



Amite River and Tributaries East of the Mississippi River, Louisiana



Appendix E: Plan Formulation November 2019

CONTENTS

1.0	Introduction	3
2.0	Management Measures	2
2.2	Structural Measures	5
2.3	Screening Criteria	7
2.4	Screening of Measures	7
2.4.1	Diversion Structures (RW-10, RW-11 and RW-13 thru RW-16)	7
2.4.2	Channelization (RW-18 thru RW-20).....	7
2.4.3	Drainage Improvements (RW-17 thru HW-5).....	8
2.4.4	Dredging of Lakes (RW-22).....	8
2.4.5	Channel Bank Gapping (RW-21).....	8
2.4.6	Floodgates (HW-4 and HW-6).....	8
3.0	INITIAL ARRAY OF ALTERNATIVES	18
3.1	Development of Initial Array of Alternative	18
3.1.1	Influence Area Lower Basin.....	18
3.1.2	Influence Area Central Basin.....	19
3.1.3	Influence Area Upper Amite River Basin.....	20
3.1.4	Influence Area of Upper and Lower Amite River Basin.....	20
3.2	Screening Criteria	23
3.3	Screening of Alternatives.....	23
3.3.1	Alternative 2: Dredging of the Amite River outfall and in the lower reaches of the Amite River	23
3.3.2	Alternative 3: Lower Amite River Channel Bank Gapping.....	23
3.3.3	Alternative 4: Hwy 22 and Port Vincent Bridge Drainage Improvement	23
3.3.4	Alternative 5: Dredging and Storage along Bayou Manchac in Multiple Small Reservoirs.....	23
3.3.5	Alternative 6: Flood Gate with Pump to Mississippi River along with Open Flood Gates at Turtle/Alligator Bayous, Nonstructural and Focused Structural	24
3.3.6	Alternative 7: Reduction of Flow Restrictions from Bridges	24
3.3.7	Alternative 8: Dredging of the Upper and Central Amite Basin above I-12.....	24
3.3.8	Alternative 9: University Lakes as Reservoirs	24
3.3.9	Alternative 11: Small Dry Dams on the Amite River (HW-2).....	24
3.3.10	Alternative 14: Conversion of Sand and Gravel Mines in the Amite Riverine to Bottomland Hardwood Forest	25
3.3.11	Alternative 15: Restoration of River Meanders.....	25
3.4	The Focused and Final Array of Alternatives	25

LIST OF TABLES

Table 1 Objectives and Constraints	3
Table 2 Management Measures	9
Table 3 Alternatives	26
Table 4 Focused Array of Alternatives	29
Table 5 Final Array of Alternatives	29

LIST OF FIGURES

Figure E-1. Management Measures located in the Lower ARB.....	15
Figure E-2. Management Measures located in the Central ARB.....	16
Figure E-3. Management Measures located in the Upper ARB.....	17
Figure E-4 – Location of Alternative 15.....	22

Section 1

Introduction

This appendix provides supplemental plan formulation information on the Amite River and Tributaries Comprehensive Study East of the Mississippi River, Louisiana (ART) to investigate and determine the extent of Federal interest in alternatives that reduce flood risk along the Amite River Basin (ARB). It supplements the information in Chapter 4 of the main report and includes tables and maps used in the development, screening, and evaluation of management measures and alternative plans.

The ART goals, objectives and constraints are identified in Chapter 2 of the report. They are included here as a point of reference for screening purposes (Table 1).

Table 1 Objectives and Constraints

OBJECTIVES	CONSTRAINTS
Reduce risk to human life from flooding.	Avoid induced development, to the maximum extent practicable, which contributes to increased life safety risk.
Reduce flood damages in the ARB to industrial, commercial, agricultural facilities, and residential and nonresidential structures.	
Reduce interruption to the nation's transportation corridors in particularly the I-10/I-12 infrastructure.	
Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.).	

Additionally, several planning considerations were identified for plan formulation that would not require the removal of an alternative plan, but were assessed as part of the plan formulation process:

- Avoid or minimize negative impacts to:
 - threatened and endangered species and protected species;
 - critical habitat, e.g., threatened and endangered species (T&E);
 - water quality;
 - cultural, historic, and Tribal resources;
 - recreation use in the basin.
- Recognition/awareness that reaches of the Amite and Comite Rivers are Scenic Rivers, which may require legislative changes in order to implement alternatives.
- Consistency with local floodplain management plans by not inducing flooding in other areas.

Section 2

Management Measures

Measures considered for this study are referred to in Chapter 4, Section 4.1. This section provides additional information about those measures that were evaluated and removed from further consideration during the planning process. Due to the large size of the study area, for presentation and discussion purposes the ARB was divided into three areas that have distinct geomorphology as discussed in Section 4.2 of the main report: the Upper Basin, Central Basin and Lower Basin (Figures 2-1 through 2-3).

The ARB primarily has flooding from two different sources. The upper basin flooding is caused from headwater flooding from rainfall events. The lower basin flooding is caused by a combination of drainage from headwaters and backwater flooding from tides and wind setup. Thirty four nonstructural and structural management measures of a variety of scales were identified for evaluation to reduce the risk of flood damages within the ARB (Table 2).

The management measures use one or more combinations of Concept/Formulation Strategy for Flood Risk Management (FRM) as follows:

- Remove Water (RW) = Removing water more quickly out of the basin
- Hold Water (HW) = During heavy rainfall events water would be held back from flowing down the basin until water levels drop to reduce the flood risk.
- Nonstructural (NS)= does not modify or restrict the natural flood
- Upper and Lower Basin (UL) = Alternative that likely results in reduced flood risk for the entire basin.
- FS = Focused Structural measures to protect critical Facilities

2.1 NONSTRUCTURAL MEASURES

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

- Nonphysical (NS-1): Consists of flood warning system/evacuation plans. While adequate land use and floodplain management development regulations already exist, it warranted further evaluation.
- Physical NS (NS-2): Consists of property acquisition and relocation assistance, elevation, and/or flood proofing of structures.

