining Wall	**EA**	**1.0000**	*6,016,773.7362* **6,016,773.74**	*6,016,773.7362* **6,016,773.74**
Soldier Piles	**EA**	**1.0000**	*2,863,201.0107* **2,863,201.01**	*2,863,201.0107* **2,863,201.01**
Steel piles, "H" Sections, 50' long, HP14 X 73, excludes mobilization or demobilization	VLF	3,750.0000	*113.2936* 424,851.10	*113.2936* 424,851.10
(Note: Assume 40 foot Soldier Pile Including Embedment - @8ft spacing = (750ft/8ft)*40ft = 3200 vlf)				
Piling special costs, pre-augering, average soil, up to 40' deep, to 48" diameter	LF	1,000.0000	*129.6158* 129,615.83	*129.6158* 129,615.83
Structural concrete, ready mix, for high-range water reducer/superplasticizer, add	CY	3,200.0000	*15.2818* 48,901.76	*15.2818* 48,901.76
(Note: Assume 94 piles @ 3 foot diam. and 5 foot concrete depth = 3200 CY)				
Structural concrete, placing, underwater pile encasement, pumped, includes vibrating, excludes material	CY	3,200.0000	*395.4677* 1,265,496.57	*395.4677* 1,265,496.57
(Note: Assume 94 piles @ 3 foot diam. and 5 foot concrete depth = 3200 CY)				
Structural concrete, ready mix, heavyweight, high early, 4000 psi, includes local aggregate, sand, Portland cement (Type III) and water, delivered, excludes all additives and treatments	CY	3,200.0000	*310.7299* 994,335.75	*310.7299* 994,335.75
(Note: Assume 94 piles @ 3 foot diam. and 5 foot concrete depth = 3200 CY)				
Soldier Lagging	**EA**	**1.0000**	*2,494,129.4309* **2,494,129.43**	*2,494,129.4309* **2,494,129.43**
Precast wall panel, smooth, gray, uninsulated, low rise, 4' x 8' x 4" thick, 3000 psi	SF	22,500.0000	*110.8502* 2,494,129.43	*110.8502* 2,494,129.43
(Note: Assume 30 ft retained height from riverbed = 30ft x 750 ft = 22,500 ft2)				

Currency in US dollars

TRACES MII Version 4.4

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES - IPR - 10.04.2019
Job Breakdown Report

Time 14:06:39

Project Total Page 4

Description	UOM	Quantity	ContractCost	ProjectCost
			659,443.2946	*659,443.2946*
Tiebacks	EA	1.0000	**659,443.29**	**659,443.29**
			7,015.3542	*7,015.3542*
Cofferdams, tie-back method, tie-backs only, typical, 35' long, average	EA	94.0000	659,443.29	659,443.29
			1,515,005.9695	*1,515,005.9695*
Earthwork/Fill	EA	1.0000	**1,515,005.97**	**1,515,005.97**
			56.0333	*56.0333*
Fill, granular fill	LCY	12,500.0000	700,415.80	700,415.80
(Note: Assume 30 ft wall height with a 1:1 Horizontal to Vretical slope on the bank side of the wall.)				
			57.4099	*57.4099*
Borrow, select granular fill, 3 C.Y. bucket, loading and/or spreading, front end loader, wheel mounted	BCY	12,500.0000	717,624.02	717,624.02
			7.7573	*7.7573*
Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 18 C.Y. 8 wheel truck, cycle 10 miles, 45 MPH, excludes loading equipment	LCY	12,500.0000	96,966.15	96,966.15
			468,056.9965	*468,056.9965*
Concrete Cap	EA	1.0000	**468,057.00**	**468,057.00**
			14.9327	*14.9327*
C.I.P. concrete forms, slab on grade, keyed joint, wood, 7" - 12" high, 4 uses, includes erecting, bracing, stripping and cleaning	LF	3,000.0000	44,798.13	44,798.13
			26.2534	*26.2534*
Structural concrete, thickened edge for slab on grade (3500 psi), depth is added to and poured monolithically with slab, 8" wide x 8" deep, reinforced, includes forms(4 uses), Grade 60 rebar, concrete (Portland cement Type I), placing and finishing	LF	2,250.0000	59,070.09	59,070.09
			485.5850	*485.5850*
Structural concrete, in place, slab on grade (3500 psi), 6" thick, includes forms(4 uses), Grade 60 rebar, concrete (Portland cement Type I), and placing, excludes finishing	CY	750.0000	364,188.78	364,188.78
			488,259.8015	*488,259.8015*
Rip Rap End Cap	EA	1.0000	**488,259.80**	**488,259.80**
			130.0015	*130.0015*
Rip-rap, random pieces, dumped from truck, 25 - 500 pound pieces	LCY	3,333.0000	433,295.01	433,295.01
(Note: Assume 4000lb/cy — 100 ft width at each end on a 1:1 vertical to horizontal slope at 30 ft height = 2 ends x 100ft x 450ft = 90,000 ft3 — 90,000ft3 / 27 = 3,333)				
			174.4914	*174.4914*
Rip-rap and rock lining, random, broken stone, 18" minimum thickness, machine placed for slope protection, not grouted	SY	315.0000	54,964.80	54,964.80
(Note: 42.5ft slope face x 2 ends x 100 ft = 8,500 ft2 / 27 = 315 cy)				

Currency in US dollars

TRACES MII Version 4.4

Print Date Tue 18 August 2020
Eff. Date

U.S. Army Corps of Engineers
Project : Bankline Stabilization - MCACES - IPR - 10.04.2019
Job Breakdown Report

Time 14:06:39

Table of Contents

Currency in US dollars

TRACES MII Version 4.4

Exhibit F-2: Abbreviated Risk Analysis for Each Alternative

Abbreviated Risk Analysis

Project (less than $40M): **Buyouts**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative:

Meeting Date: **1/30/2020**

Total Estimated Construction Contract Cost = $ 3,965,000

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
1	02 RELOCATIONS	Buyouts and Relocations	$ 1,183,000		25.28%	$ 293,976	$ 1,456,976
2	01 LANDS AND DAMAGES	Real Estate	$ 3,000,000		23.35%	$ 700,610	$ 3,700,610
3					0.00%	$ -	$ -
4			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6					0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ (188,000)	0.0%	0.00%	$ (33,726)	$ (231,726)
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 163,000		19.30%	$ 31,460	$ 194,460
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 104,000		17.38%	$ 18,072	$ 122,072
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals				
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 3,965,000	24.23%	$ 960,859	$ 4,925,859
Total Planning, Engineering & Design	$ 163,000	19.30%	$ 31,460	$ 194,460
Total Construction Management	$ 104,000	17.38%	$ 18,072	$ 122,072
Total Excluding Real Estate	$ 4,232,000	24%	$ 1,010,391	$ 5,242,391

	Base	60%	80%
Confidence Level Range Estimate ($000's)	$4,232k	$4,838k	$5,242k

[illegible]

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.	

Abbreviated Risk Analysis

Project (less than $40M): **Optimized Levee**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **High Risk: Complex Project or Unique Type Construction**

Alternative:
Meeting Date: **1/30/2020**

Total Estimated Construction Contract Cost = $ 36,000,000

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
1	11 LEVEES AND FLOODWALLS	Optimized Levee Profile	$ 34,700,000		56.81%	$ 19,711,597	$ 54,411,597
2	01 LANDS AND DAMAGES	Real Estate	$ 1,300,000		18.63%	$ 242,202	$ 1,542,202
3					0.00%	$ -	$ -
4			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6					0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		d	$ -	$ -
12	All Other	**Remaining Construction Items**	$ -	*0.0%*	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	**Planning, Engineering, & Design**	$ 4,858		9.89%	$ 480	$ 5,338
14	31 CONSTRUCTION MANAGEMENT	**Construction Management**	$ 3,123		21.55%	$ 673	$ 3,796
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 36,000,000	55.43%	$ 19,953,799	$ 55,953,799
Total Planning, Engineering & Design	$ 4,858	9.89%	$ 480	$ 5,338
Total Construction Management	$ 3,123	21.55%	$ 673	$ 3,796
Total Excluding Real Estate	**$ 36,007,981**	**55%**	**$ 19,954,952**	**$ 55,962,933**
		Base	**50%**	**80%**
Confidence Level Range Estimate ($000's)		$36,008k	$47,981k	$55,963k

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.

Abbreviated Risk Analysis

Project (less than $40M): **Soldier-Pile Wall**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative:
Meeting Date: 1/30/2020

Total Estimated Construction Contract Cost = $ 16,444,000

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
1	16 BANK STABILIZATION	Soldier Pile Wall	$ 16,064,000		27.93%	$ 4,486,468	$ 20,550,468
2	01 LANDS AND DAMAGES	Real estate	$ 380,000		17.51%	$ 66,547	$ 446,547
3					0.00%	$ -	$ -
4			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6					0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 2,249,000		16.50%	$ 371,124	$ 2,620,124
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 1,446,000		7.00%	$ 101,220	$ 1,547,220
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 16,444,000	27.69%	$ 4,553,015	$ 20,997,015
Total Planning, Engineering & Design	$ 2,249,000	16.50%	$ 371,124	$ 2,620,124
Total Construction Management	$ 1,446,000	7.00%	$ 101,220	$ 1,547,220
Total Excluding Real Estate	**$ 20,139,000**	**25%**	**$ 5,025,358**	**$ 25,164,358**

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$20,139k	$23,154k	$25,164k

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analysis. Must include justification. Does not allocate to Real Estate.	

Abbreviated Risk Analysis

Project (less than $40M): **Soldier-Pile Wall and Buyouts**
Project Development Stage/Alternative: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project Construction Type**

Alternative:
Meeting Date: 1/30/2020

Total Estimated Construction Contract Cost = $ 20,527,000

	CWWBS	Feature of Work	Contract Cost		% Contingency	$ Contingency	Total
1	16 BANK STABILIZATION	Soldier Pile Wall	$ 17,227,000		27.93%	$ 4,811,279	$ 22,038,279
2	01 LANDS AND DAMAGES	Real estate	$ 3,300,000		19.49%	$ 643,061	$ 3,943,061
3					0.00%	$ -	$ -
4			$ -		0.00%	$ -	$ -
5			$ -		0.00%	$ -	$ -
6					0.00%	$ -	$ -
7					0.00%	$ -	$ -
8			$ -		0.00%	$ -	$ -
9			$ -		0.00%	$ -	$ -
10			$ -		0.00%	$ -	$ -
11			$ -		0.00%	$ -	$ -
12	All Other	Remaining Construction Items	$ -	0.0%	0.00%	$ -	$ -
13	30 PLANNING, ENGINEERING, AND DESIGN	Planning, Engineering, & Design	$ 2,412,000		18.48%	$ 445,643	$ 2,857,643
14	31 CONSTRUCTION MANAGEMENT	Construction Management	$ 1,550,000		11.35%	$ 175,860	$ 1,725,860
XX	FIXED DOLLAR RISK ADD (EQUALLY DISPERSED TO ALL, MUST INCLUDE JUSTIFICATION SEE BELOW)					$ -	

Totals	Contract Cost	% Contingency	$ Contingency	Total
Real Estate	$ -	0.00%	$ -	$ -
Total Construction Estimate	$ 20,527,000	26.57%	$ 5,454,340	$ 25,981,340
Total Planning, Engineering & Design	$ 2,412,000	18.48%	$ 445,643	$ 2,857,643
Total Construction Management	$ 1,550,000	11.35%	$ 175,860	$ 1,725,860
Total Excluding Real Estate	$ 24,489,000	25%	$ 6,075,843	$ 30,564,843

	Base	50%	80%
Confidence Level Range Estimate ($000's)	$24,489k	$28,135k	$30,565k

Fixed Dollar Risk Add: (Allows for additional risk to be added to the risk analsyis. Must include justification. Does not allocate to Real Estate.

