



3.0 ENVIRONMENTAL CONSEQUENCES (*NEPA REQUIRED)

This chapter describes the environmental consequences associated with implementing the alternatives for the nonstructural hurricane storm surge damage risk reduction (HSDRR) NED plans and the ecosystem restoration NER plans. The impacts of the NED and NER plan measures described herein and in Appendix A are assessed at a full feasibility level and are recommended for construction. Fact sheets describing the NER measures in more detail can be found in Appendix K. The Alternatives carried forward, as described in Chapter 2, for comparative analysis include the following:

NED Alternatives:

- (A) Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain is the recommended plan consisting of approximately 3,961 structures that meet the eligibility criteria broken down as follows:
 - a. 3,462 residential
 - b. 342 non-residential
 - c. 157 warehouses
- (B) Plan 8 Alternative – Nonstructural 100-Year Floodplain includes 15,667 total eligible structures broken down as follows:
 - a. 13,934 residential
 - b. 1,003 non-residential
 - c. 730 warehouses

NER Alternatives: Table 2-13 includes a listing of measures included in the final array of alternatives and tables at 2-17 includes a listing of measures that make up the NER RP alternative.

- (A) Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan is the RP. It includes 22 features in the Mermentau Basin and 27 measures in the Calcasieu/Sabine Basin for a total of 49 features. The hydrologic/salinity control measures are recommended for further study, and the oyster reef preservation measure was removed from further consideration. The features comprising the recommended plan are broken out as follows:
 - a. 9 marsh restoration measures restoring/nourishing 11,614 acres of wetlands.
 - b. 35 Chenier reforestation locations.
 - c. 5 shoreline protection measures totaling approximately 47.6 miles.
- (B) Plan M4 Alternative - This alternative totals 22 measures in the Mermentau Basin only. The measures comprising the alternatives include:
 - a. 5 marsh restoration features restoring/nourishing 6,542 acres of wetlands.
 - b. 13 Chenier reforestation locations
 - c. 4 shoreline protection measures totaling approximately 38.9 miles.

The CM-4 Alternative would restore approximately 50% more marsh or 6,063 more acres; reforest approximately 60% more (22 more) Chenier reforestation locations; and protect approximately 22% or 8.7 miles more of shoreline through shoreline protection measures.

Two marsh restoration features (124d - Marsh Restoration at Mud Lake and 3c1 - Beneficial Use of Dredged Material from the Calcasieu Ship Channel) are partially located on USFWS refuge lands. The USACE recommends that USFWS independently seek authorization and appropriation to construct these projects.

3.1 The Human Environment (Socioeconomics)

Consideration of public and policy comments on the Southwest Coastal Louisiana, Integrated Draft Feasibility Report and Programmatic Environmental Impact Statement released on December 13, 2013 and the Revised Integrated Draft Feasibility Report and Environmental Impact Statement released on March 20, 2015 regarding the NED TSP resulted in removal of the mandatory component of the plan which called for the acquisition and demolition of structures located within the FEMA Regulatory Floodway. Consequently, implementation



of the nonstructural NED Alternative would be performed on an entirely voluntary basis, which lessens the potential adverse impacts on the human environment.

3.1.1 Population and Housing HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts include the potential for damage to structures, landscaping and driveways while the structure is being elevated. There could be potential inconvenience to residents having to move and store their personal possessions and relocate to a temporary residence while their residences are being elevated. Additionally, access to the residence would be impeded during the time the residence is being elevated. Temporary relocation of individuals and families could entail different travel routes through unfamiliar areas, longer commute times to work, school, and other destinations for typical life activities (e.g., shopping, doctor and dentist visits, etc.). The change in commute times could be a positive or negative impact, since the relocation could temporarily move individuals and families either closer or farther away from their destinations.

Indirect impacts would include reduced risk of damages from hurricane storm surge events for population and housing located in the 25-year floodplain. This risk reduction would lead to greater stability and sustainability of population and housing resources. However, if a residence is elevated, access to the elevated residences could be more difficult, especially for the elderly and physically handicapped, even if retrofitted with an elevator and other special access improvements. Additional indirect impacts would be the different visual appearance of neighborhoods and communities with a few elevated structures located within a community of nearby structures that are not elevated. There could also be potential drainage issues, especially related to construction of localized storm surge risk reduction measures. However, any such Project-induced impacts would be avoided or corrected to pre-construction conditions. There is a potential that existing landscaping around residential structures could be damaged and require restoration.