2.2 STRUCTURAL MEASURES

Structural measures are those that are physical modifications designed to reduce the frequency of damaging levels of flood inundation. Retention Structures are large, regional,

below grade structures, designed to attenuate flood peaks and release downstream at non-damaging flow rates. The following features are being considered:

- .01 Annual Exceedance Probability (AEP) dry dams along smaller Amite River Tributaries north of I-12 and/or below I-12 (HW-1).
- Large and small scale dams in the upper portion of the ARB (HW-2 and UL-1).
- Storage Area at Spanish Lake Basin (RW-7)
- Reservoirs along Bayou Manchac (HW-3)
- Diversion Structures: Diversion structure(s) located in the lower portions of the ARB that can divert flow to the Mississippi River. Gravity Fed and Pump diversions were considered as well as modifications to the Comite and Amite Rivers diversions that are presently in place RW-10 through RW-16)
- Channelization: There are numerous possible variations of this measure, including dredging channelization segments in specific downstream reaches of the river combined with upstream detention (RW-1 through RW-4, RW-18 through RW-20, and UL-2)
- Ring Levees: Ring levees, or similar, could be constructed to protect communities and other significant structures and/or lands (FS-1).
- Drainage Improvements: Numerous possibilities such as a combination of contoured swales or road cuts with traditional drainage infrastructure (culverts, catch basins, flow control structures and slotted pipe) to regulate the flow and discharge of storm water south of French Settlement (RW-17 and HW-5).
- Bridge improvements: Change in design to bridges where applicable to reduce the restriction of the flow of the Amite River and tributaries (RW-5, RW-8, RW-9).
- Dredging of Lakes: Increase the depth of the Lake Maurepas and University Lakes to increase the hold capacity of the lakes during extreme rainfall events and tide/wind backwater flooding for Lake Maurepas (RW-22 and HW-7).
- Channel Bank Gapping: Select cuts into the banks of the Amite River and Tributaries (RW-6 and RW-21).
- Floodgate: Closure of tidal pass at Lake Maurepas/Lake Pontchartrain or Hwy 61 at Blind River to reduce backwater flooding caused by tides and wind driven flooding (HW-4 and HW-6).

2.3 SCREENING CRITERIA

Screening is the ongoing process of eliminating measures, based on the planning criteria. The management measures were screened by using the formulation criteria as given and defined in ER- 1105-2-100 which includes the 1983 Principles and Guidelines. The criteria are effectiveness, efficiency, acceptability, and completeness.

The screening criteria were derived for the specific planning study using planning objectives, constraints and considerations and opportunities of the project area. Each measure was scored using a 4 point scale on whether it met the objective(s) or avoids constraints and considerations as discussed in Section 1 by using the following criteria: Exceeds (++), Meets (+), No Change (n), or Decreases (-) (Table 2). Due to the limited ability to generate new data prior to the Alternatives Milestone, metrics relied principally upon existing data and professional judgment.

2.4 SCREENING OF MEASURES

The scoring results were compiled and averaged. After scoring, the PDT reviewed the results and confirmed that the highest scoring measures should be retained. The lower scoring measures were reviewed further and nineteen measures (Table 2) were carried forward for alternative development. Below is a general discussion of those measures that were screened which were limited to structural.

2.4.1 Diversion Structures (RW-10, RW-11 and RW-13 thru RW-16)

The Mississippi River at the proposed locations (RW-11, RW-13 and RW-15) has a much higher elevation in comparison to the adjacent Amite River and tributaries. A negative flow would not be achievable by gravity fed means; therefore, the gravity fed diversions to the Mississippi River were screened out. The Bayou Conway (RW-10), Romeville (RW-14) and Union (RW-16) locations, proposed for a pump at the Mississippi River with a diversion, were screened but Bayou Manchac (RW-12) was carried forward due to the complexity of the area and potential benefits. The pump stations would have a limited radius of influence, the cost would be very significant due to the head losses associated with the pump distances needed and there would be limited opportunities to place a diversion due to large developed areas under forced drainage systems.

2.4.2 Channelization (RW-18 thru RW-20)

Dredging the outfall at Blind River (RW-18), the Lower Blind River (RW-19) and Colyell Creek (RW-20) were screened out in part due to limited benefits. Based on the LADOTD 2018 Report on Investigation into the Potential Hydraulic Impacts of Dredging the Lower Amite River dredging near the mouth of Lake Maurepas would result in negligible amounts of water surface elevation reduction due to the flood elevations being controlled by the Lake and influenced by tides. Colyell Creek has also limited benefits due to the low density of structures along the creek.

2.4.3 Drainage Improvements (RW-17 thru HW-5)

Modifications to Comite Diversion (RW-17) was screened out due to the limits of the construction project authorization. Dry Retention Ponds along the Lower Amite River was screened in part because the geomorphology of the lower Amite is extremely flat which prevents the use of dry retention ponds to be feasible in the area below I-12.

2.4.4 Dredging of Lakes (RW-22)

Increasing the depth of the Lake Maurepas (RW-22) by dredging was screened for several reasons including: limited benefits and significant impacts to the Lake Maurepas ecosystem. Additionally, overtime the measure could be ineffective with relative sea level rise since it is hydrologically connected to Lake Pontchartrain. Dredging of University Lakes was carried forward as an alternative for further evaluation (HW-7).

2.4.5 Channel Bank Gapping (RW-21)

Select cuts of the bank of the Amite River at the Amite River Diversion (RW-21) was screened out in part since it would have very limited FRM benefits and would only likely affect stages directly on the Amite River diversion channel. It would also potentially impact backwater areas. Channel bank gapping along the Amite River was carried forward as an alternative for further evaluation (RW-6).

2.4.6 Floodgates (HW-4 and HW-6)

Floodgates at Hwy 61 at Blind River (HW-4) were screened out in part since the measure would require significant improvements to other infrastructure to make it work and there would be limited benefits. Lake Maurepas/Lake Pontchartrain (HW-6) was screened in part due to limited benefits, significant impacts to the Lake Maurepas ecosystem, and historically, there has been significant public opposition to closing off the passes.