Exhibit F-3: TPCS Sheets for Each Alternative

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 1 of 8

PROJECT: Selma FRM Study - Buyouts
PROJECT NO: 0
LOCATION: Selma, AL

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 08/18/2020

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2023 Effective Price Level Date: 1 OCT 22									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
16	Selma Flood Risk Management Project	$1,163	$279	24.0%	$1,442	9.5%	$1,273	$306	$1,579	$0	$1,579	3.0%	$1,312	$315	$1,626
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,163	$279		$1,442	9.5%	$1,273	$306	$1,579	$0	$1,579	3.0%	$1,312	$315	$1,626
01	LANDS AND DAMAGES	$3,000	$0	0.0%	$3,000	0.0%	$3,000	$0	$3,000	$0	$3,000	0.0%	$3,000	$0	$3,000
30	PLANNING, ENGINEERING & DESIGN	$163	$39	24.0%	$202	12.0%	$182	$44	$226	$0	$226	1.9%	$186	$45	$230
31	CONSTRUCTION MANAGEMENT	$105	$25	24.0%	$130	12.0%	$117	$28	$145	$0	$145	6.8%	$125	$30	$155
	PROJECT COST TOTALS:	$4,430	$343	7.7%	$4,774		$4,573	$377	$4,950	$0	$4,950	1.2%	$4,623	$389	$5,012

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: $5,012

Filename: TPCS Alternative 1 - Acquisition and Buyouts.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 2 of 8

****** CONTRACT COST SUMMARY ******

PROJECT: Selma FRM Study - Buyouts
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared:			9-Oct-19	Program Year (Budget EC):			2023					
		Effective Price Level:			1-Oct-19	Effective Price Level Date:			1 OCT 22					
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Buyout/Relocation Assistance													
02	RELOCATIONS	$1,163	$279	24.0%	$1,442	9.5%	$1,273	$306	$1,579	2024Q1	3.0%	$1,312	$315	$1,626
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,163	$279	24.0%	$1,442		$1,273	$306	$1,579			$1,312	$315	$1,626
01	LANDS AND DAMAGES	$3,000	$0	0.0%	$3,000	0.0%	$3,000	$0	$3,000	2024Q1	0.0%	$3,000	$0	$3,000
30	PLANNING, ENGINEERING & DESIGN													
	1.0% Project Management	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
	1.0% Planning & Environmental Compliance	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
	5.0% Engineering & Design	$58	$14	24.0%	$72	12.0%	$65	$16	$81	2023Q1	0.0%	$65	$16	$81
	1.0% Reviews, ATRs, IEPRs, VE	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
	1.0% Life Cycle Updates (cost, schedule, risks)	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
	1.0% Contracting & Reprographics	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
	3.0% Engineering During Construction	$35	$8	24.0%	$43	12.0%	$39	$9	$48	2024Q4	6.8%	$42	$10	$52
	1.0% Planning During Construction	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2024Q4	6.8%	$14	$3	$17
	0.0% Adaptive Management & Monitoring	$0	$0	24.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.0% Project Operations	$0	$0	24.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
	6.0% Construction Management	$70	$17	24.0%	$87	12.0%	$78	$19	$97	2024Q4	6.8%	$83	$20	$103
	1.5% Project Operation:	$17	$4	24.0%	$22	12.0%	$20	$5	$24	2024Q4	6.8%	$21	$5	$26
	1.5% Project Management	$17	$4	24.0%	$22	12.0%	$20	$5	$24	2024Q4	6.8%	$21	$5	$26
	CONTRACT COST TOTALS:	$4,430	$343		$4,774		$4,573	$377	$4,950			$4,623	$389	$5,012

Filename: TPCS - Alternative 1 - Acquisition and Buyouts.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 1 of 8

PROJECT: Selma FRM Study - Optimized Levee
PROJECT NO: 0
LOCATION: Selma, AL

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 08/18/2020

This Estimate reflects the scope and schedule in report; 0

Program Year (Budget EC): 2023
Effective Price Level Date: 1 OCT 22

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
16	Selma Flood Risk Management Project	$34,700	$19,085	55.0%	$53,785	9.5%	$37,993	$20,896	$58,889	$0	$58,889	3.0%	$39,132	$21,523	$60,655
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$34,700	$19,085		$53,785	9.5%	$37,993	$20,896	$58,889	$0	$58,889	3.0%	$39,132	$21,523	$60,655
01	LANDS AND DAMAGES	$1,300	$0	0.0%	$1,300	0.0%	$1,300	$0	$1,300	$0	$1,300	0.0%	$1,300	$0	$1,300
30	PLANNING, ENGINEERING & DESIGN	$4,858	$2,672	55.0%	$7,530	12.0%	$5,440	$2,992	$8,431	$0	$8,431	1.9%	$5,545	$3,050	$8,595
31	CONSTRUCTION MANAGEMENT	$3,123	$1,718	55.0%	$4,841	12.0%	$3,497	$1,923	$5,420	$0	$5,420	6.8%	$3,735	$2,054	$5,789
	PROJECT COST TOTALS:	$43,981	$23,475	53.4%	$67,456		$48,229	$25,811	$74,040	$0	$74,040	3.1%	$49,712	$26,627	$76,339

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: $76,339

Filename: TPCS_Alternative 2 - Optimized Levee Profile.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 2 of 8

****** CONTRACT COST SUMMARY ******

PROJECT: Selma FRM Study - Optimized Levee
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Oct-19				Program Year (Budget EC): 2023								
		Effective Price Level: 1-Oct-19				Effective Price Level Date: 1 OCT 22								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Optimized Levee Profile													
11	LEVEES & FLOODWALLS	$34,700	$19,085	55.0%	$53,785	9.5%	$37,993	$20,896	$58,889	2024Q1	3.0%	$39,132	$21,523	$60,655
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$34,700	$19,085	55.0%	$53,785		$37,993	$20,896	$58,889			$39,132	$21,523	$60,655
01	LANDS AND DAMAGES	$1,300	$0	0.0%	$1,300	0.0%	$1,300	$0	$1,300	2024Q1	0.0%	$1,300	$0	$1,300
30	PLANNING, ENGINEERING & DESIGN													
	1.0% PED	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2023Q1	0.0%	$389	$214	$602
	1.0% Planning & Environmental Compliance	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2023Q1	0.0%	$389	$214	$602
	5.0% Engineering & Design	$1,735	$954	55.0%	$2,689	12.0%	$1,943	$1,068	$3,011	2023Q1	0.0%	$1,943	$1,068	$3,011
	1.0% Reviews, ATRs, IEPRs, VE	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2023Q1	0.0%	$389	$214	$602
	1.0% Life Cycle Updates (cost, schedule, risks)	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2023Q1	0.0%	$389	$214	$602
	1.0% Contracting & Reprographics	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2023Q1	0.0%	$389	$214	$602
	3.0% Engineering During Construction	$1,041	$573	55.0%	$1,614	12.0%	$1,166	$641	$1,807	2024Q4	6.8%	$1,245	$685	$1,930
	1.0% Planning During Construction	$347	$191	55.0%	$538	12.0%	$389	$214	$602	2024Q4	6.8%	$415	$228	$643
	0.0% Adaptive Management & Monitoring	$0	$0	55.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.0% Project Operations	$0	$0	55.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
	6.0% Construction Management	$2,082	$1,145	55.0%	$3,227	12.0%	$2,331	$1,282	$3,613	2024Q4	6.8%	$2,490	$1,369	$3,859
	1.5% Project Operation:	$521	$286	55.0%	$807	12.0%	$583	$321	$903	2024Q4	6.8%	$622	$342	$965
	1.5% Project Management	$521	$286	55.0%	$807	12.0%	$583	$321	$903	2024Q4	6.8%	$622	$342	$965
	CONTRACT COST TOTALS:	$43,981	$23,475		$67,456		$48,229	$25,811	$74,040			$49,712	$26,627	$76,339

Filename: TPCS - Alternative 3 - Optimized Levee Profile.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 1 of 8

PROJECT: Selma FRM Study - Soldier-Pile Wall
PROJECT NO:
LOCATION: Selma, AL

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 08/18/2020

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2023 Effective Price Level Date: 1 OCT 22									
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K) K	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
16	Selma Flood Risk Management Project	$16,064	$4,016	25.0%	$20,080	9.5%	$17,588	$4,397	$21,985	$0	$21,985	3.0%	$18,116	$4,529	$22,645
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0 -		$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$16,064	$4,016		$20,080	9.5%	$17,588	$4,397	$21,985	$0	$21,985	3.0%	$18,116	$4,529	$22,645
01	LANDS AND DAMAGES	$380	$0	0.0%	$380	0.0%	$380	$0	$380	$0	$380	0.0%	$380	$0	$380
30	PLANNING, ENGINEERING & DESIGN	$2,249	$562	25.0%	$2,811	12.0%	$2,518	$630	$3,148	$0	$3,148	1.1%	$2,546	$636	$3,182
31	CONSTRUCTION MANAGEMENT	$1,446	$361	25.0%	$1,807	12.0%	$1,619	$405	$2,024	$0	$2,024	3.8%	$1,680	$420	$2,100
	PROJECT COST TOTALS:	$20,139	$4,940	24.5%	$25,078		$22,105	$5,431	$27,537	$0	$27,537	2.8%	$22,722	$5,585	$28,307

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: $28,307

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Filename: TPCS_Alternative 4 - Refined - TSP - Bank Stabilization.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 2 of 8

****** CONTRACT COST SUMMARY ******

PROJECT: **Selma FRM Study - Soldier-Pile Wall**
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Oct-19 Effective Price Level: 1-Oct-19				Program Year (Budget EC): 2023 Effective Price Level Date: 1 OCT 22								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*P*	*L*	*M*	*N*	*O*
	Soldier Pile Wall													
16	BANK STABILIZATION	$16,064	$4,016	25.0%	$20,080	9.5%	$17,588	$4,397	$21,985	2024Q1	3.0%	$18,116	$4,529	$22,645
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$16,064	$4,016	25.0%	$20,080		$17,588	$4,397	$21,985			$18,116	$4,529	$22,645
01	LANDS AND DAMAGES (LERRD)	$380	$0	0.0%	$380	0.0%	$380	$0	$380	2024Q1	0.0%	$380	$0	$380
30	PLANNING, ENGINEERING & DESIGN													
1.0%	PED	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
1.0%	Planning & Environmental Compliance	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
5.0%	Engineering & Design	$803	$201	25.0%	$1,004	12.0%	$899	$225	$1,124	2023Q1	0.0%	$899	$225	$1,124
1.0%	Reviews, ATRs, IEPRs, VE	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
1.0%	Life Cycle Updates (cost, schedule, risks)	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
1.0%	Contracting & Reprographics	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
3.0%	Engineering During Construction	$482	$120	25.0%	$602	12.0%	$540	$135	$675	2024Q1	3.8%	$560	$140	$700
1.0%	Planning During Construction	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2024Q1	3.8%	$187	$47	$233
0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$2,249												
31	CONSTRUCTION MANAGEMENT													
6.0%	Construction Management	$964	$241	25.0%	$1,205	12.0%	$1,079	$270	$1,349	2024Q1	3.8%	$1,120	$280	$1,400
1.5%	Project Operation:	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q1	3.8%	$280	$70	$350
1.5%	Project Management	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q1	3.8%	$280	$70	$350
	CONTRACT COST TOTALS:	$22,388	$4,940		$25,078		$22,105	$5,431	$27,537			$22,722	$5,585	$28,307

****** CONTRACT COST SUMMARY ******

PROJECT: **Selma FRM Study - Bank Stabilization - Soldier Pile Wall**
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure	ESTIMATED COST	PROJECT FIRST COST (Constant Dollar Basis)	TOTAL PROJECT COST (FULLY FUNDED)

Filename: [illegible] Bank Stabilization.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 1 of 9

PROJECT: Selma FRM Study - Soldier-Pile Wall and Buyouts
PROJECT NO: 0
LOCATION: Selma, AL

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2023 Effective Price Level Date: 1 OCT 22									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
16	Selma Flood Risk Management Project	$17,227	$4,307	25.0%	$21,534	9.5%	$18,862	$4,715	$23,577	$0	$23,577	3.0%	$19,427	$4,857	$24,284
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$17,227	$4,307		$21,534	9.5%	$18,862	$4,715	$23,577	$0	$23,577	3.0%	$19,427	$4,857	$24,284
01	LANDS AND DAMAGES	$3,300	$0	0.0%	$3,300	0.0%	$3,300	$0	$3,300	$0	$3,300	0.0%	$3,300	$0	$3,300
30	PLANNING, ENGINEERING & DESIGN	$2,396	$599	25.0%	$2,995	12.0%	$2,683	$671	$3,354	$0	$3,354	1.1%	$2,712	$678	$3,391
31	CONSTRUCTION MANAGEMENT	$1,550	$388	25.0%	$1,938	12.0%	$1,736	$434	$2,170	$0	$2,170	3.8%	$1,802	$451	$2,253
	PROJECT COST TOTALS:	$24,474	$5,203	21.6%	$29,767		$26,581	$5,820	$32,401	$0	$32,401	2.6%	$27,242	$5,986	$33,228

CHIEF, COST ENGINEERING, xxx

ESTIMATED TOTAL PROJECT COST: $33,228

PROJECT MANAGER, xxx

#######

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

Filename: TPCS_Alternative 5_Bank Stabilization and Buyouts.xls
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 2 of 9