Direct and indirect impacts associated with residential and commercial properties that are located in the 25-year floodplain but that do not undergo nonstructural risk reduction measures (either by choice or due to ineligibility) or that are located in the study area but do not fall within the 25-year floodplain are similar to those impacts described in Chapter 1 under the FWOP condition. This is generally true for each of the below resources and as such, will not be repeated throughout this analysis.

Plan 8 Alternative – Nonstructural 100-Year Floodplain

The impacts from this alternative are similar to the impacts identified in connection with the Modified Plan 8 Nonstructural 0-25-Year Floodplain Plan (RP) alternative but greater in scale because of the larger numbers of structures that would be included in the Project under this alternative as compared to the RP, as described in paragraph 3.0 above. This will be generally true for all resources below. Hence a discussion of impacts associated with the Plan 8 alternative will not be detailed for each of the following resources unless there is a significant reason for it to be addressed in connection with a specific resource. The scale of the differences would vary by resource but the general rule remains: impacts would be similar in nature but greater in scale for the Plan 8 alternative as compared to the RP.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

NER RP measures would have no direct impacts on population and housing. Indirect impacts would include decreasing the rate of shoreline erosion, thereby protecting the temporary population of the Holly Beach camp community located along the shoreline of the Gulf of Mexico in the Calcasieu Basin.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

The impacts of Plan M-4 are the same as the impacts identified for the Mermentau Basin component of Plan CM-4 alternative (NER RP) but overall lesser in scale due to the size of the RP by comparison, as described in paragraph 3.0 above (i.e., 49 measures in the RP as compared to 22 measures for the Plan M-4 alternative). This will be generally true for all resources below. Hence a discussion of impacts associated with the Plan M-4



alternative will not be detailed for each of the following resources unless there is a significant reason for it to be addressed in connection with a specific resource. The scale of the differences in impacts between Plan M-4 compared to the Plan CM-4 would be approximately 50% less for marsh restoration measures as there would be approximately 6,063 less acres restored; there would be 22 less chenier reforestation locations and therefore approximately 60% less impacts; miles of shoreline protected would be 8.7 miles less resulting in approximately 22% less impacts.

3.1.2 Employment, Business, and Industrial Activity (Including Agriculture)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There would be direct impacts associated with the flood proofing of businesses and the construction of localized storm surge risk reduction measures in the nonstructural plan. If commercial structures are flood proofed, businesses could potentially either shut down or relocate temporarily while the measure is being applied, which could lead to a loss of revenue, change in business clients to other more available businesses, as well as a loss of wages to employees. The construction of localized storm surge risk reduction measures around warehouses could temporarily and intermittently impede access to the warehouses during construction and cause drainage issues for adjacent areas and structures. There is a potential that existing landscaping around businesses and warehouses could be damaged and require restoration. Also, if a business relocates outside of the community, it could face the inconvenience of having to establish itself in a new area as well as longer travel distances and increased transportation costs to move the business products to markets.

Indirect impacts would include reduced risk of hurricane storm surge-related damage for employment, business, and industrial activity in the 25-year floodplain of the study area which translates into greater stability of productivity in the region.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures would have no direct impacts on employment, business, and industrial activity. Indirect effects would include the prevention of further land loss, which could result in localized positive effects of maintaining employment and businesses (e.g., recreational and commercial fishing), and industrial activity. Cumulative impacts would be beneficial and would result from improved sustainability of southwest Louisiana with similar restoration efforts, making a more stable environment for employment, business, and industrial activity.

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

The impacts for this alternative are similar to the impacts identified for the CM-4 Alternative RP but lesser in scale. For example there are 6,063 less acres of marsh restoration, 22 less Chenier reforestation locations and 8.7 miles less shoreline protection. Impacts are the same as the Mermentau Basin component of the RP.

3.1.3 Public Facilities and Services

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts associated with flood proofing to public facilities in the area would be the interruption and temporary unavailability of public services if these facilities are forced to close or are relocated to temporary locations during implementation of the nonstructural risk reduction measures.