Table 2 Management Measures

Measure ID	Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
RW-1	Dredging of Outfall @ Amite River	+	n	n	n	+	n	n	-	+	-	n	+	n
RW-2	Dredging of Lower Amite River	+	n	n	n	+	n	n	-	+	-	n	+	n
RW-3	Dredging of Upper Amite River	+	n	-	n	+	n	n	-	n	-	n	+	n
RW-4	Dredging of Bayou Manchac	+	n	++	+	+	n	n	-	n	-	n	+	n
RW-5	Bridge Restrictions/ Improvements for I-12	+	n	+	+	n	n	n	-	+	-	n	+	n
RW-6	Amite River Channel Bank Gapping	+	n	n	+	n	n	n	-	+	+	+	+	n

Measure ID	Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
RW-7	Storage Area at Spanish Lake, Ascension/Iberville Parish	+	n	+	+	+	-	-	-	-	+	-	+	+
RW-8	Hwy 22 and Port Vincent Bridge Drainage Improvements	+	n	n	n	n	-	-	n	+	+	+	-	+
RW-9	Upper Amite Bridge Restrictions/Improvements	+	n	+	+	n	n	n	-	+	-	n	+	n
RW-10	Bayou Conway Pump to Mississippi River	+	n	+	+	-	n	-	-	n	+	n	n	+
RW-11	Diversion Gravity Fed (Manchac)	+	n	+	+	-	n	-	-	n	-	n	+	+
RW-12	Diversion Pump Station (Manchac)	+	n	+	+	-	n	-	-	n	-	n	+	+

Measure ID	Description	Exceeds (**), Meets (+), No Change (n), or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (**), Medium (+), Low to no issue or not applicable (n), or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
RW-13	Diversion Gravity Fed (Union)	+	n	n	n	-	n	-	n	n	+	n	n	+
RW-14	Diversion Pump Station (Union) with conveyance channel	+	n	n	n	-	n	-	n	n	+	n	n	+
RW-15	Diversion Gravity Fed (Romeville)	+	n	n	n	-	n	-	n	n	+	n	n	+
RW-16	Diversion Pump Station (Romeville) with conveyance channel	+	n	n	n	-	n	-	n	n	+	n	n	+
RW-17	Modifications to Comite Diversion	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RW-18	Dredging of Outfall @ Blind River	+	n	n	n	+	n	n	-	+	-	n	+	n
RW-19	Dredging of Lower Blind River	+	n	n	n	+	n	n	-	+	-	n	+	n

Measure ID	Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
RW-20	Dredging of Colyell Creek	n	n	n	n	+	-	-	-	-	-	n	+	n
RW-21	Amite River Diversion Channel Bank Gapping	n	n	n	n	-	n	n	+	+	+	n	n	n
RW-22	Dredging of Lake Maurepas	n	n	n	n	-	-	-	-	-	n	+	n	n
HW-1	.01 AEP Dry Dams-Upper Amite Tributaries	+	n	+	+	+	n	n	n	+	n	n	+	n
HW-2	Small Dry Dams on Amite River - Upper Amite	++	+	+	+	+	n	n	-	+	-	+	+	n
HW-3	Reservoirs along Bayou Manchac	+	n	+	+	+	n	n	-	n	-	n	n	n
HW-4	Flood Gate at Blind River Hwy 61	+	n	n	+	-	-	n	n	n	-	n	n	n

Measure ID	Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
HW-5	Dry Retention Ponds- Lower Amite	+	n	n	n	-	-	n	-	n	n	n	n	n
HW-6	Closures at Tidal Passes	+	n	n	+	-	-	n	-	n	n	n	-	n
HW-7	University Lakes as Reservoir	+	n	n	n	-	n	n	n	n	n	++	+	n
UL-1	Large Scale .04 AEP Dam - Upper Amite (i.e. Darlington)	++	n	++	++	-	-	-	n	-	+	++	++	n
NS-1	Flood warning/Monitoring systems	n	++	+	n	n	n	n	n	n	n	n	n	n
UL-2	Dredging of Amite River Tributaries	+	+	+	+	+	n	n	-	n	-	n	+	n
NS-2	Nonstructural Improvements for high frequency events	+	+	n	n	n	n	n	n	n	n	n	+	n

Measure ID	Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective NA were used for Measures that were strictly NER Measures					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
		Obj1	Obj2	Obj3	Obj4	Obj5	Con1	Con2	Con3	Con4	Con5	Con6	Con7	Con8
		Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T&E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
FS-1	Ring Levees around Critical Facilities	+	+	n	+	-	n	n	-	n	n	n	+	n