****** CONTRACT COST SUMMARY ******

PROJECT: Selma FRM Study - Soldier-Pile Wall and Buyouts
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Oct-19				Program Year (Budget EC): 2023								
		Effective Price Level: 1-Oct-19				Effective Price Level Date: 1 OCT 22								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	RISK BASED CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Soldier Pile Wall													
16	BANK STABILIZATION	$16,064	$4,016	25.0%	$20,080	9.5%	$17,588	$4,397	$21,985	2024Q1	3.0%	$18,116	$4,529	$22,645
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$16,064	$4,016	25.0%	$20,080		$17,588	$4,397	$21,985			$18,116	$4,529	$22,645
01	LANDS AND DAMAGES	$300	$0	0.0%	$300	0.0%	$300	$0	$300	2024Q1	0.0%	$300	$0	$300
30	PLANNING, ENGINEERING & DESIGN													
	1.0% PED	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0% Planning & Environmental Compliance	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	4.9% Engineering & Design	$789	$197	25.0%	$986	12.0%	$883	$221	$1,104	2023Q1	0.0%	$883	$221	$1,104
	1.0% Reviews, ATRs, IEPRs, VE	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0% Life Cycle Updates (cost, schedule, risks)	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0% Contracting & Reprographics	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	3.0% Engineering During Construction	$482	$120	25.0%	$602	12.0%	$540	$135	$675	2024Q1	3.8%	$560	$140	$700
	1.0% Planning During Construction	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2024Q1	3.8%	$187	$47	$233
	0.0% Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.0% Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$2,235												
31	CONSTRUCTION MANAGEMENT													
	6.0% Construction Management	$964	$241	25.0%	$1,205	12.0%	$1,079	$270	$1,349	2024Q1	3.8%	$1,120	$280	$1,400
	1.5% Project Operation:	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q1	3.8%	$280	$70	$350
	1.5% Project Management	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q1	3.8%	$280	$70	$350
	CONTRACT COST TOTALS:	$22,279	$4,936		$24,980		$22,009	$5,427	$27,436			$22,626	$5,581	$28,207

****** CONTRACT COST SUMMARY ******

PROJECT: Selma FRM Study - Bank Stabilization - Soldier Pile Wall
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure	ESTIMATED COST	PROJECT FIRST COST (Constant Dollar Basis)	TOTAL PROJECT COST (FULLY FUNDED)

Filename: TPCS - Alternative 5 - Bank Stabilization and Buyouts.xlsx
TPCS

****** TOTAL PROJECT COST SUMMARY ******

Printed:8/18/2020
Page 3 of 9

		Estimate Prepared:			9-Oct-19	Program Year (Budget EC):			2023					
		Effective Price Level:			1-Oct-19	Effective Price Level Date:			1 OCT 22					
WBS NUMBER A	Civil Works Feature & Sub-Feature Description B	COST ($K) C	CNTG ($K) D	CNTG (%) E	TOTAL ($K) F	ESC (%) G	COST ($K) H	CNTG ($K) I	TOTAL ($K) J	Mid-Point Date P	INFLATED (%) L	COST ($K) M	CNTG ($K) N	FULL ($K) O
	Buyout/Relocation Assistance													
02	RELOCATIONS	$1,163	$291	25.0%	$1,454	9.5%	$1,273	$318	$1,592	2024Q1	3.0%	$1,312	$328	$1,639
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$1,163	$291	25.0%	$1,454		$1,273	$318	$1,592			$1,312	$328	$1,639
01	LANDS AND DAMAGES	$3,000	$0	0.0%	$3,000	0.0%	$3,000	$0	$3,000	2024Q1	0.0%	$3,000	$0	$3,000
30	PLANNING, ENGINEERING & DESIGN													
1.0%	Project Management	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
1.0%	Planning & Environmental Compliance	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
4.9%	Engineering & Design	$57	$14	25.0%	$71	12.0%	$64	$16	$80	2023Q1	0.0%	$64	$16	$80
1.0%	Reviews, ATRs, IEPRs, VE	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
1.0%	Life Cycle Updates (cost, schedule, risks)	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
1.0%	Contracting & Reprographics	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
3.0%	Engineering During Construction	$35	$9	25.0%	$44	12.0%	$39	$10	$49	2024Q1	3.8%	$41	$10	$51
1.0%	Planning During Construction	$12	$3	25.0%	$15	12.0%	$13	$3	$16	2024Q1	3.8%	$14	$3	$17
0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		$162												
31	CONSTRUCTION MANAGEMENT													
6.0%	Construction Management	$70	$17	25.0%	$87	12.0%	$78	$20	$98	2024Q1	3.8%	$81	$20	$101
1.5%	Project Operation:	$17	$4	25.0%	$22	12.0%	$20	$5	$24	2024Q1	3.8%	$20	$5	$25
1.5%	Project Management	$17	$4	25.0%	$22	12.0%	$20	$5	$24	2024Q1	3.8%	$20	$5	$25
	CONTRACT COST TOTALS:	$4,591	$357		$4,787		$4,572	$393	$4,965			$4,616	$404	$5,020

Filename: TPCS - Alternative 5 - Bank Stabilization and Buyouts.xlsx
TPCS

**** TOTAL PROJECT COST SUMMARY ****

Printed:8/18/2020
Page 1 of 10

PROJECT: Selma FRM Study - Levee, Soldier-Pile Wall and Buyouts
PROJECT NO: 0
LOCATION: Selma, AL

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 08/18/2020

This Estimate reflects the scope and schedule in report; 0

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)						TOTAL PROJECT COST (FULLY FUNDED)			
						Program Year (Budget EC): 2023									
						Effective Price Level Date: 1 OCT 22									
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Spent Thru: 1-Oct-19 ($K)	TOTAL FIRST COST ($K)	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J		K	L	M	N	O
16	Selma Flood Risk Management Project	$51,884	$23,356	45.0%	$75,240	9.5%	$56,807	$25,573	$82,380	$0	$82,380	3.0%	$58,511	$26,340	$84,851
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	#N/A	$0	$0	-	$0	-	$0	$0	$0	$0	$0	-	$0	$0	$0
	CONSTRUCTION ESTIMATE TOTALS:	$51,884	$23,356		$75,240	9.5%	$56,807	$25,573	$82,380	$0	$82,380	3.0%	$58,511	$26,340	$84,851
01	LANDS AND DAMAGES	$3,100	$0	0.0%	$3,100	0.0%	$3,100	$0	$3,100	$0	$3,100	0.0%	$3,100	$0	$3,100
30	PLANNING, ENGINEERING & DESIGN	$7,264	$3,270	45.0%	$10,534	12.0%	$8,133	$3,661	$11,795	$0	$11,795	1.9%	$8,291	$3,733	$12,024
31	CONSTRUCTION MANAGEMENT	$4,670	$2,102	45.0%	$6,772	12.0%	$5,229	$2,354	$7,582	$0	$7,582	6.0%	$5,584	$2,514	$8,098
	PROJECT COST TOTALS:	$66,917	$28,728	42.9%	$95,646		$73,269	$31,588	$104,857	$0	$104,857	3.1%	$75,487	$32,586	$108,073

CHIEF, COST ENGINEERING, xxx

PROJECT MANAGER, xxx

CHIEF, REAL ESTATE, xxx

CHIEF, PLANNING, xxx

CHIEF, ENGINEERING, xxx

CHIEF, OPERATIONS, xxx

CHIEF, CONSTRUCTION, xxx

CHIEF, CONTRACTING,xxx

CHIEF, PM-PB, xxxx

CHIEF, DPM, xxx

ESTIMATED TOTAL PROJECT COST: $108,073

Filename: TPCS - Alternative 6 - Optimized Levee and Bank Stabilization and Buyouts.xlsx
TPCS

**** TOTAL PROJECT COST SUMMARY ****

**** CONTRACT COST SUMMARY ****

PROJECT: Selma FRM Study - Levee, Soldier-Pile Wall and Buyouts
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
			Estimate Prepared: 9-Oct-19				Program Year (Budget EC): 2023								
			Effective Price Level: 1-Oct-19				Effective Price Level Date: 1 OCT 22								
					RISK BASED										
WBS NUMBER		Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A		B	C	D	E	F	G	H	I	J	P	L	M	N	O
		Soldier Pile Wall													
16		BANK STABILIZATION	$16,064	$4,016	25.0%	$20,080	9.5%	$17,588	$4,397	$21,985	2024Q1	3.0%	$18,116	$4,529	$22,645
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		CONSTRUCTION ESTIMATE TOTALS:	$16,064	$4,016	25.0%	$20,080		$17,588	$4,397	$21,985			$18,116	$4,529	$22,645
01		LANDS AND DAMAGES	$300	$0	0.0%	$300	0.0%	$300	$0	$300	2024Q1	0.0%	$300	$0	$300
30		PLANNING, ENGINEERING & DESIGN													
	1.0%	PED	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0%	Planning & Environmental Compliance	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	5.0%	Engineering & Design	$803	$201	25.0%	$1,004	12.0%	$899	$225	$1,124	2023Q1	0.0%	$899	$225	$1,124
	1.0%	Reviews, ATRs, IEPRs, VE	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0%	Life Cycle Updates (cost, schedule, risks)	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	1.0%	Contracting & Reprographics	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2023Q1	0.0%	$180	$45	$225
	3.0%	Engineering During Construction	$482	$120	25.0%	$602	12.0%	$540	$135	$675	2024Q4	6.8%	$576	$144	$720
	1.0%	Planning During Construction	$161	$40	25.0%	$201	12.0%	$180	$45	$225	2024Q4	6.8%	$192	$48	$240
	0.0%	Adaptive Management & Monitoring	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.0%	Project Operations	$0	$0	25.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31		CONSTRUCTION MANAGEMENT													
	6.0%	Construction Management	$964	$241	25.0%	$1,205	12.0%	$1,079	$270	$1,349	2024Q4	6.8%	$1,153	$288	$1,441
	1.5%	Project Operation:	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q4	6.8%	$288	$72	$360
	1.5%	Project Management	$241	$60	25.0%	$301	12.0%	$270	$67	$337	2024Q4	6.8%	$288	$72	$360
		CONTRACT COST TOTALS:	$20,059	$4,940		$24,998		$22,025	$5,431	$27,457			$22,712	$5,603	$28,316

**** CONTRACT COST SUMMARY ****

PROJECT: Selma FRM Study - Optimized Levee and Bank Stabilization
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure		ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
		Estimate Prepared: 9-Oct-19				Program Year (Budget EC): 2023								
		Effective Price Level: 1-Oct-19				Effective Price Level Date: 1 OCT 22								
WBS NUMBER	Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A	B	C	D	E	F	G	H	I	J	P	L	M	N	O
	Optimized Levee													
[illegible]	LEVEES & FLOODWALLS	[illegible]	[illegible]	55.0%	$53,718	9.5%	$37,946	$20,870	$58,816	2024Q1	3.0%	$39,084	$21,496	$60,580

Filename: TPCS - Alternative 5 - Optimized Levee and Bank Stabilization and Buyouts.xlsx
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**** TOTAL PROJECT COST SUMMARY ****

Printed:6/18/2020
Page 3 of 10

		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		CONSTRUCTION ESTIMATE TOTALS:	$34,657	$19,061	55.0%	$53,718		$37,946	$20,870	$58,816			$39,084	$21,496	$60,580
01		LANDS AND DAMAGES	$1,300	$0	0.0%	$1,300	0.0%	$1,300	$0	$1,300	2024Q1	0.0%	$1,300	$0	$1,300
30		PLANNING, ENGINEERING & DESIGN													
	1.0%	Project Management	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2023Q1	0.0%	$388	$213	$601
	1.0%	Planning & Environmental Compliance	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2023Q1	0.0%	$388	$213	$601
	5.0%	Engineering & Design	$1,733	$953	55.0%	$2,686	12.0%	$1,940	$1,067	$3,007	2023Q1	0.0%	$1,940	$1,067	$3,007
	1.0%	Reviews, ATRs, IEPRs, VE	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2023Q1	0.0%	$388	$213	$601
	1.0%	Life Cycle Updates (cost, schedule, risks)	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2023Q1	0.0%	$388	$213	$601
	1.0%	Contracting & Reprographics	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2023Q1	0.0%	$388	$213	$601
	3.0%	Engineering During Construction	$1,040	$572	55.0%	$1,612	12.0%	$1,164	$640	$1,804	2024Q4	6.8%	$1,243	$684	$1,927
	1.0%	Planning During Construction	$347	$191	55.0%	$537	12.0%	$388	$213	$601	2024Q4	6.8%	$414	$228	$642
	0.0%	Adaptive Management & Monitoring	$0	$0	55.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
	0.0%	Project Operations	$0	$0	55.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31		CONSTRUCTION MANAGEMENT													
	6.0%	Construction Management	$2,079	$1,144	55.0%	$3,223	12.0%	$2,328	$1,281	$3,609	2024Q4	6.8%	$2,487	$1,368	$3,854
	1.5%	Project Operation:	$520	$286	55.0%	$806	12.0%	$582	$320	$902	2024Q4	6.8%	$622	$342	$964
	1.5%	Project Management	$520	$286	55.0%	$806	12.0%	$582	$320	$902	2024Q4	6.8%	$622	$342	$964
		CONTRACT COST TOTALS:	$43,926	$23,445		$67,374		$48,171	$25,779	$73,950			$49,052	$26,594	$76,246

**** CONTRACT COST SUMMARY ****

PROJECT: Selma FRM Study - Optimized Levee and Bank Stabilization
LOCATION: Selma, AL
This Estimate reflects the scope and schedule in report; 0