Indirect impacts include reduced risk of hurricane storm surge-related damages for public facilities and services in the area thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the general public. Indirect impacts to public facilities and services not included in the plan would be the same as identified under the no-action alternative. Other direct and indirect impacts would be similar to those described in sections 3.1.1 and 3.1.2.

**Ecosystem Restoration (NER) Plans**Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures would have no direct, indirect, or cumulative impacts on public facilities or services.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of the RP.

3.1.4 Transportation**HSDRR (NED) Plans**Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts associated with the NED RP for transportation would include temporary and intermittent delays, disruption of traffic movement, congestion of roads, and re-routing of vehicles and pedestrians during the construction of the various risk reduction measures. Local parking access to businesses could also be affected by construction vehicles and crews and construction of the localized storm surge risk reduction measures around the warehouses.

Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials including borrow material transported for construction of local risk reduction measures at warehouses, as well as reduced parking. There would also be greater noise and dust generated by construction vehicles. However, best construction management practices would be utilized to limit dust emissions and to ensure the safety of construction workers, residents, and employees during construction of the nonstructural measures. There could be minor indirect short term impact to transportation due to construction related activities related to both structural elevations and commercial /warehouse flood proofing measures. These impacts will vary depending on the number and location of structures undergoing improvements at a given time and the timing and duration of the construction-related activities. There would be no long term impact.

Ecosystem Restoration (NER) PlansPlan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

No direct impacts on transportation. Dredging for borrow material from the Calcasieu Ship Channel would be conducted in a manner to avoid impacting navigation. Indirect impacts would include the additional wear and tear on roads, especially local roads, caused by large trucks transporting construction materials. Additional indirect impacts to transportation includes reducing the intensity of damages to the following transportation structures:

- Marsh restoration measures 124c and 47a1 would reduce the intensity of almost daily wind-generated wave action which erodes areas adjacent to Highway 82;
- Marsh restoration measure 3c1 would reduce the wave action which erodes the southern spoil bank along the GIWW from the south (This impact would only apply if USFWS obtains authorization and funding and independently implements measure 3c1.);
- Shoreline protection measure 16b would protect the shoreline of Freshwater Bayou through the placement of foreshore rock dikes;

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.5 Community and Regional Growth**HSDRR (NED) Plans**Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts would include a temporary monetary stimulus to the region due to spending associated with the construction activities in the area. This stimulus would be an increase the region's income for as long as the



spending continued. For the study area as a whole, temporary relocations would likely take place within the overall study area during implementation of the nonstructural measures, resulting in little if any change.

Indirect impacts would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25 year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Restoration measures of this alternative would have no direct or indirect impacts on community and regional growth other than the temporary monetary stimulus associated with construction activities, as described above in connection with the NED RP.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of the RP.

3.1.6 Tax Revenues and Property Values

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

For the nonstructural plan, Parish sales tax revenue would likely increase during the implementation of nonstructural measures as a result of an expected influx of workers and construction expenditures from outside of the area. Construction activities associated with the NED RP would provide jobs and could increase the level of spending, labor, and capital expenditures in the area.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

No direct effects to tax revenues and property values. Indirect effects could include following:

- fee lands acquired by the State would be removed from the ad valorem tax base of local government and no property taxes could be collected on those lands.
- the prevention of land loss could result in localized positive effects of maintaining tax revenues and property values.

Plan M-4 Alternative - Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP. Two marsh restoration features (124d - Marsh Restoration at Mud Lake and 3c1 - Beneficial Use of Dredged Material from the Calcasieu Ship Channel) are partially located on USFWS refuge lands. The USACE recommends that USFWS independently seek authorization and appropriation to construct these projects.

3.1.7 Other Social Effects (OSE)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

A summary of OSEs is presented in the Table 3-1. These include reduction in risks associated with damages from hurricane storm surge events to housing units, public facilities, and commercial structures located within areas where the RP is implemented, as well as improvement in the health and safety of those residents living within these and surrounding areas. Depending on participation rates, the overall social vulnerability of all three parishes could be reduced, and thus, the potential for long-term growth and sustainability could be enhanced. These areas could be at a reduced risk of incurring costs associated with clean-up, debris removal, and building and infrastructure repair associated with damage from a hurricane storm surge event.



Table 3-1: Summary of other social effects.