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

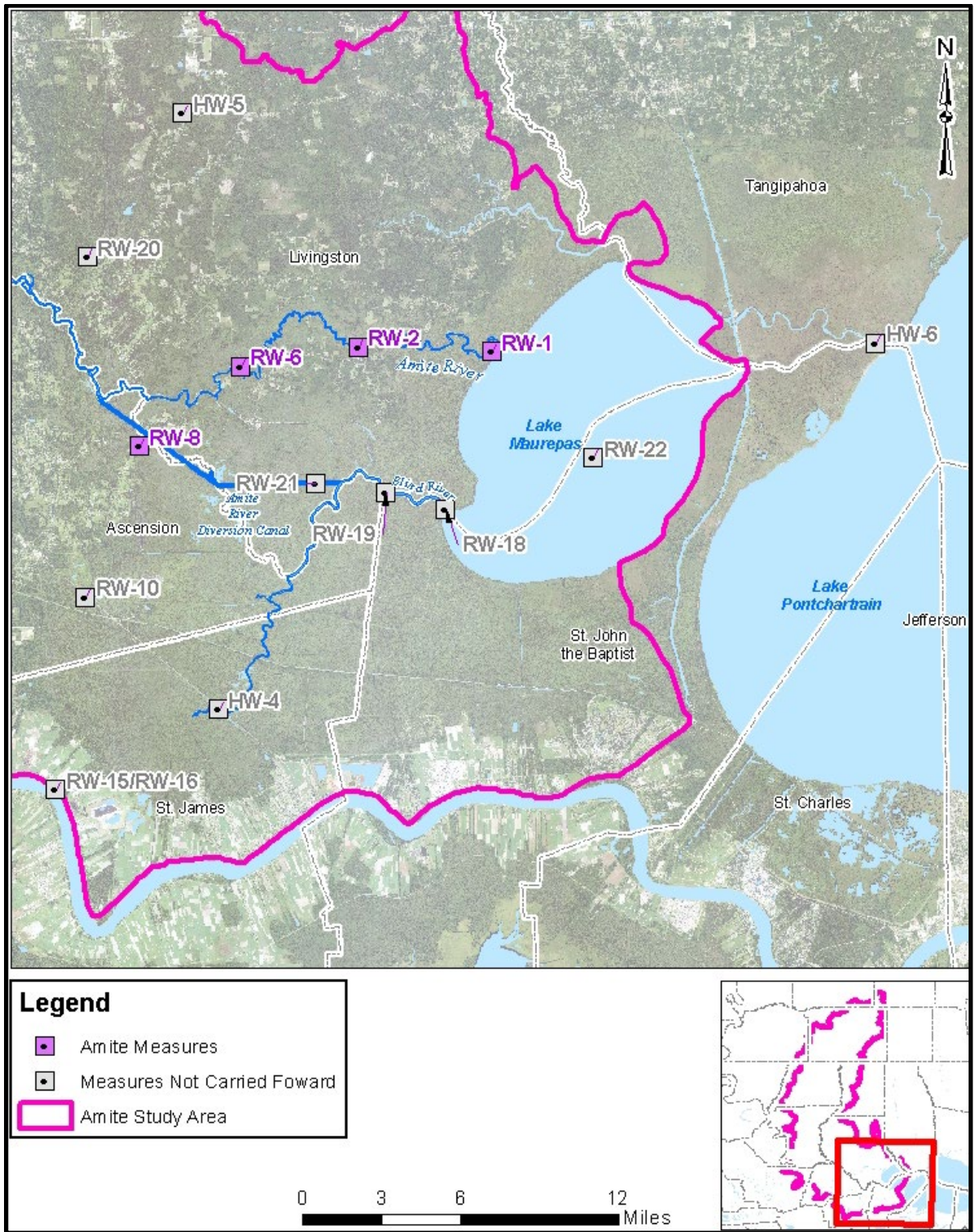


Figure E-1. Management Measures located in the Lower ARB

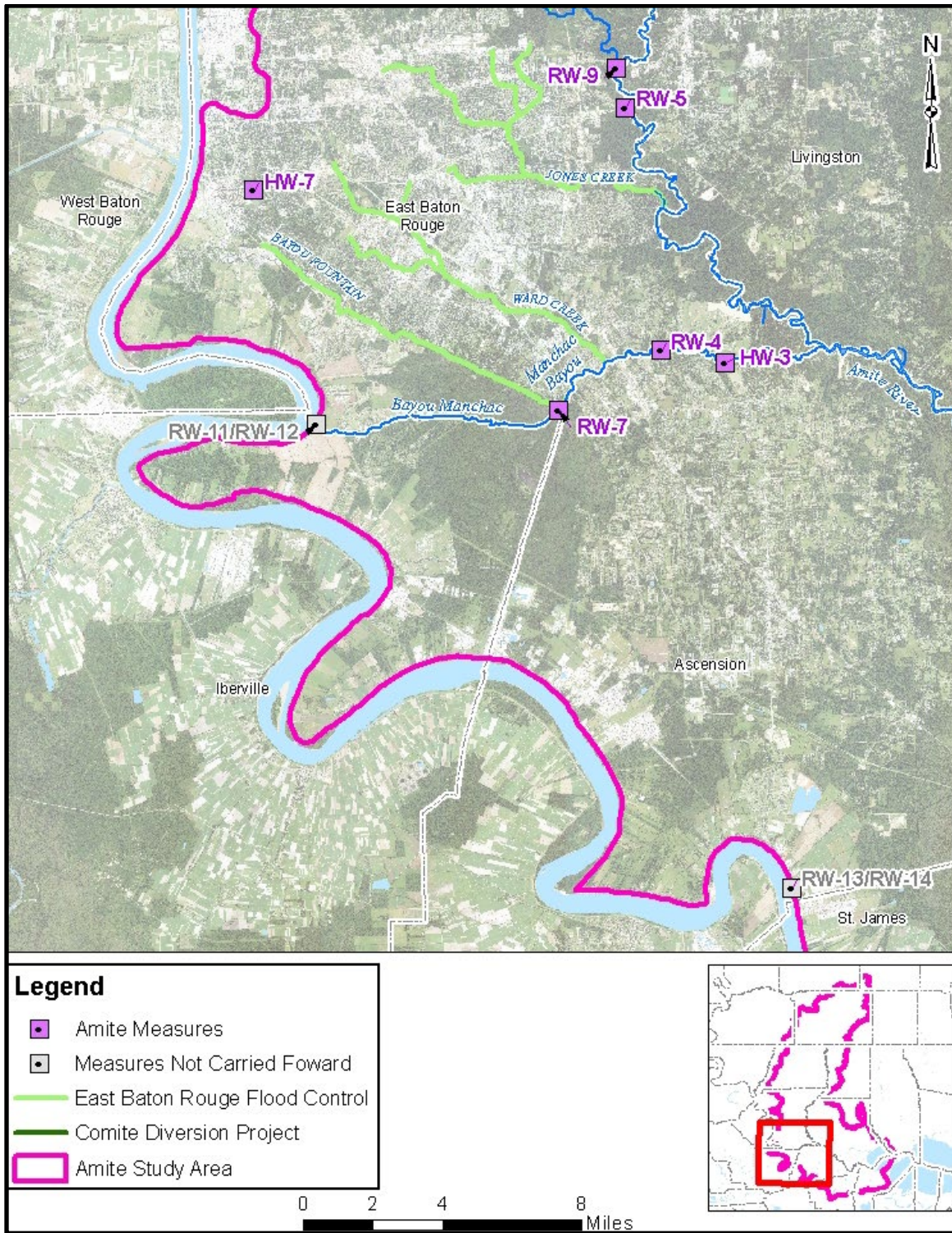


Figure E-2. Management Measures located in the Central ARB

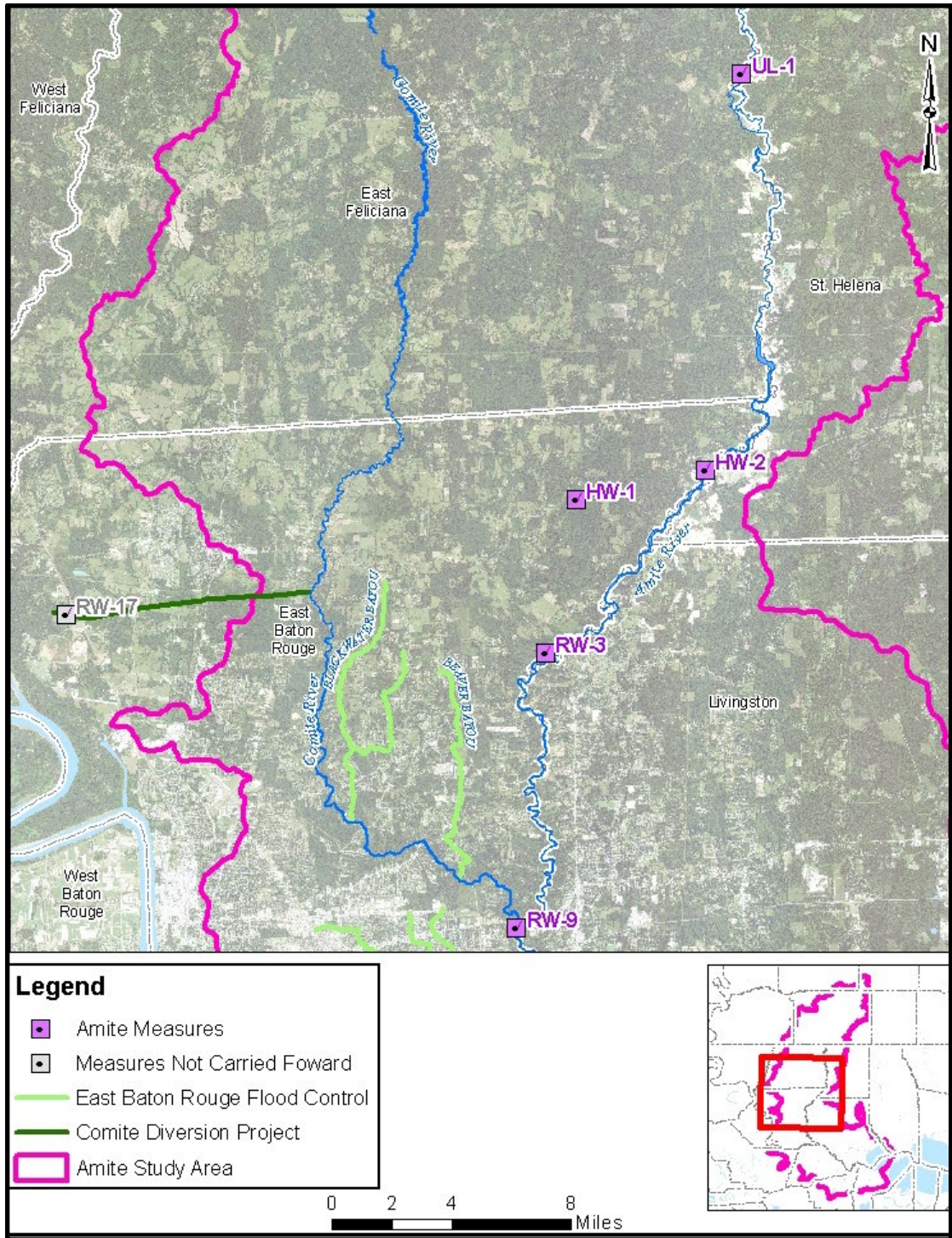


Figure E-3. Management Measures located in the Upper ARB

Section 3

INITIAL ARRAY OF ALTERNATIVES

3.1 DEVELOPMENT OF INITIAL ARRAY OF ALTERNATIVE

Fifteen alternatives were assembled through the plan formulation process. Thirteen alternative plans were initially identified using one or more of the nineteen management measures that were carried forward after the screening process. Two additional alternatives (Alternatives 14 and 15) were identified through public scoping as discussed in Section 2.4 of the main report. Similarly, to the development of management, for presentation and discussion purposes, the ARB was divided into areas of hydraulic influence as follows:

- Lower Basin
- Central Basin
- Upper Basin
- Upper and Lower Basin

NEPA regulations (40 CFR 1502.14(d)) requires that a No Action plan be considered as a viable alternative in the final array of plans. It represents future conditions that will likely occur if USACE takes no action. The No Action plan is included as Alternative 1. In accordance with Section 73 of the Water Resources Development Act of 1974, a minimum of one primarily nonstructural plan must be considered; therefore, Alternative 13 for nonstructural is included.

3.1.1 Influence Area Lower Basin

Three alternatives were identified with an influence area of the lower ARB near Lake Maurepas that use the strategy of removing water out of the basin more quickly than baseline conditions (Figure 2-1). The alternatives could be combined into several different combinations, but they focus on dredging (i.e. clearing/snagging of banks) of the Amite River in the lower reaches and outfall, channel bank gapping and Hwy 22 drainage improvements.

Alternative 2: Dredging of the Amite River outfall (RW-1) and in the lower reaches of the Amite River (RW-2). The dredging would include scraping, clearing and snagging of the banks. This potentially had an influence area from Colyell Creek to Lake Maurepas and some backwater areas.

Alternative 3: Lower Amite River Channel Bank Gapping (RW-6). This potentially had an influence area from French Settlement to Lake Maurepas.

Alternative 4: Hwy 22 and Port Vincent Bridge drainage improvements (RW-8). This potentially had an influence area from French Settlement to the River Outlet. This alternative included the assessment of the local hydrology to identify restrictions from the Port Vincent

and Highway 22 bridges. Placing culverts in the area as well as the Ascension Parish proposed plan of placing a Causeway for a portion of Hwy 22 instead of the roadway and small bridge currently in place were assessed as part of this alternative.