DISTRICT: Mobile District
POC: CHIEF, COST ENGINEERING, xxx

PREPARED: 12/12/2019

Civil Works Work Breakdown Structure			ESTIMATED COST				PROJECT FIRST COST (Constant Dollar Basis)				TOTAL PROJECT COST (FULLY FUNDED)				
			Estimate Prepared: / Effective Price Level:			9-Oct-19 / 1-Oct-19	Program Year (Budget EC): / Effective Price Level Date:			2023 / 1 OCT 22					
WBS NUMBER		Civil Works Feature & Sub-Feature Description	COST ($K)	CNTG ($K)	CNTG (%)	TOTAL ($K)	ESC (%)	COST ($K)	CNTG ($K)	TOTAL ($K)	Mid-Point Date	INFLATED (%)	COST ($K)	CNTG ($K)	FULL ($K)
A		B	C	D	E	F	G	H	I	J	P	L	M	N	O
		Acquisition and Buyouts													
02		RELOCATIONS	$1,163	$279	24.0%	$1,442	9.5%	$1,273	$306	$1,579	2024Q1	3.0%	$1,312	$315	$1,626
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		#N/A	$0	$0	0.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
		CONSTRUCTION ESTIMATE TOTALS:	$1,163	$279	24.0%	$1,442		$1,273	$306	$1,579			$1,312	$315	$1,626
01		LANDS AND DAMAGES	$1,500	$0	0.0%	$1,500	0.0%	$1,500	$0	$1,500	2024Q1	0.0%	$1,500	$0	$1,500
30		PLANNING, ENGINEERING & DESIGN													
	1.0%	Project Management	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
		Filename:TPCS Planning&Env-Optimized Compliance&Bank Stabilization and Buyouts.xlsx	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16

TPCS

**** TOTAL PROJECT COST SUMMARY ****

Printed:8/18/2020
Page 4 of 10

5.0%	Engineering & Design	$59	$14	24.0%	$73	12.0%	$65	$16	$81	2023Q1	0.0%	$65	$16	$81
1.0%	Reviews, ATRs, IEPRs, VE	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
1.0%	Life Cycle Updates (cost, schedule, risks)	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
1.0%	Contracting & Reprographics	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2023Q1	0.0%	$13	$3	$16
3.0%	Engineering During Construction	$35	$8	24.0%	$43	12.0%	$39	$9	$48	2024Q4	6.8%	$42	$10	$52
1.0%	Planning During Construction	$12	$3	24.0%	$14	12.0%	$13	$3	$16	2024Q4	6.8%	$14	$3	$17
0.0%	Adaptive Management & Monitoring	$0	$0	24.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
0.0%	Project Operations	$0	$0	24.0%	$0	0.0%	$0	$0	$0	0	0.0%	$0	$0	$0
31	CONSTRUCTION MANAGEMENT													
6.0%	Construction Management	$70	$17	24.0%	$87	12.0%	$78	$19	$97	2024Q4	6.8%	$83	$20	$103
1.5%	Project Operation:	$17	$4	24.0%	$22	12.0%	$20	$5	$24	2024Q4	6.8%	$21	$5	$26
1.5%	Project Management	$17	$4	24.0%	$22	12.0%	$20	$5	$24	2024Q4	6.8%	$21	$5	$26
	CONTRACT COST TOTALS:	$2,930	$343		$3,274		$3,073	$377	$3,450			$3,123	$389	$3,512

Filename: TPCS - Alternative 6 - Optimized Levee and Bank Stabilization and Buyouts.xlsx
TPCS

Selma, Alabama

Flood Risk Management Study

Draft Integrated Feasibility Report and Environmental Assessment

APPENDIX G

US Army Corps of Engineers
Mobile District

September 14, 2020

The City of Selma Alabama
Civil War to Civil Rights and Beyond

APPENDIX-G: Other Documentation

Table of Contents

G.1. Non Federal Sponsor Documentation

G.1.1. *Feasibility Cost Share Agreement (October 9, 2018)*

AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
CITY OF SELMA ALABAMA
FOR THE
CITY OF SELMA, ALABAMA STUDY

THIS AGREEMENT is entered into this 9th day of October, 2018, by and between the Department of the Army (hereinafter the "Government"), represented by the District Commander for Mobile District (hereinafter the "District Commander") and the City of Selma, Alabama (hereinafter the "Non-Federal Sponsor"), represented by its Mayor.

WITNESSETH, THAT:

WHEREAS, on June 7, 1961, the Committee on Public Works of the House of Representatives adopted a resolution requesting the U.S. Army Corps of Engineers to review the report on the Alabama-Coosa Branch of the Mobile River, published as House Document 66, to determine the advisability of improvements for flood control on the Alabama River in Dallas County, Alabama (hereinafter the "Study");

WHEREAS, notwithstanding Section 105(a) of the Water Resources Development Act of 1986 (33 U.S.C. 2215(a)), which specifies the cost-sharing requirements generally applicable to feasibility studies, Title IV, Division B of the Bipartisan Budget Act of 2018, Public Law 115-123, enacted February 9, 2018 (hereinafter "BBA 2018"), authorizes the Government to conduct the Study at full Federal expense to the extent that appropriations provided under the Investigations heading of the BBA 2018 are available and used for such purpose; and

WHEREAS, the Government and the Non-Federal Sponsor have the full authority and capability to perform in accordance with the terms of this Agreement.

NOW, THEREFORE, the parties agree as follows:

ARTICLE I - OBLIGATIONS OF THE PARTIES

A. In accordance with Federal laws, regulations, and policies, the Government shall conduct the Study using BBA 2018 funds. In the event that there are insufficient BBA 2018 funds to complete the Study, such completion shall be subject to cost-sharing otherwise applicable to the Study and amendment of this Agreement.

1. The Government shall conduct the Study consistent with the Project Management Plan, which specifies the scope, cost, and schedule for Study activities. In consultation with the Non-Federal Sponsor, the Government may modify the Project Management Plan as necessary.

2. The cost of the Study is limited to $3 million in Federal funds, unless the Assistant Secretary of the Army (Civil Works) approves an exemption for the Study to exceed $3 million.

3. To the extent practicable and in accordance with Federal laws, regulations, and policies, the Government shall afford the Non-Federal Sponsor the opportunity to review and comment on solicitations for contracts prior to the Government's issuance of such solicitations; proposed contract modifications, including change orders; and contract claims prior to resolution thereof. Ultimately, the contents of solicitations, award of contracts, execution of contract modifications, and resolution of contract claims shall be exclusively within the control of the Government.

B. In addition to the ongoing, regular discussions of the parties in the delivery of the Study, the Government and the Non-Federal Sponsor may establish a Study Coordination Team to discuss significant issues or actions. The Non-Federal Sponsor's costs for participation on the Study Coordination Team shall be paid solely by the Non-Federal Sponsor without reimbursement or credit by the Government.

C. The Non-Federal Sponsor shall not be entitled to any credit or reimbursement for any costs it incurs in performing its responsibilities under this Agreement.

ARTICLE II - TERMINATION OR SUSPENSION

A. Upon 30 calendar days written notice to the other party, either party may elect at any time, without penalty, to suspend or terminate future performance of the Study. Furthermore, unless an exemption is approved by the Assistant Secretary of the Army (Civil Works), the Study may be terminated if a Report of the Chief of Engineers, or, if applicable, a Report of the Director of Civil Works, is not signed for the Study within 3 years after the effective date of this Agreement.

B. If the Government determines at any time that BBA 2018 funds made available for the Study are not sufficient to complete the Study, the Government shall so notify the Non-Federal Sponsor in writing, and upon exhaustion of such funds, the Government shall suspend the Study until the parties execute an amendment to this Agreement that provides for cost-sharing of the remaining work.

ARTICLE III - DISPUTE RESOLUTION

As a condition precedent to a party bringing any suit for breach of this Agreement, that party must first notify the other party in writing of the nature of the purported breach and seek in good faith to resolve the dispute through negotiation. If the parties cannot resolve the dispute through negotiation, they may agree to a mutually acceptable method of non-binding alternative dispute resolution with a qualified third party acceptable to the parties. Each party shall pay an equal share of any costs for the services provided by such a third party as such costs are incurred.

ARTICLE IV - RELATIONSHIP OF PARTIES

In the exercise of their respective rights and obligations under this Agreement, the Government and the Non-Federal Sponsor each act in an independent capacity, and neither is to be considered the officer, agent, or employee of the other. Neither party shall provide, without the consent of the other party, any contractor with a release that waives or purports to waive any rights a party may have to seek relief or redress against that contractor.

ARTICLE V - NOTICES

Any notice, request, demand, or other communication required or permitted to be given under this Agreement shall be deemed to have been duly given if in writing and delivered personally or mailed by certified or registered mail, with return receipt, as shown below. A party may change the recipient or address for such communications by giving written notice to the other party in the manner provided in this Article.

If to the Non-Federal Sponsor:

Mayor
City of Selma
P.O. Box 450
Selma, Alabama 36702-0450

If to the Government:

Commander
U.S. Army Corps of Engineers, Mobile District Attn:
CESAM-PM-C
P.O. Box 2288
Mobile, Alabama 36628

ARTICLE VI - CONFIDENTIALITY

To the extent permitted by the laws governing each party, the parties agree to maintain the confidentiality of exchanged information when requested to do so by the providing party.

ARTICLE VII - THIRD PARTY RIGHTS, BENEFITS, OR LIABILITIES

Nothing in this Agreement is intended, nor may be construed, to create any rights, confer any benefits, or relieve any liability, of any kind whatsoever in any third person not a party to this Agreement.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement, which shall become effective upon the date it is signed by the District Commander.

DEPARTMENT OF THE ARMY	CITY OF SELMA, ALABAMA
BY: Sebastien P. Joly Colonel, U.S. Army District Commander	BY: Darrio Melton Darrio Melton Mayor
DATE: 9 OCT 18	DATE: 10-3-18

CERTIFICATION REGARDING LOBBYING

The undersigned certifies, to the best of his or her knowledge and belief that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by 31 U.S.C. 1352. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Darrio Melton

Darrio Melton
Mayor
City of Selma, Alabama

DATE: 10-3-18

CITY OF SELMA, ALABAMA
OFFICE OF THE CITY ATTORNEY

JIMMY L. NUNN
City Attorney

Website:
[illegible]

Mailing Address
[illegible]
Post Office Box [illegible]
Selma, AL [illegible]

Telephone: [illegible]
Fax: [illegible]
Email: [illegible]

CERTIFICATE OF AUTHORITY

I, Jimmy Nunn, do hereby certify that I am the principal legal officer of the City of Selma, Alabama, that the City of Selma, Alabama is legally constituted public body with full authority and legal capability to perform the terms of the Agreement between the department of the Army and the City of Selma, Alabama in connection with the City of Selma, Alabama Study, and to pay damages, if necessary, in the event of the failure to perform in accordance with the terms of the Agreement, as required by Section 221 of the Flood Control Act of 1970, as amended (42 U.S.C. 1962d-5b), and that the person who executed the Agreement on behalf of the City of Selma, Alabama acted within his statutory authority.

IN WITNESS WHEREOF, I have made and executed this certification this 3rd day of October 2018.

Respectfully yours,

CITY OF SELMA, ALABAMA

A Municipal Corporation

JIMMY L. NUNN, *City Attorney*

G.1.2. *Self Certification (August 16, 2018)*

NON-FEDERAL SPONSOR'S
SELF-CERTIFICATION OF FINANCIAL CAPABILITY
FOR AGREEMENTS

I ________________ do hereby certify that I am the Chief Financial Officer of the CITY OF SELMA ALABAMA ; that I am aware of the financial obligations of the Non-Federal Sponsor for the CITY OF SELMA, ALABAMA, FLOOD RISK MANAGEMENT STUDY; and that the Non-Federal Sponsor has the financial capability to satisfy the Non-Federal Sponsor's obligations under the AGREEMENT BETWEEN THE DEPARTMENT OF THE ARMY AND CITY OF SELMA ALABAMA FOR THE CITY OF SELMA, ALABAMA, FLOOD RISK MANAGEMENT STUDY.

IN WITNESS WHEREOF, I have made and executed this certification this ______ day of ________, ____.

BY: Darrio Melton

TITLE: mayor

DATE: 8/16/18

G.1.3. *Letter of Intent (August 20, 2018)*

CITY OF SELMA

Darrio Melton
Mayor

August 20, 2018

Colonel Sebastien P. Joly
U.S. Army Corps of Engineers
Mobile District
P.O. Box 2288
Mobile, AL 36228

RE: *Letter of Intent for a General Investigation Study of City of Selma, AL Flood Risk Management*

Dear Colonel Joly:

The City of Selma is willing and able to participate as the Sponsor for the City of Selma, Alabama Flood Risk Management (FRM) Study, in partnership with the U.S. Army Corps of Engineers (USACE), to cooperatively investigate and address water resources problems and opportunities previously identified from past and current study efforts in the City of Selma, AL.

City of Selma understands that the City of Selma, AL FRM Study effort cannot occur without the allocation of Federal funds provided through the annual Congressional appropriations process. However, if selected, we intend to sign a Feasibility Cost Sharing Agreement (FCSA) to participate in the study with the USACE. After signing the FCSA, a Project Management Plan that delineates the City's and the USACE's individual and collective responsibilities (including fiscal) would be developed and agreed upon by the City of Selma and the USACE. The study would be conducted and managed by the USACE. The cost-sharing for the study would be based on a contribution determined by the Federal government and agreed to by the City of Selma based upon Congressional guidelines for this type of study. The City would also anticipate some level of "In-Kind" non monetary service contribution to offset any local match contribution would be considered.