OSE Alternative Evaluation				
Social Factors and Metrics	Nonstructural Measures	CM-4	M-4	No Action
	DL / FE	DL / FE	DL / FE	DL / FE
Physical Health/Safety	1/2	1/1	0/0	-1/-2
Regional Healthcare	1/2	1/1	0/0	0/-2
Employment Opportunities	1/3	0/0	0/0	-1/-3
Community Cohesion	1/2	0/0	0/0	-1/-1
Vulnerable Groups	1/1	1/1	0/0	-1/-2
Residents of Study Area	1/1	1/1	0/0	-1/-2
Recreational Activities	1/2	1/2	0/1	-1/-2
Impacts are in comparison to the Without Project Condition DL = impacts to daily life when there is no storm/flooding FE = impacts during a storm/flood event Scores range from -3 (significant negative impact) to +3 (significant positive impact)				

Under the NED RP, tenants would be eligible for certain relocation assistance benefits. While structure owners would not be responsible for eligible costs associated with the nonstructural measures, (see Appendix L for a description of eligible costs), they would be responsible for ineligible costs associated with the structure elevation, including temporary relocation costs and any costs for moving out of the eligible structure during construction of the nonstructural measure. (See Chapter 4 and Appendix L for more information about the benefits of and the eligible and ineligible costs associated with the nonstructural plan.) The ability of lower income groups to participate in the Project could be impacted by these out of pocket expenses including the costs associated with temporary relocation during structure elevation, and any additional costs that would be required in order to meet the Project eligibility criteria, (i.e., costs associated with any necessary structural repair or asbestos abatement). This could potentially offset, to some degree, the reduction in overall social vulnerability at least in lower income communities.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

This alternative would reduce the adverse impacts to OSE associated with continued land loss, habitat fragmentation and degradation, especially with regard to the vulnerability of existing transportation (navigation and roads), oil and gas infrastructure, and recreational and commercial fishing opportunities. In the short-term the area’s social vulnerability would be reduced, to some extent, by increasing wetland EFH habitat for aquatic species associated with recreational and commercial fishing. In addition, the proposed action would increase marsh-related leisure and recreational and commercial fishing opportunities thereby having a positive localized economic impact. The long-term benefits of marsh restoration, shoreline protection, bank stabilization, and chenier reforestation would improve wetland and chenier habitats which would subsequently improve or slow the loss of leisure and recreation opportunities and contribute to regional economic growth and sustainability.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.8 Community Cohesion

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Direct impacts that would disrupt community cohesion, temporarily, include the noise and fugitive dust from construction activities, the temporary displacement and relocation of residents during construction, and



disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during Project implementation.

Indirect impacts for the nonstructural plan would include reduced risk of hurricane storm surge-related damages for lower-lying structures within communities, thus preserving community cohesion in the region. Other indirect impacts include improvements to pedestrian and handicap access not only to homes, but also to community facilities benefiting from nonstructural measures.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

There would be no direct impacts on community cohesion. Indirect impacts would include maintaining the integrity of the coastal landscape that supports ecosystem services that in turn supports human population and activities.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.1.9 Environmental Justice

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

An EJ analysis was conducted which focused on the potential for disproportionately high and adverse impacts to minority and low-income populations during the construction and normal operation of the proposed nonstructural risk-reduction measures. EJ communities, as defined by minority composition and percent of population existing at or below the federal poverty level, have been identified within the Project area.

As discussed in greater detail in Appendix A, Annex O, low-income and minority populations within the Project area were assessed using up-to-date economic statistics, aerial photographs and U.S. Census Bureau 2007-2011 ACS estimates. Based on the analysis described in Appendix A, Annex O, the NED RP would not cause any disproportionate adverse impacts to minority or low-income residents within the Project or study area.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Many of the areas in which these activities will occur are sparsely populated or devoid of permanent structures and/or population. Access to some areas due to marsh restoration and nourishment activities may be temporarily interrupted. Impacts due to shoreline protection construction would also be temporary. Temporary impacts from construction activities due to increased turbidity, noise, and access interruption are compensated for by the opportunity for long-term positive cumulative impacts as other restoration programs improve the habitat and sustainability of coastal Louisiana. The long-term benefits of marsh restoration, shoreline protection, bank stabilization, and chenier reforestation would improve wetland habitat which would subsequently improve leisure and recreation opportunities to all residents of the area. The proposed action would have no disproportionate adverse impacts on minority and low-income populations.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

The proposed action would have no disproportionate adverse impacts on minority and low-income populations.