3.1.2 Influence Area Central Basin

Five alternatives (Alternatives 5-9) were identified that focus on addressing flood risk in the central portion of the ARB including the area of Bayou Manchac (Figure 2-2). Alternatives 5 and 6 focus on the Bayou Manchac Area and include dredging (i.e. clearing/snagging of banks), small dry reservoirs, and operation of flood gates and pumps.

Alternatives 7 and 8 focus on the central portion of the Amite River and Alternative 9 focuses on a tributary to Bayou Manchac which flows into the Amite River.

Alternative 5: Dredging (RW-4) and storage along Bayou Manchac in multiple small reservoirs (HW-3). The dredging would include scraping, clearing and snagging of the banks. This potentially had an influence area for the entire Bayou Manchac area.

Alternative 6: Flood gate with Pump to Mississippi River along with open flood gates at Turtle/Alligator Bayous (RW-7), nonstructural (NS-2) and focused structural (FS-1). This alternative includes placing a flood gate on Bayou Manchac at Airline Hwy in order to address flooding from the Amite River. Pumping to Mississippi River with a conveyance channel along Bluebonnet was included in order to address the water in Bayou Manchac between the floodgate and the Mississippi River, along with the flood gates at Turtle and Alligator Bayous to remain open so the water would flow into the natural retention area, Spanish Lake. Additionally, the alternative included nonstructural measures to address potential impacts as well and focused nonstructural such as ring levees for residential communities and critical infrastructure in the area.

Alternative 7: Reduction of flow restrictions from bridges at I-12 (RW-5) and above I-12 (RW-9). Public feedback has expressed concern over the I-12 and Hwy 190 Bridges contributing to flooding.

Alternative 8: Dredging of the Upper and Central Amite Basin, above I-12 (RW-3). The dredging would include scraping, clearing and snagging of the banks. This potentially had an influence area for the Upper and Central portions of the Amite River.

Alternative 9: University Lakes as reservoirs (HW-7). This alternative is part of the Baton Rouge Area Foundation's Baton Rouge Lakes Master Plan with a potential influence of the Bayou Duplanier area. The plan includes changing the local hydrology including the use of weirs.

3.1.3 Influence Area Upper Amite River Basin

Two alternatives (Alternatives 10 and 11) were identified with an influence area of the upper ARB that use the strategy of holding water to address extreme frequency flood events (Figure 2-3).

Alternative 10: Dry Dams along tributaries (HW-1). The .01 AEP dry dams would be placed on the larger tributaries that flow into the Amite River to provide flood risk reduction to the immediate areas and to delay the release of water being conveyed into the Amite River.

Alternative 11: Small dry dams on the Amite River (HW-2). This alternative is from the recommendations in the 1995 ARBC commissioned study which recommended three locations: Grangeville Bridge, just North of Greenwell Springs, and the St Helena/Livingston Parish Boundary.

3.1.4 Influence Area of Upper and Lower Amite River Basin

Four alternatives (Alternatives 12 through 15) were identified as having an influence area of the upper and lower ARB. These alternatives include holding water back by a large scale dam, nonstructural and natural river restoration.

Alternative 12: Large scale .04 AEP dam (UL-1). This alternative is from the recommendations in the 1997 Darlington Reservoir Re-evaluation Study by USACE. The alternative includes an earthen dam that could be dry or wet, located on the Amite River in East Feliciana and St. Helena Parishes (Figure 2-3).

Alternative 13: Nonstructural (NS-1 and NS-2). Nonstructural allows for people and structures that are exposed and vulnerable to flood risk to adapt to flooding and to risks associated with flooding. NS-1 measure improves the Flood warning/Monitoring systems by installing rain gauges in the state of Mississippi and real time water level gauges in the backwater areas so predictive flooding could be identified more easily as requested by the Natural Weather Service. NS-2 measure consist of improving elevation and/or flood proofing of residential and non-residential structures or acquisitions/relocation assistance of floodplain properties. The alternative is located throughout the ARB.

Alternative 14: Conversion of sand and gravel mines in the Amite Riverine to bottomland hardwood forest and swamp forest. Per request of the Healthy Gulf Coalition letter submitted on April 23, 2019, the alternative was added which includes the conversion of 14,000 acres of fallow mines.

Alternative 15: Restoration of River Meanders. Per request of the USFWS letter submitted on June 25, 2019, the alternative was added which includes restoring meanders to critical sections of the river where straightening has occurred due to sand and gravel mining operations. No specific locations were suggested; however, based on the recommendations in the 2011 USACE Amite River Field Investigation and Geomorphic Assessment Report, the reach of the river from approximately river mile 114 to 73 had twenty-one preliminary restoration sites (Figure 3-1).