The City of Selma is aware that this letter only constitutes an expression of intent to the USACE for a study to address the water resources problems associated with the Alabama River and is not a contractual obligation. We understand that work on the study cannot commence until it is included in the contractual obligation. We understand that work on the study cannot commence until it is included in the Administration's budget request, funds are appropriated by Congress, and an FCSA is signed. It is further understood that the City or the USACE may opt to discontinue the study at any time after the FCSA is signed but will commit to work together as partners from the scoping phase and subsequent decision points throughout the feasibility study, to include necessary support required to support risk-informed decision making. If it is determined that additional time or funding is necessary to support decisions to be made in order to complete the study, our agency will work with the USACE to determine the appropriate course of action.

Thank you for your every consideration to this request. If you require additional information, please contact Mayor Darrio Melton at (334) 874-2101.

Sincerely,

Darrio Melton, Mayor
City of Selma

Post Office Box 450 ▪ 222 Broad Street ▪ Selma, Alabama 36702 ▪ Phone: 334.874.2101 ▪ Fax 334.874.2402 ▪ [illegible]

G.2. Policy Exemption Documentation

G.2.1. *National Economic Development (NED) Exception Memo (January 10, 2020)*

**DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001**

REPLY TO ATTENTION OF:

CESAM-PD-FP

10 January 2020

MEMORANDUM FOR, Mr. Eric Bush, CESAD-PDP, U.S. Army Corps of Engineers, South Atlantic Division (SAD), 60 Forsyth Street SW, Room 10M15, Atlanta, Georgia 30303

SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

1. References:

a. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

b. Deputy for Programs and Projects Management (DPM) CW 2019-02 Director's Policy Memorandum, "Employing MSC and District Technical Expertise and Professional Judgment to empower enhanced delivery of the 2018 Emergency Supplemental Program," 24 January 2019.

c. SAD Programs Director Memorandum, "Implementation Plan to Employ District Technical Expertise and Professional Judgment to empower enhanced delivery of the 2018 Emergency Supplemental Program," 13 February 2019.

d. Director of Civil Works Memorandum Section 6, "Furthering Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works," 31 June 2017.

2. Purpose of this Memorandum: This Memorandum requests a policy exception for proposed buy-outs and bank stabilization in the City of Selma to the rule that plan selection be based on the greatest net economic benefit (the NED Plan).

3. Bipartisan Budget Act of 2018 and WRDA 2018: The Selma, Alabama Flood Risk Management Study was funded $3 million dollars to conduct and complete the study under flood risk management within 3-years.

This study also utilized best professional judgment to expedite and enhance the efficiency and effectiveness of incorporating bank stabilization elements, per WRDA 2018, to complete delivery of a feasibility report using innovative approaches to solve the City of Selma's issues. Per SMART Planning guidelines, this study is expected to be compliant with 3x3x3 and includes three levels of review.

4. Exception Request: The Mobile District is requesting a policy exception for proposed buy-outs and bank stabilization in downtown Selma to the rule that plan selection be based on the NED Plan. This rule is provided in the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. In accordance with this guidance, the Secretary may grant an exception to the rule.

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

For the tentatively selected plan, USACE would not perform an incremental benefit cost analysis to identify the recommended project, and would not make project recommendations based upon maximizing net national economic development benefits. Rather, plan selection would be based on a project that meets the four planning criteria of effectiveness, efficiency, completeness, and acceptability. Additionally, plan selection will address the P&G Four Accounts for National Economic Development, Regional Economic Development, Environmental Quality, and Other Social Effects (as it relates to cultural significance and historic preservation of national landmarks along the Alabama River shoreline).

5. Below is an assessment of the actions the District took to meet all other USACE Planning and Policy requirements. The attachment to this memo addresses the Four Accounts in detail. The NED and OSE assessments are listed below.

a. Historic and Cultural Significance: The city is best known for the 1960s Selma Voting Rights Movement which included the Selma to Montgomery marches, which began on 7 March 1965. This demonstration is remembered as "Bloody Sunday", and was covered extensively by media outlets across the United States and around the world. The imagery of Bloody Sunday led to the iconic march of Civil Rights leaders – led by Dr. Martin Luther King, Jr. - across the Edmund Pettus Bridge and through downtown Selma. The downtown area was the center of a number of hotels and businesses housed in buildings that date from the Civil War. These historic buildings provide a significant backdrop to the Edmund Pettus Bridge with its colorful array of structures and views of the Alabama River. A second march through the area was again thwarted but precipitated President Lyndon B. Johnson's introduction of the Voting Rights Act on 15 March 1965 and its ultimate passage in August of 1965. The Voting Rights Act is now a keystone of democracy in the United States.

b. Existing Flood, Erosion and Structure Conditions: Selma experiences frequent flooding due to river confluences from inland streams becoming impounded by high river flows, causing back flow into low lying areas. Additionally, the employees, residents, and visitors to the historic structures along the riverbank are exposed to public/life safety threats associated with potential sudden bank failure caused by repetitive flooding along the riverbank and increased instability of substrates. While the riverbank structures do not experience direct flood impacts, and are not in immediate danger of those impacts, there are indirect flood impacts that pose a threat to the stability of the bank and thus the structures over time. A costly assessment of the stability of the structures and a geotechnical analysis of the substrate conditions would need to be conducted to determine failure probability and imminence; this assessment would exceed the current study cost. The structures in the area, even the historically significant ones, have low depreciated replacement values. Depreciated replacement value is the standard by which the USACE estimates NED benefits for implementation of flood reduction interventions and does not consider cultural or historic significance. It should be noted that the nonstructural buyouts in the residential area are not historic or of particular cultural significance as the structures are typical 1960s style shotgun housing, currently tenant or owner occupied.

USACE has formulated flood risk reduction alternatives that would reduce risk but the limited stream of benefits from the standard assessment of NED does not produce a benefit to cost ratio that would approach unity for any USACE measure. While the structures in Selma are assigned low financial value on the basis of their physical characteristics, they are obviously of high cultural and historical value to the region and Nation and thus should be considered under OSE.

c. Preliminary NED Assessment: While Selma has a rich history, the city is financially constrained. The median household income is $24,225 compared to the Alabama average of $46,472 and national average of $57,652 according to the American Community Survey (ACS), 2013-2017 data. Since 2010,

2

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

Selma's population has declined approximately 14% (17,886 inhabitants), 80% of whom identify as Black or African American. The ACS estimates that 38.3% of Selma's residents live in poverty. This severely limits the sponsor's ability to effectively cost share construction of a selected plan. The solution to address the sponsor's ability to cost-share would be to recommend during construction a 30-year loan program for repayment.

Removing a significant number of the population to reduce flood risk would have an adverse impact to the city's tax base. To reduce these impacts, the study assessed a range of potential options for structural buy-outs to reduce flood damages which include 300, 150, and 30 structures. Moreover, to provide bank stabilization along the Selma historic riverfront, where historic structures adjacent to the bridge are located, a range of potential options for bank stabilization were also assessed. Preliminary Rough Order of Magnitude (ROM) first cost estimates were developed for each of the alternatives.

For comparison to the benefits, which are average annual flood damages reduced, the preliminary ROM first costs were stated in average annual terms using the current Federal discount rate of 2.75% for a 50-year period of analysis. Interest during construction was not included nor was the annual operation and maintenance included for these preliminary first costs.

The equivalent annual benefits were then compared to the average annual cost to develop net benefits and a benefit-to-cost ratio (BCR) for each alternative. There are no NED benefits derived for the alternatives that provide bank stabilization because these alternatives do not produce inundation reduction benefits (i.e. reduce average annual flood damages). The net benefits for each alternative were then calculated by subtracting the average annual costs from the equivalent average annual benefits, and a BCR was derived by dividing average benefits by average annual costs. The estimated net benefits and BCR based on preliminary first costs are as followed for the remaining alternatives:

Table 1: TSP Benefits and Costs Comparison ($000)
December 2019 Price Levels

TSP	Bank Stablization	Buyout	Bank Stablization and Buyout
Project First Cost	$21,408	$5,800	$27,208
Interest During Construction	$441	$160	$601
Average Annual First Cost	$809	$221	$1,030
Annual O&M Cost	$8	$0	$8
Average Annualized Costs	$817	$221	$1,038
Average Annualized Benefits	N/A	$111	$111
Net Benefits	N/A	($110)	($927)
BCR	N/A	0.5	0.1

As a result of the comparison of the alternatives, no alternatives could be identified as the NED Plan in accordance with the Federal objective. No alternative plan had positive net benefits; therefore, all alternatives were determined to have benefit to cost ratio less than 1 and would not yield an economically justified project.

d. Other Social Effects Assessment: The team also conducted an OSE analysis to determine the qualitative effects of the proposed alternatives on a number of factors that are typically considered in OSE assessments that address: historic importance, life and safety, social connectivity, and social vulnerability (see Table 2). The OSE analysis indicates that the combined alternatives of limited structural buy-outs in

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

combination with bank-line stabilization would provide some long-term benefits to the community and would help to maintain community resiliency and connectivity as well as maximize overall cultural and historical benefits to the City of Selma and to the Nation. While the structures along the riverbank do not have direct flood impacts, there are some benefits with a combination and complete alternative that would be realized.

Table 2: Other Social Effects Matrix

Factor	No Action	Buyouts	Retention Walls
Historic Importance	**Direct Adverse** impact due to loss of NRHPs along the riverfront **No Change** in Ward 8 due to no known historic properties within the area	No Change as there are no known historic properties within the proposed buyout areas	**Direct Beneficial** impact as threat to NRHP along riverfront is greatly reduced. **Indirect Adverse** impact to viewshed along historic Selma Riverfront.
Life and Safety	**Indirect adverse** impact due to threats to structural integrity of structures along the bank posing potential life and safety risk* **Indirect adverse** impact from inundation to structures in Ward 8.*	**Direct** beneficial impact as this alternative would remove people from the floodplain	**Indirect Beneficial** impact as this alternative would reduce the occurrence of structure and infrastructure collapse
Community Resiliency	**Direct adverse** impact due to city's financial difficulties in continued repairs to structures in Ward 8 and along the bank	**Direct beneficial** impact due to removal of flood prone structures	**Direct beneficial** impact due to reduced rehabilitation cost for threatened NRHP and roadways along the bank
Community Cohesion	Direct adverse impact as population decline is projected to continue	- Buyout 1A would be a direct adverse impact due to a huge reduction in the population - Buyout 1C would be **no change** due to a minimal relocation	**Indirect beneficial** impacts due to renewed revitalization and increased pride in residents, potentially leading to population retention
Social Vulnerability	**Direct Adverse** impact as low income, low employment, low population/business retention will continue	- Buyout 1A would be a direct adverse impact due to relocation of such a large number of residents* - Buyout 1C would be **no change** due to the relocation of such a low number of residents	**Indirect beneficial** impacts due to potential increase in income, employment, and population/business retention

It is the District's position that this study is significant to Alabama residents and the nation. The area is unique because it was the location of the first evidence of violent racial animus perpetrated on peaceful Civil Rights activist and served as tangible visual evidence of the mistreatment of a minority class of American citizens. This event galvanized the nation to address fundamental human and civil rights for people of color and diverse backgrounds, and lead to the historic landmark signing of the Civil Rights Voting Act of 1965 by then President Johnson.

4

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

The historic landmark and structures along the Alabama River serve as the canvas backdrop to the famed Edmund Pettus Bridge, much like the immediately recognizable New York City skyline prior to the destruction of the Twin Towers, the loss of which has forever changed the face of the famed view-scape of that city, diminishing in some respects its intrinsic value. Similarly, Selma's historic structures are indelibly linked to the bridge and the other historic structures which forms the historic context and view shed of this national/international landmark and are invaluable in their scope and breadth when it comes to their importance to the nation. Preservation of the shoreline and historic building structures ensures that the more than 200,000 world-wide visitors, which has included the last seven Presidents of the United States, that walk across the famed Edmund Pettus Bridge for commemorative events, have the opportunity to walk the same path early activist marched, reflect on their courage, respect their endurance, and protect the sacrifices many made to ensure that the nation lived up to its guiding principles of equal rights and protections for all Americans by showcasing this nation's commitment to democratic ideologies highlighted by the right to vote.

These events generate opportunities for local residents to showcase their art, share their rich culture, and reaffirm the standing principles that changed the lives of many and solidified this nation's place as a beacon of hope for many world-wide. The TSP addresses the study problems and provides opportunities for the City of Selma to build on his historic legacy in educating the region, nation, and world as it relates to addressing civil rights and equality for all. It also presents an opportunity for the agency to provide support and strengthen ties to vulnerable, small town communities that are the heart-beat of this nation.

As a standalone plan and even as a combined plan, the TSP does not yield a justified project, however considering other accounts in the justification process constructing this alternative would ensure the continued preservation of Selma's historic landmarks and view-shed structures, provides intrinsic value to the nation in solidifying its role in our civil rights history through it's contribution to standing landmark legislation, and in the stability and quality of the natural and human environment.