3.2 Water Environment (Hydrology and Hydraulics)

3.2.1 Flow and Water Levels

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

The total level of impact would be relatively minor and would be dependent on the combination of nonstructural methods used and the participation rate in the Project. Potential direct and indirect impacts to flow and water depend on the method used. For example:



- Raising structures with pilings could increase storage capacity and lower surge elevations for those structures not elevated.
- Localized storm surge risk reduction measures could decrease storage capacity and raise the surge elevations for those nearby structures that are not elevated.
- Raising structures with a cinderblock chain wall would have similar impacts as existing conditions on storage capacity and surge elevations since it would mimic existing conditions of the structure.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Existing fragmented marsh and shallow open water areas would be restored to marsh habitat. Temporary containment/exclusion dikes would temporarily prevent local flows from coming into and over marsh restoration site during construction activities. However, temporary containment/exclusion dikes would naturally degrade or would be degraded to provide hydrologic exchange following dewatering and consolidation of dredge sediment slurry. Consequently, these changes would not cause water levels in adjacent lakes to permanently alter flows or water levels.

Shoreline Protection: Segmented breakwaters along the Gulf would dissipate the high energy Gulf waves without changing water levels or flows. Rather, these structures would provide conditions conducive to land building behind them. Interior shoreline protection measures will not alter flows or water levels. Rather, these structures will reduce erosion caused by waves.

Chenier Reforestation: No direct or indirect impacts.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as MB component of RP.

3.2.2 Water Quality and Salinity

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No direct impacts to water quality or salinity by implementing any of the nonstructural risk reduction measures. Construction would use the best practical techniques and BMPs to avoid potential adverse impacts. Construction impacts to runoff would be minimized through implementation of a Stormwater Pollution Prevention Plan (SWPPP) (USEPA 2012).

Indirect Impacts: Elevating and flood proofing structures, as well as protecting warehouses with localized storm surge risk reduction measures, would prevent them from being flooded, which would reduce water quality impacts associated with flooding from storm surge events that exists under the FWOP conditions.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration and Shoreline Protection: Direct impacts of marsh restoration and shoreline protection measures would include protection and restoration of existing open water, fragmented and degrading wetlands to transitional estuarine marsh and shoreline protection. Construction activities, hydraulic dredging and placement of dredged sediments and other fill materials could result in the following localized and temporary impacts to water quality including: reduction of water clarity; change in color; reduction in the pH of receiving area waters toward more acidic conditions; emission of reduced sulfur compounds including hydrogen sulfide often characterized as an objectionable rotten-egg smell; release of organic material with varying quantities of ammonia, nitrogen, and phosphorus compounds which could stimulate growth of algae and other aquatic plants. The factors responsible include increased turbidity, increased suspended sediments, and organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels, among others. Tidal currents present in the Project measure areas would serve to disperse and thereby dilute localized changes. Following construction, pH levels, water clarity, color, emissions of sulfur compounds, and release of organic material, ammonia, nitrogen, phosphorus compounds, turbidity, organic enrichment, dissolved oxygen, and



carbon dioxide levels in the area would return to those observed prior to measure construction. Any such impacts would be minimized and controlled by the use of the best available practical techniques and BMPs. The proposed action would have no significant long-term adverse impacts to water chemistry. Because rock, fill, and construction materials for proposed shoreline protection measures are anticipated to be free of contaminants, discharge of these materials into existing adjacent waters is not expected to result in adverse effects to aquatic organisms. During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Material proposed for construction of marsh restoration and shoreline protection has been evaluated to determine suitability for placement in the aquatic environment in accordance with Clean Water Act Section 404(b)(1). Dredging borrow from the CSC would occur during regularly scheduled maintenance events. Hence, water quality and salinity impacts at the CSC borrow sites would be the same as those described under future without Project conditions. The depths of borrow pits in the Gulf would be limited to the area of wave penetration. There is no expectation of low dissolved oxygen in the borrow pits due to designs that will control depth, shape and location in the existing wave/wind climate. The NER RP would utilize the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts.