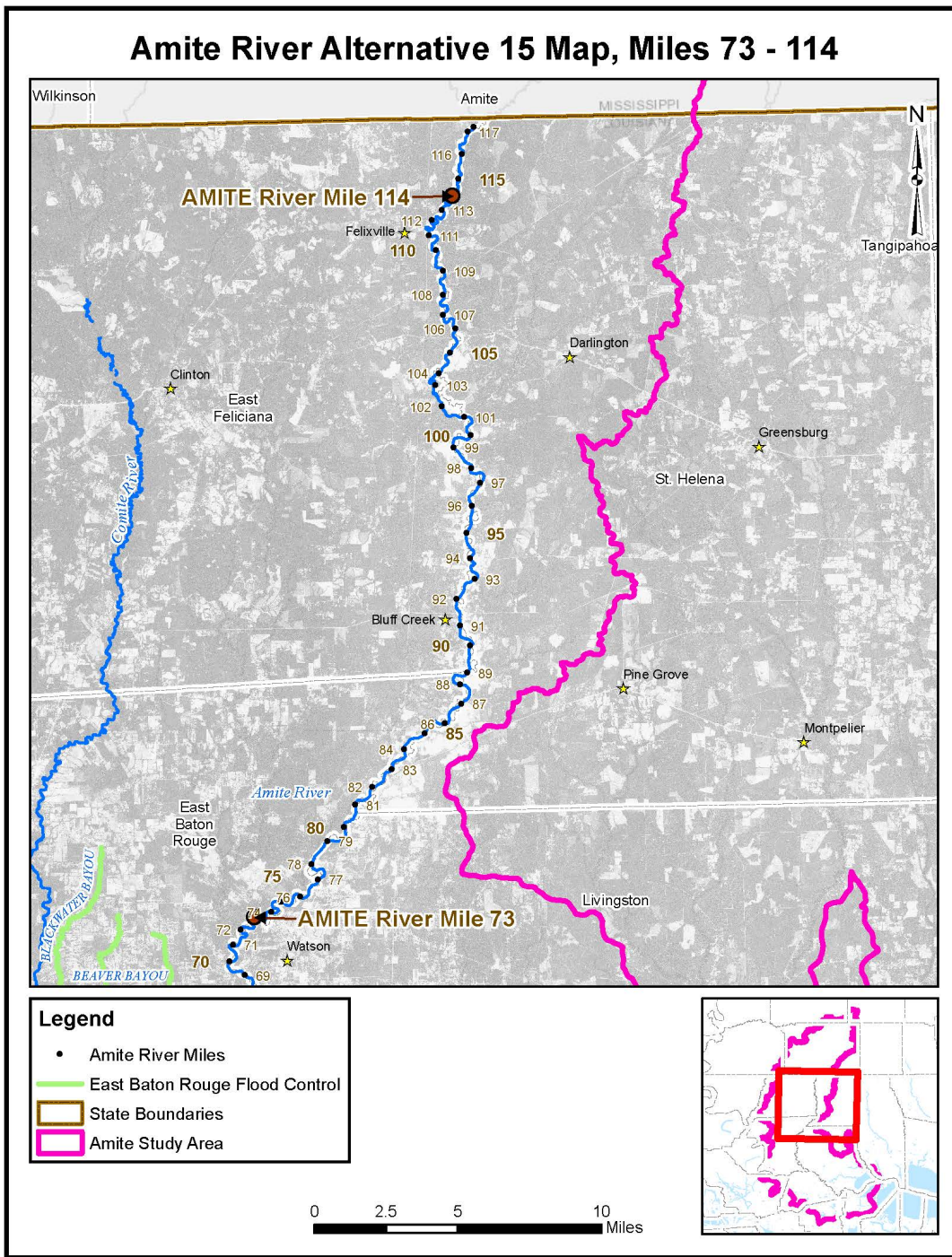


Figure E-4 – Location of Alternative 15

3.2 SCREENING CRITERIA

After the alternatives were assembled, a qualitative screening process was employed to carry forward the alternatives that showed the most promise (Table 3). Alternatives were assessed using the same specific planning study criteria used to assess individual mitigation measures as described in Section 2.2.

3.3 SCREENING OF ALTERNATIVES

The scoring results were compiled and averaged. After scoring, the PDT reviewed the results and confirmed that the highest scoring alternatives should be retained in addition to No Action and nonstructural. Alternatives 1, 10, 12 and 13 were carried forward to the final array of alternatives for further assessment and are discussed in the text of the main report. The lower scoring alternatives were reviewed further and were screened. Below is a general discussion regarding why each of the alternatives were screened. Appendix G of the main report provides an in-depth discussion of the hydrology of the ARB and of the areas that would be influenced by the alternatives.

3.3.1 Alternative 2: Dredging of the Amite River outfall and in the lower reaches of the Amite River

Per the LADOTD January 24, 2019 report by Dewberry Engineers Inc., the alternative ranged from a water surface elevation reduction of a maximum of 4-5 inches and would require dredging of 2 - 8 million cubic yards to begin seeing the lowerings. With a cost estimate minimum of \$20-80 million for dredging and without a high density of structures that would be impacted, this alternative would have limited benefits.

3.3.2 Alternative 3: Lower Amite River Channel Bank Gapping

The Lower Amite River has very low banks and quickly overflows; therefore, the alternative has limited benefits. Also, implementing bank gapping could cause shoaling of the river thus resulting in reduced capacity of the river to carry flood water.

3.3.3 Alternative 4: Hwy 22 and Port Vincent Bridge Drainage Improvement

Appendix G of the main report provides an H&H discussion of the modeling results for this area including a discussion regarding Hwy 16 for Colyell Creek and the need for additional surveys to assess this area which is outside of this feasibility study. While lowerings could be achieved at each of these areas, the drainage would provide limited benefits due to the low density of structures in the area.

3.3.4 Alternative 5: Dredging and Storage along Bayou Manchac in Multiple Small Reservoirs

Along Bayou Manchac there are limited areas that are largely undeveloped that would be available to build small reservoirs. Additionally, as stated in the USACE 1995 Feasibility Study for the East Baton Rouge Parish Watershed Flood Control Projects, due to the lack of

topographical relief of the watershed detention/retention storage, basins were determined to be impractical. Required containment structures, in conjunction with land requirements would be excessive in order to achieve significant flow retention. Detention/retention storage basins would also only reduce flood risk during localized rainfall events.

Clearing and snagging was determined to increase the flood risk as water would move more quickly into the area since the flooding along Bayou Manchac is in part due to backwater flooding from the Amite River.

3.3.5 Alternative 6: Flood Gate with Pump to Mississippi River along with Open Flood Gates at Turtle/Alligator Bayous, Nonstructural and Focused Structural

This alternative was screened out due to limited benefits and in large part due to the size and costs of the pumps required to implement the alternative. It was estimated that ten 1,000 cfs pumps each with 10' diameter discharge would be needed to pump into the Mississippi River over the levee.

3.3.6 Alternative 7: Reduction of Flow Restrictions from Bridges

Based on the hydraulic model for baseline conditions, minimal flow restrictions from bridges along the Amite River were identified; therefore it was screened out due to limited benefits. Many of the bridge restrictions presented by the public during the scoping of the study are likely from debris carried by the water during a flood event such as vegetation and general trash that become trapped within the bridge support system located in the river channel resulting in a reduction of flow.

3.3.7 Alternative 8: Dredging of the Upper and Central Amite Basin above I-12

The hydraulic model for baseline conditions did not show any areas of significance where clearing/snagging would reduce flood risk benefits due to the size of the channel and the floodplain.