To address the Four Planning Criteria, a discussion of the TSP is listed below. A more detailed discussion will be included in the draft report and appendices with supportable data.

- *Acceptable:* Agencies such as the U.S. Park Service, Department of Transportation, and the City of Selma support the plan actions of preserving the historic landmarks along the Alabama River and reinforcement of the areas adjacent to the Edmund-Pettus Bridge. The plan is feasible from a technical perspective as it relates to engineering constructability, has minimal environmental impacts, is legal as there are no policies that restrict consideration of including bank stabilization measures in a flood risk management study, and with ASA(CW) approval of the NED exception to policy would be justified. Additionally, it is institutionally supported by local colleges/universities and other state/local agencies, and the limited buy-out with bank stabilization is socially acceptable to the public.

- *Effective:* The plan addresses the specific flood risk management problems by removing structures inland that receive repetitive flood damages within the flood zone. Additionally, it provides protection of historic structures that sit along the riverbank by armoring the shoreline and providing stability to weakened structural foundations that occur as a result of frequent riverine flooding and inundation processes that can lead to shear bank failure over time. This plan also reduces shoaling downstream by slowing down erosion rates of the bank, for this reach of Alabama River.

5

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

- *Efficient:* The plan is not identified as a cost effective or justified plan. It does however, provide specific opportunities for regional economic development by providing jobs and a boost to the local economy, considers other social effects by assessing community cohesion and other impacts to the residents of Selma, and protects the Nation's natural environment along the Alabama River. This plan also provides a good/service by reducing erosion and sediment inputs into the Alabama River, thus potentially reducing the need for frequent dredging activities downstream. There is a need for an ASA(CW) approved NED exception to policy.

- *Complete:* Regardless of the evaluated benefits, structural buy-out and protection of the bank in Selma, AL is complete and in the public interest and not dependent on any other actions by other entities. The plan addresses the study goals and objectives to reduce flood damages to structures receiving frequent flooding and to provide protection of historic landmarks/structures along the Alabama River by armoring the river shoreline and slowing down potential shear bank failure as a result of natural riverine flood and inundation processes. The plan provides and accounts for necessary investments and actions to ensure realization of the planned flood risk management goals and objectives specific to the TSP.

e. Programs Assessment: From a programming perspective, there is a very low risk associated with the exception request. It does not impact study milestones or the Office of Management and Budget approved list of studies that have approved funding in the amount of $3 million. The total project cost for construction is approximately $21,035,000.

f. Real Estate Assessment: Based on the existing study schedule, this request also carries a low risk associated with the completion of a Real Estate Plan. In accordance with 49 CFR § 24.205, relocation assistance shall be planned in such a manner that the problems associated with the displacement of individuals, families, businesses, farms, and nonprofit organizations are recognized and solutions are developed to minimize the adverse impacts of displacement. Such planning, where appropriate, shall precede any action by an Agency which will cause displacement, and should be scoped to the complexity and nature of the anticipated displacing activity including an evaluation of program resources available to carry out timely and orderly relocations.

g. Office of Counsel View: Due to existing and pending Congressional language and intent, specific study authority is not required. While the process of calculating benefits and solutions for damages under an FRM study and that for streambank erosion is different, there appears to be no explicit prohibition to including streambank erosion measures in an FRM study.

The policy for which an exception is being sought was developed by USACE Headquarters Office (HQ). Specifically, in the case of the HQ guidance that directs districts to include appropriate WRDA language and assessment of applicable Planning Accounts (i.e. OSE analysis via national, cultural, and historic significance) to justify projects; and provide recommendations to the ASA (CW) for exception request for policy waivers.

6. Specific "Policy" Requested to Be Waived: Using the direction provided in Section 6 of the 21 June 2017 Memorandum from the Director of Civil Works entitled, "Furthering Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works" and inclusion of bank stabilization per WRDA 2018, the District is seeking an exception policy waiver from the (ASA(CW)) to complete the feasibility study as described in paragraph 5 above.

7. Coordination: This request has been coordinated with all appropriate functional offices and subject matter experts.

8

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

8. The District point of contact for this action is Ms. Jerica Richardson, Chief of Plan Formulation Team at (251) 690-3411 or email at jerica.m.richardson@usace.army.mil.

TODD SETTERS
Acting Chief, Planning and Environmental
Division

7

G.2.2. *NED South Atlantic Division Exception Memo (January 22, 2020)*

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SOUTH ATLANTIC DIVISION
60 FORSYTH STREET SW, ROOM 10M15
ATLANTA, GA 30303-8801

CESAD-PD 22 January 2020

MEMORANDUM FOR Chief, Planning and Policy Division, HQUSACE, US Army Corps of Engineers, 441 G Street, NW, Washington DC 20314-1000

SUBJECT: Request Approval for an Exception to the U.S. Army Corps of Engineers National Economic Development Policy for the Selma, Alabama, Flood Risk Management Study

1. References:

a. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 10 March 1983.

b. Memorandum, CESAM-PD-FP, 10 January 2020, subject as above.

c. Selma, Alabama, Flood Risk Management Feasibility Study, Tentatively Selected Plan Report Summary, 13 November 2019.

2. Purpose: The purpose of this memorandum is to request your concurrence with releasing a draft feasibility report that recommends a plan that is not economically justified; and, due to unique circumstances, includes in the flood risk reduction plan critical streambank erosion measures recommended to reduce the risk of damages to historic properties.

3. Background: Selma, Alabama, with a population of about 18,000 residents, is known for its historical links to the Civil Rights Movement and the Civil War. The downtown contains three historic districts and historic properties such as the Edmund Pettus Bridge, an icon of the Civil Rights Movement. Selma has received 31 moderate or major floods since 1866 and has 1,436 structures located in the 500-year floodplain. The feasibility study is particularly focused on two parts of the city, the historic downtown adjacent to the Alabama River and the 8th Ward residential neighborhood, also adjacent to the Alabama River. The downtown is situated on high ground and does not flood. However, flood-induced streambank erosion threatens a row of historic buildings lining the Alabama River on Water Street.

4. Selma is among the more economically depressed cities in the United States. Median household income is $24,223 compared to Alabama's median household income of $46,472. Low property values throughout the city, including in the 8th Ward, limit the possibility of obtaining positive benefit to cost ratios. Consequently, Mobile District is requesting an exception to the USACE National Economic Development policy for the Selma, Alabama, Flood Risk Management Study because the proposed alternatives have a benefit to cost ratio less than one. The District evaluated the benefits and costs of several

CESAD-PD
SUBJECT: Request Approval for an Exception to the U.S. Army Corps of Engineers National Economic Development Policy for the Selma, Alabama, Flood Risk Management Study

alternatives including both structural and non-structural measures. These alternatives consisted of the buy-outs of residential parcels frequently flooded in the 8th Ward (including options to purchase about 30, 150 or 300 parcels), a levee to reduce the risk of flooding in the 8th Ward, and a retention wall at the base of the bluff overlooking the Alabama River to reduce the risk of flood-induced streambank erosion that threatens historic buildings in downtown Selma adjacent to the Edmund Pettus Bridge.

5. Mobile District reports that there are unique circumstances within Selma supporting inclusion of streambank stabilization measures in a flood risk management project to help preserve historically significant structures. The District states that there is no legal prohibition to studying streambank erosion in the Selma flood risk management study, if there is a sufficient nexus between the erosion and flood risk. Periodic flood events saturate the soils of the river embankment in downtown Selma resulting in sloughing and destabilization of the embankment, threatening adjacent historic structures.

6. For the Tentatively Selected Plan (TSP), Mobile District proposes a buy-out of about 30 parcels in the 8th Ward of Selma, along with river embankment stabilization via a retaining wall to protect historic buildings in the downtown area adjacent to the Edmund Pettus Bridge. The benefit to cost ratio for the TSP is 0.1.

7. Assuming a successful TSP Milestone meeting, South Atlantic Division (SAD) supports releasing the draft report describing the Tentatively Selected Plan for concurrent public, agency, policy, and technical reviews. Appropriate caveat language vetted with the Vertical Team will be incorporated in the draft report. SAD also endorses further consideration by the Vertical Team of the requests for policy exceptions.

8. Additionally, South Atlantic Division directed Mobile District to further evaluate and include in the draft report the feasibility of a structural (levee) alternative plan in lieu of the proposed buy-outs. Although the levee alternative would have a significantly greater cost than the buy-out of about 30 parcels, this alternative may offer a more complete flood-risk-management solution and also meeting a primary objective of maintaining community cohesion.

9. The point of contact for this action is Mr. Eric Bush, telephone (404) 562-5220, email Eric.L.Bush@usace.army.mil

LARRY D. MCCALLISTER, PhD, PE, SES
Director of Programs

2

G.2.3. *Director of Civil Works Exception Memo to Assistant Secretary of the Army for Civil Works (ASA(CW)) (May 15, 2020)*

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

CECW-SAD

May 15, 2020

MEMORANDUM FOR the Assistant Secretary of the Army for Civil Works (ASA(CW)) (Attn Mr. David Leach)

SUBJECT: Selma, Alabama, Flood Risk Management Study, National Economic Development (NED) Exception Request

1. Reference. CESAD-PD Memorandum dated 22 January 2020, Subject: Request Approval for an Exception to the U.S. Army Corps of Engineers National Economic Development Policy for the Selma, Alabama, Flood Risk Management Study (enclosed).

2. Authority. The study is being performed under the authority of House Resolution No.66 adopted 07 June 1961 and Section 1203 of the Water Resources Development Act (WRDA) of 2018 (Public Law (P.L.) No. 115-270). The study is funded through the Bipartisan Budget Act of 2018 (P.L. No. 115-123).

3. Purpose. To submit for your consideration an exception to the requirement for the U.S. Army Corps of Engineers (Corps) to recommend the NED plan, and instead allow a recommended plan based on contributions to the Other Social Effects (OSE) account.

4. Background. Selma is among the more economically depressed cities in the United States, and is known for its historical link to the Civil Rights Movement and the Civil War. The feasibility study is focused on two parts of the city, both adjacent to the Alabama River: 1) the historic downtown and 2) the 8th Ward residential neighborhood. The historic downtown and the 8th Ward residential neighborhood are hydraulically separable. The downtown is situated on high ground and does not flood, but flood-induced stream bank erosion threatens a row of historic buildings lining the Alabama River. Per the referenced Memorandum, the South Atlantic Division (SAD) and the Mobile District are requesting an exception to the NED policy for the subject study because the proposed alternatives have a benefit-to-cost ratio (BCR) less than one.

5. The 8th Ward Residential Neighborhood. Median household income in Selma is $24,223 compared to Alabama's median of $46,472. Low property values throughout the city, including in the 8th Ward, limit the possibility of obtaining positive BCRs. The Mobile District evaluated the benefits and costs of several alternatives including buyouts of residential parcels frequently flooded in the 8th Ward (including options to purchase about 30, 150 or 300 parcels) and a levee to reduce the risk of flooding. For the tentatively selected plan (TSP), the Mobile District proposes a buy-out of about 30

parcels in the 8th Ward. The non-structural plan has a BCR of 0.5. The exception request seeks to use OSE benefits to support the proposed TSP because the structures that would be bought would be removed from the floodplain and thus a reduction in life safety risk. Additionally, SAD would like the Mobile District to further evaluate and include the feasibility of a structural (levee) alternative plan in the draft report, potentially in lieu of the proposed buyouts. Although the levee alternative would have a significantly greater cost than the buyout of about 30 parcels, SAD believes the alternative may offer a more complete flood risk management solution and meets a primary objective of maintaining community cohesion.

The exception request lacks a qualitative evaluation on the likelihood of loss of life or any documentation supporting historical floods that could have led to loss of life (i.e., flood fighting activities). In addition, the exception request does not discuss the residual risk and how that would be managed through the floodplain management plan. Both factors result in an incomplete formulation of plans needed to identify the least cost alternative to address the OSE consequences, in accordance with the 1983 Principles and Guidelines for Water and Land Related Resources Implementation Studies. Based on a qualitative assessment of the velocity and depth of flooding from inundation maps and the nature of the floodplain, the review team believes evacuation may be the least cost option if given reasonable warning times. The review team believes that an evaluation of Selma's floodplain management plan/emergency evacuation plan could result in identifying cost effective alternatives to reduce OSE through evacuation planning.

6. The Historic Downtown. The proposed TSP includes river embankment stabilization via a retaining wall to protect historic buildings in the downtown area adjacent to the Edmund Pettus Bridge. The stabilization cost is estimated to be $21.4 million with a BCR of 0.1. Stream bank stabilization can be considered in the formulation of a project for Selma in accordance with Section 1203 of WRDA 2018. The district is formulating alternatives to prevent erosion that would impact historic properties linked to the National Park Service historic trail and view shed. The exception request makes a case that the community effort to sustain the historic fabric of Selma is a worthy local, state and federal goal that allows the continuation of celebrations commemorating historic events during the civil rights movement in Selma. The exception request proposes that the historic districts and trail and their significance to the community of Selma are significant enough to justify an investment decision.