Indirect impacts of marsh restoration and shoreline protection include water quality improvements as restored and nourished marsh would trap sediments and nutrients helping to maintain or improve local water quality. Sediments and dredge effluent taken from off-shore borrow areas (see Appendix K Fact Sheets) and placed at interior marsh restoration (disposal) areas may have higher salinities compared to the saline marsh restoration sites. However, any differences would likely be minimal and the dredged effluent and higher saline borrow sediments would rapidly desalinate to those ambient salinity conditions following dewatering and consolidation of sediments. Borrow areas would be configured so that stratification would be minimized by orienting the long axis of each borrow area parallel to the Gulf shoreline and with side slopes no steeper than 4(H):1(V). Borrow material has been evaluated to determine suitability for placement in the aquatic environment in accordance with Clean Water Act Sections 401 and 404(b)(1) and are anticipated to be free of contaminants. Discharge of these materials into waters would not be expected to result in adverse contamination effects to aquatic organisms. Indirect impacts regarding ecosystem restoration measures could lead to water quality improvements through the restoration and protection of wetland and chenier habitats.

Chenier Replantation: Water quality impacts of these measures would be minimal, if at all, as these features are located on chenier ridges and removed from nearby waters.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the NER RP.

3.3 Natural Environment

3.3.1 Sedimentation and Erosion

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There would be no direct or indirect impacts.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Increased marsh surface area would increase sediment entrapment when marshes are flooded (e.g., tidal and storm surge). Restored marsh would reduce fetch over open water areas thereby reducing wind generated waves and subsequent erosion. Previous STWAVE modeling performed in 2012 for the Louisiana Coastal Area – Stabilize Shoreline at Point Au Fer Island Project indicated that offshore borrow areas and access channels would not be expected to significantly increase wave energy or erosion processes. Detailed modeling of specific borrow areas proposed for this study would be conducted during the PED phase.

Shoreline Protection: Sedimentation patterns in the vicinity of the measures would be altered. Sediment deposition and/or erosion would occur depending on the hydrodynamics at the site. For example, the location and



orientation of individual measures could cause erosion and/or sediment accretion. Shoreline erosion adjacent to the measures would likely be reduced. Longshore sediment transport in the vicinity of the shoreline protection measures in the Gulf of Mexico may result in the accumulation of sediment behind breakwater measures, creating salients or tombolos. No detrimental changes in longshore sediment transport processes are anticipated to occur from the construction of the four offshore breakwater measures (5a, 6b1, 6b2, and 6b3). Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tombolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and static equilibrium at low tide. Measure 5a would extend from the western CSC jetty to the existing breakwaters of the Holly Beach Sand Management (CS-31) project. The introduction of sands for the Cameron Parish Shoreline Restoration (CS-33) project increased the sediment budget for this area, so that downstream (longshore) sediment starvation is not expected to be a problem. Additionally, the existing jetty and shipping channel already disrupt the littoral sediment transport in this area from the east. The area immediately west of the CSC jetty has been used as a single point discharge for maintenance dredging sediment from the jetty channel. Its probable continued use as such in the future should also help to further offset down current sediment starvation caused by the jetty. Measures 6b1, 6b2, and 6b3 would be constructed offshore from the Gulf of Mexico shoreline of Rockefeller Refuge, which is fine-grained marsh sediment, with a veneer of shell hash. The fine-grained sediment does not contribute to the littoral sediment transport. All offshore breakwater measures are expected to reduce shoreline erosion rates by approximately 50% based on previous experiences with this type of structure at Holly Beach and other nearby areas.

Chenier Reforestation: Tree roots bind sediments together and would likely reduce erosion of cheniers if the Cheniers are overtopped during storm events or by rising sea levels. Trees would likely reduce storm surge and subsequent erosion of adjacent marshes.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.3.2 Soils, Water Bottoms, and Prime and Unique Farmlands HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

Although there could be some minor direct and or indirect impacts on soils due to nonstructural elevation, flood proofing and construction of small localized storm surge risk reduction measures, nonstructural measures would be implemented in residential and non-residential commercial areas where soils have been previously disturbed and the best available practical techniques and BMPs would be used during construction to avoid, minimize and reduce potential direct and indirect impacts to soils, water bottoms and prime and unique farmlands. There would be no direct or indirect impacts associated with nonstructural measures on prime and unique farmlands or water bottoms.