3.3.8 Alternative 9: University Lakes as Reservoirs

The Baton Rouge Area Foundation provided their modeling and costs for the suggested plan. While the plan does have flood risk reduction benefits they were not enough to justify the project based on FRM alone; therefore, the alternative was screened.

3.3.9 Alternative 11: Small Dry Dams on the Amite River (HW-2)

The potential benefits from this alternative, as well as in channel weirs, would be limited to very few higher frequency events, since the river very quickly flows out of the channel. The limited benefits would also have to be adjusted for inducements of flooding upstream including along small tributaries. Additionally, in the upper basin where the small dry dams were proposed, the channel is up to two miles wide at flooding stages and the dam and/or weir would have to be fairly large with significant bank armoring. Without significant bank

armorings and tie in points, these measures would have the potential to change the geomorphology and course of the river. This alternative was screened based on limited benefits.

3.3.10 Alternative 14: Conversion of Sand and Gravel Mines in the Amite Riverine to Bottomland Hardwood Forest

The baseline conditions of the H&H model shows that the area of the sand and gravel mines is already providing a higher storage/retention than what the conversion of floodplain forest would provide so the alternative was screened. Additionally, the location of the gravel pits are primarily not immediately adjacent to the main channel of the Amite River, so the velocity reductions from the conversion of the area to Bottomland Hardwood forest would be very limited.

3.3.11 Alternative 15: Restoration of River Meanders

Adding river meanders to the Amite River would increase the length of the river and thus additional storage capacity, and floodwaters would be slowed down on their journey to inundate populated areas downstream. There are potential benefits from this alternative at higher frequency events but very unlikely at lower frequency events; therefore, the alternative was screened due to limited benefits. Appendix G of the main report provides further H&H discussion of the alternative assessment.

3.4 THE FOCUSED AND FINAL ARRAY OF ALTERNATIVES

The focused and final array of alternatives carried forward for consideration are presented in Table 4 and Table 5. Sections 4 through 7 of the Main Report presents the evaluation of the focused and final Array and subsequent Tentatively Selected Plan.

Table 3 Alternatives

Alt ID	Measures	Alternative Description	Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
			Reduce flood damages	Reduce risk to human life from flooding from rainfall events	Reduce interruption to the nation's transportation corridors	Reduce risks to critical infrastructure (e.g. medical centers, schools, transportation etc.);	Engineering with nature	T & E	Critical Habitat	Cultural	Water Quality	Scenic Rivers	Local Flood Management Plans	BBA Authorization limits	Not to induce development within flood plain
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.	n	n	n	n	n	n	N	n	n	n	n	n	n
Alt 2	RW-1+RW-2	Dredging of the Amite River outfall (RW-1) and in the lower reaches of the Amite River (RW-2)	+	n	n	n	+	n	N	-	+	-	n	+	n
Alt 3	RW-6	Lower Amite River Channel Bank Gapping (RW-6)	+	n	n	n	+	n	N	-	+	-	n	+	n
Alt 4	RW-8	Hwy 22 and Port Vincent Bridge drainage improvements (RW-8)	+	n	n	n	+	n	N	-	+	-	n	+	n

Amite River and Tributaries East of the Mississippi River, Louisiana
Appendix E: Plan Formulation

			Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration							
Alt 5	HW-3+ RW-4	Dredging (RW-4) and storage along Bayou Manchac in multiple small reservoirs (HW-3)	+	n	+	+	+	n	N	-	n	-	n	n	n
Alt 6	RW-7+NS-2+FS-1	Flood gate at Airline Hwy, Pump to MS River, open flood gates at Turtle and Alligator Bayous (RW-7) with the addition of nonstructural measures (NS-2) and ring levees for residential communities and critical infrastructure (FS-1)	+	n	++	++	++	n	N	-	n	-	n	+	n
Alt 7	RW-5+RW-9	Reduction of flow restrictions from bridges at I-12 (RW-5) and above I-12 (RW-9)	+	n	++	++	+	-	N	-	n	-	n	+	n
Alt 8	RW-3	Dredging of the Upper and Central Amite Basin, above I-12 (RW-3)	+	n	++	++	+	-	N	-	n	-	n	+	n
Alt 9	HW-7	University Lakes as reservoirs (HW-7)	+	n	n	n	-	n	n	n	n	n	++	+	n
Alt 10	HW-1	.01 AEP Dry Dams along tributaries (HW-1)	+	n	+	+	+	n	n	n	+	n	n	+	n
Alt 11	HW-2	Small dry dams on the Amite River (HW-2)	++	+	+	+	+	-	-	-	+	-	+	+	n
Alt 12	UL-1	Large scale .04 AEP dam (UL-1)	++	n	++	++	-	+	n	-	n	-	+	++	n
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2)	++	+	n	++	-	n	n	-	n	n	+	++	n

			Exceeds (++) , Meets (+) , No Change (n) , or Decreases (-) the Objective					Avoids Constraint/Considerations High (++) , Medium (+) , Low to no issue or not applicable (n) , or Conflicts (-) with the Constraint/Consideration								
Alt 14	None	Conversion of sand and gravel mines in the Amite Riverine to bottomland hardwood forest and swamp forest	n	n	n	n	++	+	+	n	-	++	++	n	n	n
Alt 15	None	Restoration of River Meanders	n	n	n	n	++	+	++	-	n	n	n	-	n	n

Table 4 Focused Array of Alternatives

Alt ID	Management Measures	Alternative Description
Alt 1	No Action	No action would be taken under this plan. Damages would continue into the future.
Alt 10	HW-1	0.01 AEP Dry Dams along tributaries (HW-1)
Alt 12	UL-1	Large scale dam: 0.04 AEP dam (UL-1)
Alt 13	NS-1+ NS-2	Nonstructural (NS-1 and NS-2)

Table 5 Final Array of Alternatives

Alternative
No Action
Dry Dam along tributary: Sandy Creek Dry Dam 0.01 AEP
Large scale dam: Darlington Dry Dam 0.04 AEP
Nonstructural: 0.04 AEP Floodplain (NS-1 and NS-2)