7. The review team believes that if the Mobile District can demonstrate that the plan to mitigate the erosion is the least cost plan, an exception request could be supportable. The Mobile District has not completed that analysis and it was not discussed in the exception request. The approach to formulating a project under Section 14 of the Flood Control Act of 1946, as amended, could be applicable to the Selma study. For Section 14 projects, the formulation and evaluation focus on the least cost alternative solution and that alternative plan is considered to be justified if the total costs of the proposed

CECW-SAD
SUBJECT: Selma, Alabama, Flood Risk Management Study, National Economic Development (NED) Exception Request

alternative is less than the costs to relocate the threatened facility. Relocation of the structures and the potential degradation of the historic view shed that would occur if they were moved was not discussed in the exception request. Such an analysis could justify a project and render the need for an exception moot.

8. Recommendation. Considering the above, the review team believes that a project for the 8th Ward residential neighborhood would require a NED exception and a project for the Historic Downtown may need a NED exception. Both separable parts of a TSP for Selma require additional analyses to identify the least cost alternative. It is my recommendation that a NED exception be granted for the Selma Flood Risk Management Study.

ALVIN B. LEE
Director of Civil Works

Encl
1. SAD Memo, 22 Jan 20

3

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, SOUTH ATLANTIC DIVISION
60 FORSYTH STREET SW, ROOM 10M15
ATLANTA, GA 30303-8801

CESAD-PD

22 January 2020

MEMORANDUM FOR Chief, Planning and Policy Division, HQUSACE, US Army Corps of Engineers, 441 G Street, NW, Washington DC 20314-1000

SUBJECT: Request Approval for an Exception to the U.S. Army Corps of Engineers National Economic Development Policy for the Selma, Alabama, Flood Risk Management Study

1. References:

a. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, 10 March 1983.

b. Memorandum, CESAM-PD-FP, 10 January 2020, subject as above.

c. Selma, Alabama, Flood Risk Management Feasibility Study, Tentatively Selected Plan Report Summary, 13 November 2019.

2. Purpose: The purpose of this memorandum is to request your concurrence with releasing a draft feasibility report that recommends a plan that is not economically justified; and, due to unique circumstances, includes in the flood risk reduction plan critical streambank erosion measures recommended to reduce the risk of damages to historic properties.

3. Background: Selma, Alabama, with a population of about 18,000 residents, is known for its historical links to the Civil Rights Movement and the Civil War. The downtown contains three historic districts and historic properties such as the Edmund Pettus Bridge, an icon of the Civil Rights Movement. Selma has received 31 moderate or major floods since 1886 and has 1,436 structures located in the 500-year floodplain. The feasibility study is particularly focused on two parts of the city, the historic downtown adjacent to the Alabama River and the 8th Ward residential neighborhood, also adjacent to the Alabama River. The downtown is situated on high ground and does not flood. However, flood-induced streambank erosion threatens a row of historic buildings lining the Alabama River on Water Street.

4. Selma is among the more economically depressed cities in the United States. Median household income is $24,223 compared to Alabama's median household income of $46,472. Low property values throughout the city, including in the 8th Ward, limit the possibility of obtaining positive benefit to cost ratios. Consequently, Mobile District is requesting an exception to the USACE National Economic Development policy for the Selma, Alabama, Flood Risk Management Study because the proposed alternatives have a benefit to cost ratio less than one. The District evaluated the benefits and costs of several

CESAD-PD
SUBJECT: Request Approval for an Exception to the U.S. Army Corps of Engineers National Economic Development Policy for the Selma, Alabama, Flood Risk Management Study

alternatives including both structural and non-structural measures. These alternatives consisted of the buy-outs of residential parcels frequently flooded in the 8th Ward (including options to purchase about 30, 150 or 300 parcels), a levee to reduce the risk of flooding in the 8th Ward, and a retention wall at the base of the bluff overlooking the Alabama River to reduce the risk of flood-induced streambank erosion that threatens historic buildings in downtown Selma adjacent to the Edmund Pettus Bridge.

5. Mobile District reports that there are unique circumstances within Selma supporting inclusion of streambank stabilization measures in a flood risk management project to help preserve historically significant structures. The District states that there is no legal prohibition to studying streambank erosion in the Selma flood risk management study, if there is a sufficient nexus between the erosion and flood risk. Periodic flood events saturate the soils of the river embankment in downtown Selma resulting in sloughing and destabilization of the embankment, threatening adjacent historic structures.

6. For the Tentatively Selected Plan (TSP), Mobile District proposes a buy-out of about 30 parcels in the 8th Ward of Selma, along with river embankment stabilization via a retaining wall to protect historic buildings in the downtown area adjacent to the Edmund Pettus Bridge. The benefit to cost ratio for the TSP is 0.1.

7. Assuming a successful TSP Milestone meeting, South Atlantic Division (SAD) supports releasing the draft report describing the Tentatively Selected Plan for concurrent public, agency, policy, and technical reviews. Appropriate caveat language vetted with the Vertical Team will be incorporated in the draft report. SAD also endorses further consideration by the Vertical Team of the requests for policy exceptions.

8. Additionally, South Atlantic Division directed Mobile District to further evaluate and include in the draft report the feasibility of a structural (levee) alternative plan in lieu of the proposed buy-outs. Although the levee alternative would have a significantly greater cost than the buy-out of about 30 parcels, this alternative may offer a more complete flood-risk-management solution and also meeting a primary objective of maintaining community cohesion.

9. The point of contact for this action is Mr. Eric Bush, telephone (404) 562-5220, email Eric.L.Bush@usace.army.mil

LARRY D. MCCALLISTER, PhD, PE, SES
Director of Programs

2

DEPARTMENT OF THE ARMY
MOBILE DISTRICT, CORPS OF ENGINEERS
P.O. BOX 2288
MOBILE, ALABAMA 36628-0001

REPLY TO
ATTENTION OF:

CESAM-PD-FP | 10 January 2020

MEMORANDUM FOR, Mr. Eric Bush, CESAD-PDP, U.S. Army Corps of Engineers, South Atlantic Division (SAD), 60 Forsyth Street SW, Room 10M15, Atlanta, Georgia 30303

SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

1. References:

a. Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

b. Deputy for Programs and Projects Management (DPM) CW 2019-02 Director's Policy Memorandum, "Employing MSC and District Technical Expertise and Professional Judgment to empower enhanced delivery of the 2018 Emergency Supplemental Program," 24 January 2019.

c. SAD Programs Director Memorandum, "Implementation Plan to Employ District Technical Expertise and Professional Judgment to empower enhanced delivery of the 2018 Emergency Supplemental Program," 13 February 2019.

d. Director of Civil Works Memorandum Section 6, "Furthering Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works," 30 June 2017.

2. Purpose of this Memorandum: This Memorandum requests a policy exception for proposed buy-outs and bank stabilization in the City of Selma to the rule that plan selection be based on the greatest net economic benefit (the NED Plan).

3. Bipartisan Budget Act of 2018 and WRDA 2018: The Selma, Alabama Flood Risk Management Study was funded $3 million dollars to conduct and complete the study under flood risk management within 3-years.

This study also utilized best professional judgment to expedite and enhance the efficiency and effectiveness of incorporating bank stabilization elements, per WRDA 2018, to complete delivery of a feasibility report using innovative approaches to solve the City of Selma's issues. Per SMART Planning guidelines, this study is expected to be compliant with 3x3x3 and includes three levels of review.

4. Exception Request: The Mobile District is requesting a policy exception for proposed buy-outs and bank stabilization in downtown Selma to the rule that plan selection be based on the NED Plan. This rule is provided in the Economic and Environmental Principles and Guidelines (P&G) for Water and Related Land Resources Implementation Studies. In accordance with this guidance, the Secretary may grant an exception to the rule.

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

For the tentatively selected plan, USACE would not perform an incremental benefit cost analysis to identify the recommended project, and would not make project recommendations based upon maximizing net national economic development benefits. Rather, plan selection would be based on a project that meets the four planning criteria of effectiveness, efficiency, completeness, and acceptability. Additionally, plan selection will address the P&G Four Accounts for National Economic Development, Regional Economic Development, Environmental Quality, and Other Social Effects (as it relates to cultural significance and historic preservation of national landmarks along the Alabama River shoreline).

5. Below is an assessment of the actions the District took to meet all other USACE Planning and Policy requirements. The attachment to this memo addresses the Four Accounts in detail. The NED and OSE assessments are listed below.

a. Historic and Cultural Significance: The city is best known for the 1960s Selma Voting Rights Movement which included the Selma to Montgomery marches, which began on 7 March 1965. This demonstration is remembered as "Bloody Sunday", and was covered extensively by media outlets across the United States and around the world. The imagery of Bloody Sunday led to the iconic march of Civil Rights leaders – led by Dr. Martin Luther King, Jr. - across the Edmund Pettus Bridge and through downtown Selma. The downtown area was the center of a number of hotels and businesses housed in buildings that date from the Civil War. These historic buildings provide a significant backdrop to the Edmund Pettus Bridge with its colorful array of structures and views of the Alabama River. A second march through the area was again thwarted but precipitated President Lyndon B. Johnson's introduction of the Voting Rights Act on 15 March 1965 and its ultimate passage in August of 1965. The Voting Rights Act is now a keystone of democracy in the United States.

b. Existing Flood, Erosion and Structure Conditions: Selma experiences frequent flooding due to river confluences from inland streams becoming impounded by high river flows, causing back flow into low lying areas. Additionally, the employees, residents, and visitors to the historic structures along the riverbank are exposed to public/life safety threats associated with potential sudden bank failure caused by repetitive flooding along the riverbank and increased instability of substrates. While the riverbank structures do not experience direct flood impacts and are not in immediate danger of those impacts, there are indirect flood impacts that pose a threat to the stability of the bank and thus the structures over time. A costly assessment of the stability of the structures and a geotechnical analysis of the substrate conditions would need to be conducted to determine failure probability and imminence; this assessment would exceed the current study cost. The structures in the area, even the historically significant ones, have low depreciated replacement values. Depreciated replacement value is the standard by which the USACE estimates NED benefits for implementation of flood reduction interventions and does not consider cultural or historic significance. It should be noted that the nonstructural buyouts in the residential area are not historic or of particular cultural significance as the structures are typical 1960s style shotgun housing, currently tenant or owner occupied.

USACE has formulated flood risk reduction alternatives that would reduce risk but the limited stream of benefits from the standard assessment of NED does not produce a benefit to cost ratio that would approach unity for any USACE measure. While the structures in Selma are assigned low financial value on the basis of their physical characteristics, they are obviously of high cultural and historical value to the region and Nation and thus should be considered under OSE.

c. Preliminary NED Assessment: While Selma has a rich history, the city is financially constrained. The median household income is $24,223 compared to the Alabama average of $46,472 and national average of $57,652 according to the American Community Survey (ACS), 2013-2017 data. Since 2010,

2

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

Selma's population has declined approximately 14% (17,886 inhabitants), 80% of whom identify as Black or African American. The ACS estimates that 38.3% of Selma's residents live in poverty. This severely limits the sponsor's ability to effectively cost share construction of a selected plan. The solution to address the sponsor's ability to cost-share would be to recommend during construction a 30-year loan program for repayment.

Removing a significant number of the population to reduce flood risk would have an adverse impact to the city's tax base. To reduce these impacts, the study assessed a range of potential options for structural buy-outs to reduce flood damages which include 300, 150, and 30 structures. Moreover, to provide bank stabilization along the Selma historic riverfront, where historic structures adjacent to the bridge are located, a range of potential options for bank stabilization were also assessed. Preliminary Rough Order of Magnitude (ROM) first cost estimates were developed for each of the alternatives.

For comparison to the benefits, which are average annual flood damages reduced, the preliminary ROM first costs were stated in average annual terms using the current Federal discount rate of 2.75% for a 50-year period of analysis. Interest during construction was not included nor was the annual operation and maintenance included for these preliminary first costs.

The equivalent annual benefits were then compared to the average annual cost to develop net benefits and a benefit-to-cost ratio (BCR) for each alternative. There are no NED benefits derived for the alternatives that provide bank stabilization because these alternatives do not produce inundation reduction benefits (i.e. reduce average annual flood damages). The net benefits for each alternative were then calculated by subtracting the average annual costs from the equivalent average annual benefits, and a BCR was derived by dividing average benefits by average annual costs. The estimated net benefits and BCR based on preliminary first costs are as followed for the remaining alternatives:

Table 1: TSP Benefits and Costs Comparison ($000)
December 2019 Price Levels

TSP	Bank Stablization	Buyout	Bank Stablization and Buyout
Project First Cost	$21,408	$5,800	$27,208
Interest During Construction	$441	$160	$601
Average Annual First Cost	$809	$221	$1,030
Annual O&M Cost	$8	$0	$8
Average Annualized Costs	$817	$221	$1,038
Average Annualized Benefits	N/A	$111	$111
Net Benefits	N/A	($110)	($927)
BCR	N/A	0.5	0.1

As a result of the comparison of the alternatives, no alternatives could be identified as the NED Plan in accordance with the Federal objective. No alternative plan had positive net benefits; therefore, all alternatives were determined to have benefit to cost ratio less than 1 and would not yield an economically justified project.

d. Other Social Effects Assessment: The team also conducted an OSE analysis to determine the qualitative effects of the proposed alternatives on a number of factors that are typically considered in OSE assessments that address: historic importance, life and safety, social connectivity, and social vulnerability (see Table 2). The OSE analysis indicates that the combined alternatives of limited structural buy-outs in

3

CESAM-PD-PP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

combination with bank-line stabilization would provide some long-term benefits to the community and would help to maintain community resiliency and connectivity as well as maximize overall cultural and historical benefits to the City of Selma and to the Nation. While the structures along the riverbank do not have direct flood impacts, there are some benefits with a combination and complete alternative that would be realized.