The PDT anticipates that only a small amount of borrow would be needed for construction of the localized storm surge risk reduction measures for each warehouse being accomplished by separate task order. Based on this conclusion, it is foreseeable that commercial borrow sites would be used. As of the date of this Report, there are several commercial borrow sites within the project area that are readily available. Real Estate regulations (ER. 405-1-12, paragraph 12-9d(3)) allow for small quantities of borrow material to be supplied by the construction contractor through the use of readily available commercial sites, if supported by an analysis conducted by the Government and the NFS, and if no other constraints exist. Since it has been determined that each IDIQ task order will address a single warehouse, for purposes of this Final Report, it has been assumed that the analysis performed pursuant to the above cited ER 405-1-12 will determine that the required borrow quantities constitute a small quantity that can be obtained through a commercial site that meets the Project requirements. Prior to issuing a construction task order, the Government will conduct the necessary analysis in accordance with ER 405-1-12. Contractors would be required to demonstrate that any proposed commercial borrow site is environmentally cleared and contains geotechnically suitable borrow material. In evaluating the suitability of the proposed commercial borrow site, impacts to wetlands or bottomland



hardwoods would be prohibited. Costs of utilizing a commercial borrow site would be considered an item of construction cost, and not an item of LERRD cost.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Marsh restoration measures would include the use of dredged material from the Calcasieu Ship Channel and the Gulf of Mexico (Gulf) for the restoration and nourishment of marsh. Hydric soils in the marsh restoration areas consist primarily of Bancker muck, Creole mucky clay, Scatlake mucky clay, Larose mucky clay; and less frequently Allemands mucky peat, Clovelly muck, and Mermentau clay (Table 3-2).

Table 3-2: Hydric soils in marsh restoration areas.

Soil Association	Acres
Allemands mucky peat (AE)	40
Bancker muck (BA)	4,747
Clovelly muck (CO)	142
Creole mucky clay (CR)	3,481
Larose mucky clay (LR)	503
Mermentau clay (MM and ME)	24
Scatlake mucky clay (SC)	1,327

Impacts to hydric soils from the restoration and nourishment of marsh would be beneficial. As marsh is restored, hydric soils would increase and become more stable. Direct impacts to water bottoms in the marsh restoration footprints in Calcasieu and Mermentau Basins would result in the restoration of existing water bottom habitat to marsh habitat. The containment dikes would naturally degrade over time, resulting in the restoration of water bottom habitat to marsh habitat. Borrow areas to provide sediment for the restoration and nourishment of the marsh areas would result in direct impacts to water bottom habitat topography. Soils associated with prime and unique farmlands are most common on chenier ridges, and none of these soils were identified in the marsh restoration areas. There would be no direct impacts to prime and unique farmlands as a result of the restoration and nourishment of marsh areas. The restoration and nourishment of marsh could result in an indirect impact that could be beneficial to soils identified as prime and unique farmlands. The restoration of marsh could contribute to flood attenuation from small storm events and could prevent future loss of prime and unique farmland soils that may be present on nearby chenier ridges. See Table 2-17 (Chapter 2) for a listing of each marsh restoration measure with total acres of temporary and permanent impacts to water bottom habitat.

Shoreline Protection: The Holly Beach Shoreline Stabilization - Breakwaters measure (5a) would include placement of rock breakwaters, resulting in direct impacts to water bottoms in the Gulf of Mexico. The Gulf shoreline restoration Calcasieu River to Freshwater Bayou measures would be constructed in three segments (6b1, 6b2, and 6b3), resulting in direct impacts to water bottoms in the Gulf of Mexico. Measure 16b (Fortify Spoil Banks of GIWW and Freshwater Bayou) would consist of bankline protection with rock dikes along three separate reaches of Freshwater Bayou, resulting in direct impacts to water bottoms in Freshwater Bayou. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been determined not to be significant. In addition, all shoreline protection measures would include construction of "fish dips" to allow for ingress and egress of aquatic organisms. In all shoreline protection measures, soft surface water bottoms would be replaced with rock resulting in indirect impacts to aquatic habitat along the shorelines. Additionally, the dredging of floatation canals and associated disposal areas would result in temporary direct impacts to 4,042 acres of water bottom habitat. Hydric soils could be directly impacted during the placement of stone breakwaters and rock dikes, but long term indirect impacts would include the prevention of further erosion and loss of these soils, and potentially an increase in hydric soils along the Gulf shoreline. See Table 2-17 (Chapter 2) for a listing of each shoreline protection measure with total acres of temporary and permanent impacts to water bottom habitat.