Table 2: Other Social Effects Matrix

Factor	No Action	Buyouts	Retention Walls
Historic Importance	**Direct Adverse** impact due to loss of NRHPs along the riverfront **No Change** in Ward 8 due to no known historic properties within the area	No Change as there are no known historic properties within the proposed buyout areas	**Direct Beneficial** impact as threat to NRHP along riverfront is greatly reduced. **Indirect Adverse** impact to viewshed along historic Selma Riverfront.
Life and Safety	**Indirect adverse** impact due to threats to structural integrity of structures along the bank posing potential life and safety risk* **Indirect adverse** impact from inundation to structures in Ward 8.*	**Direct** beneficial impact as this alternative would remove people from the floodplain	**Indirect Beneficial** impact as this alternative would reduce the occurrence of structure and infrastructure collapse
Community Resiliency	**Direct adverse** impact due to city's financial difficulties in continued repairs to structures in Ward 8 and along the bank	**Direct beneficial** impact due to removal of flood prone structures	**Direct beneficial** impact due to reduced rehabilitation cost for threatened NRHP and roadways along the bank
Community Cohesion	Direct adverse impact as population decline is projected to continue	- Buyout 1A would be a direct adverse impact due to a huge reduction in the population - Buyout 1C would be **no change** due to a minimal relocation	**Indirect beneficial** impacts due to renewed revitalization and increased pride in residents, potentially leading to population retention
Social Vulnerability	**Direct Adverse** impact as low income, low employment, low population/business retention will continue	- Buyout 1A would be a direct adverse impact due to relocation of such a large number of residents* - Buyout 1C would be **no change** due to the relocation of such a low number of residents	**Indirect beneficial** impacts due to potential increase in income, employment, and population/business retention

It is the District's position that this study is significant to Alabama residents and the nation. The area is unique because it was the location of the first evidence of violent racial animus perpetrated on peaceful Civil Rights activist and served as tangible visual evidence of the mistreatment of a minority class of American citizens. This event galvanized the nation to address fundamental human and civil rights for people of color and diverse backgrounds, and lead to the historic landmark signing of the Civil Rights Voting Act of 1965 by then President Johnson.

4

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

The historic landmark and structures along the Alabama River serve as the canvas backdrop to the famed Edmund Pettus Bridge, much like the immediately recognizable New York City skyline prior to the destruction of the Twin Towers, the loss of which has forever changed the face of the famed view-scape of that city, diminishing in some respects its intrinsic value. Similarly, Selma's historic structures are indelibly linked to the bridge and the other historic structures which forms the historic context and view shed of this national/international landmark and are invaluable in their scope and breadth when it comes to their importance to the nation. Preservation of the shoreline and historic building structures ensures that the more than 200,000 world-wide visitors, which has included the last seven Presidents of the United States, that walk across the famed Edmund Pettus Bridge for commemorative events, have the opportunity to walk the same path early activist marched, reflect on their courage, respect their endurance, and protect the sacrifices many made to ensure that the nation lived up to its guiding principles of equal rights and protections for all Americans by showcasing this nation's commitment to democratic ideologies highlighted by the right to vote.

These events generate opportunities for local residents to showcase their art, share their rich culture, and reaffirm the standing principles that changed the lives of many and solidified this nation's place as a beacon of hope for many world-wide. The TSP addresses the study problems and provides opportunities for the City of Selma to build on his historic legacy in educating the region, nation, and world as it relates to addressing civil rights and equality for all. It also presents an opportunity for the agency to provide support and strengthen ties to vulnerable, small town communities that are the heart-beat of this nation.

As a standalone plan and even as a combined plan the TSP does not yield a justified project, however considering other accounts in the justification process constructing this alternative would ensure the continued preservation of Selma's historic landmarks and view-shed structures, provides intrinsic value to the nation in solidifying its role in our civil rights history through it's contribution to standing landmark legislation, and in the stability and quality of the natural and human environment.

To address the Four Planning Criteria, a discussion of the TSP is listed below. A more detailed discussion will be included in the draft report and appendices with supportable data.

- *Acceptable:* Agencies such as the U.S. Park Service, Department of Transportation, and the City of Selma support the plan actions of preserving the historic landmarks along the Alabama River and reinforcement of the areas adjacent to the Edmund-Pettus Bridge. The plan is feasible from a technical perspective as it relates to engineering constructability, has minimal environmental impacts, is legal as there are no policies that restrict consideration of including bank stabilization measures in a flood risk management study, and with ASA(CW) approval of the NED exception to policy would be justified. Addt'onally, it is institutionally supported by local colleges/universities and other state/local agencies, and the limited buy-out with bank stabilization is socially acceptable to the public.

- *Affective:* The plan addresses the specific flood risk management problems by removing structures inland that receive repetitive flood damages within the flood zone. Additionally, it provides protection of historic structures that sit along the riverbank by armoring the shoreline and providing stability to weakened structural foundations that occur as a result of frequent riverine flooding and inundation processes that can lead to shear bank failure over time. This plan also reduces shoaling downstream by slowing down erosion rates of the bank, for this reach of Alabama River.

5

CESAM-PD-P 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

- *Efficient:* The plan is not identified as a cost effective or justified plan. It does however, provide specific opportunities for regional economic development by providing jobs and a boost to the local economy, considers other social effects by assessing community cohesion and other impacts to the residents of Selma, and protects the Nation's natural environment along the Alabama River. This plan also provides a good/service by reducing erosion and sediment inputs into the Alabama River, thus potentially reducing the need for frequent dredging activities downstream. There is a need for an ASA(CW) approved NED exception to policy.

- *Complete:* Regardless of the evaluated benefits, structural buy-out and protection of the bank in Selma, AL is complete and in the public interest and not dependent on any other actions by other entities. The plan addresses the study goals and objectives to reduce flood damages to structures receiving frequent flooding and to provide protection of historic landmarks/structures along the Alabama River by armoring the river shoreline and slowing down potential shear bank failure as a result of natural riverine flood and inundation processes. The plan provides and accounts for necessary investments and actions to ensure realization of the planned flood risk management goals and objectives specific to the TSP.

e. Programs Assessment: From a programming perspective, there is a very low risk associated with the exception request. It does not impact study milestones or the Office of Management and Budget approved list of studies that have approved funding in the amount of $3 million. The total project cost for construction is approximately $21,035,000.

f. Real Estate Assessment: Based on the existing study schedule, this request also carries a low risk associated with the completion of a Real Estate Plan. In accordance with 49 CFR § 24.205, relocation assistance shall be planned in such a manner that the problems associated with the displacement of individuals, families, businesses, farms, and nonprofit organizations are recognized and solutions are developed to minimize the adverse impacts of displacement. Such planning, where appropriate, shall precede any action by an Agency which will cause displacement, and should be scoped to the complexity and nature of the anticipated displacing activity including an evaluation of program resources available to carry out timely and orderly relocations.

g. Office of Counsel View: Due to existing and pending Congressional language and intent, specific study authority is not required. While the process of calculating benefits and solutions for damages under an FRM study and that for streambank erosion is different, there appears to be no explicit prohibition to including streambank erosion measures in an FRM study.

The policy for which an exception is being sought was developed by USACE Headquarters Office (HQ). Specifically, in the case of the HQ guidance that directs districts to include appropriate WRDA language and assessment of applicable Planning Accounts (i.e. OSE analysis via national, cultural, and historic significance) to justify projects; and provide recommendations to the ASA (CW) for exception request for policy waivers.

6. Specific "Policy" Requested to Be Waived: Using the direction provided in Section 6 of the 21 June 2017 Memorandum from the Director of Civil Works entitled, "Furthering Advancing Project Delivery Efficiency and Effectiveness of USACE Civil Works" and inclusion of bank stabilization per WRDA 2018, the District is seeking an exception policy waiver from the (ASA(CW)) to complete the feasibility study as described in paragraph 5 above.

7. Coordination: This request has been coordinated with all appropriate functional offices and subject matter experts.

8

CESAM-PD-FP 10 January 2020
SUBJECT: Request Approval for an exception to the U.S. Army Corps of Engineers (USACE) National Economic Development (NED) Policy for the Selma, Alabama Flood Risk Management Study

8. The District point of contact for this action is Ms. Jerica Richardson, Chief of Plan Formulation Team at (251) 690-3411 or email at jerica.m.richardson@usace.army.mil.

TODD SETTERS
Acting Chief, Planning and Environmental
Division

7

G.2.4. *NED Exception Approval from ASA(CW)*

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON, DC 20310-0108

SACW 10 June 2020

MEMORANDUM FOR THE COMMANDING GENERAL, U.S. ARMY CORPS OF ENGINEERS

SUBJECT: Selma, Alabama, Flood Risk Management Study, National Economic Development (NED) Exception Request

1. Reference memorandum, CECW-SAD, 15 May 2020, subject as above.

2. I am responding to CECW-SAD memorandum requesting an exception to the policy requiring the recommendation of the plan that maximizes net NED benefits.

3. I approve the requested policy exemption to complete the report based upon criteria under the Other Social Effects account. Upon receipt of the Chief's Report, I will provide my review and recommendation to Congress.

4. If there are any questions, your staff may contact Ms. Andrea Walker, Project Planning and Review at (202) 761-0027.

R James

R.D. JAMES
Assistant Secretary of the Army
(Civil Works)

CF:
DCG-CEO, USACE
DCW, USACE
CECW-SAD

G.2.5. *NED Exception Endorsement from Headquarters to SAD (July 16, 2020)*

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, D.C. 20314-1000

CECW-SAD RIT

16 July 2020

MEMORANDUM FOR Commander South Atlantic Division (CESAD-PD/ Dr. McCallister), 60 Forsyth Street SW, Atlanta, GA 30303-8801

SUBJECT: Approval for the Selma, Alabama, Flood Risk Management Study, National Economic Development (NED) Exception Request

1. Reference Memorandum from the Assistant Secretary of the Army for Civil Works (ASA(CW)) dated 10 June 2020, subject: Selma, Alabama, Flood Risk Management Study, National Economic Development (NED) Exception Request.

2. Per the referenced Memorandum, the ASA(CW) approved the requested policy exception to complete the report based upon criteria under the Other Social Effects (OSE) account. The following analyses are required to inform plan formulation and to support the selection of a least cost plan as the tentatively selected plan (TSP).

3. The 8th Ward Residential Neighborhood. The exception request lacked a qualitative evaluation on the likelihood of loss of life or any documentation supporting historical floods that could have led to loss of life. The exception request did not discuss residual risk and how that would be managed through the floodplain management plan. Both factors result in an incomplete formulation of plans needed to identify the least cost alternative and address the OSE consequences, in accordance with the 1983 Principles and Guidelines for Water and Land Related Resources Implementation Studies. Based on a qualitative assessment of the velocity and depth of flooding from inundation maps and the nature of the floodplain, the review team believes evacuation may be the least cost option if given reasonable warning times. The review team believes that an evaluation of Selma's floodplain management plan/emergency evacuation plan could result in identifying cost effective alternatives to reduce OSE through evacuation planning.

4. The Historic Downtown. The proposed TSP includes river embankment stabilization via a retaining wall to protect historic buildings in the downtown area adjacent to the Edmund Pettus Bridge. Stream bank stabilization can be considered in the formulation of a project for Selma in accordance with Section 1203 of WRDA 2018. It needs to be demonstrated that the recommended plan is the least cost plan to mitigate the erosion. That analysis has not been completed and it was not discussed in the exception request. The approach to formulating a project under Section 14 of the Flood Control Act of 1946, as amended, could be applicable to the Selma study. For Section 14 investigations, the formulation and evaluation of alternatives focus on the least cost alternative solution. The least cost plan is justified if the total costs of the proposed

alternative are less than the costs to relocate the threatened facility. The monetary cost of relocation of the structures, and the potential impacts to historic resources including the view shed should be analyzed at an appropriate level of detail to determine the costs of relocation.

5. In accordance with Planning Bulletin 2018-01, Feasibility Study Milestones, dated 26 September 2018, the milestone decision making authority for the Selma study and the approval of the feasibility report will now reside at Headquarters, U.S. Army Corps of Engineers. Questions regarding this matter may be directed to Wesley E. Coleman, Jr., Chief, Office of Water Project Review, at (202) 761-4102.

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STACEY E. BROWN, PMP
Chief, Planning and Policy Division
Directorate of Civil Works