Soils associated with prime and unique farmlands are most common on chenier ridges, and none of these soils were identified in the vicinity of the Gulf shoreline restoration or Freshwater Bayou measures. Approximately 549 acres of Hackberry loamy fine sand, classified as a prime farmland soil, is located along the shoreline adjacent to the Holly Beach shoreline stabilization measure. The 549 acres of prime farmland soils along the shoreline at Holly Beach would not be directly impacted by the placement of the rock breakwaters, nor would any other prime and unique farmlands be directly impacted or removed from agriculture use by the shoreline protection measure of the RP. Indirect impacts to this area of prime farmland soil would include a reduction in erosion and loss of the prime farmlands. Over time, tomobolo or sandbars could form between the breakwaters and existing beach resulting in the direct conversion of water bottom habitat. Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tomobolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and static equilibrium at low tide.

Chenier Reforestation: A total of 578 acres of hydric soils were identified along the cheniers. Reforestation of the cheniers would stabilize soils and could prevent future erosion and loss of hydric soils. Therefore, the direct and indirect impacts to hydric soils on the cheniers would be beneficial. No water bottoms were identified on the cheniers, so there would be no direct or indirect impacts to water bottoms as a result of chenier reforestation. Soils that are suitable for agriculture and pastureland in the Chenier Plains are most commonly located on the chenier ridges. Approximately 514 acres of soils classified as prime farmlands, consisting entirely of Hackberry loamy fine sand, are present along the chenier ridges that are proposed for reforestation under this alternative. The reforestation of the chenier ridges would remove these areas and identified prime farmlands from future agricultural use. In compliance with the Farmland Protection Policy Act (FPPA), the USACE consulted with the Department of Agriculture NRCS to determine the precise acreage of prime and unique farmlands that would be impacted. It was determined that the proposed activities would not irreversibly impact prime farmlands and is exempt from the rules and regulations of the FPPA, Subtitle I of Title XV, Section 1539 – 1549 (NRCS letter dated December 13, 2013). (See Appendix A, Annex E).

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

3.3.3 Coastal Shorelines

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No impacts as the NED areas are far removed from the Gulf coastal shoreline.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Only measure 124c (Marsh Restoration at Mud Lake) would occur in proximity to the Gulf shoreline. Construction of this measure would require temporary placement of dredge pipeline so that dredged material may be pumped from the Gulf borrow site to the marsh restoration sites. This would result in temporary and minor disturbance to the shoreline resources such as the nearshore, beach and dune as a designated pathway for placement of the dredge pipeline resulting in the temporary unavailability of this small area until this construction activity is completed. Following construction, the best available practical techniques and best management practices (BMPs) would be used to restore the shoreline to pre-construction conditions.

Shoreline Protection: Proposed segmented breakwaters are expected to eliminate or substantially reduce erosion of the gulf shoreline, but would not directly affect hydrology or salinity levels since the openings between the breakwater segments would allow free passage of water. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been assessed and determined not to be significant. In addition, all shoreline protection measures would include construction of “fish dips” to allow for ingress and egress of aquatic organisms. Edwards (2006) examined breakwaters at Holly Beach that have caused sediment deposition, specifically low tide tomobolos. Analysis of survey data and tracer data indicated that the beach/breakwater system is in a state of dynamic equilibrium at high tide, and



static equilibrium at low tide. Indirectly, the breakwaters would help to maintain existing salinity and hydrology in the marshes and water bodies behind the shoreline, which could otherwise be altered by continued erosion. In the MB there are numerous canals and natural bayous and ponds that lie inland of the Gulf shoreline. The Gulf shoreline restoration measures Calcasieu River to Freshwater Bayou Measures (6b1, 6b2, and 6b3) would prevent new openings from forming between the Gulf and these inland water bodies.

Chenier Reforestation: Several of the chenier restoration projects would occur in close proximity to the Gulf shoreline. It is possible that some construction equipment may be delivered by barge from the Gulf to access the chenier ridges to perform restoration activities. In such cases, there would be minor, localized, temporary adverse impacts, including loss of vegetation cover and displacement of shoreline sediments. Following reforestation efforts, the best available practical techniques and best management practices (BMPs) would be used to restore the shoreline to pre-construction conditions.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Direct and indirect impacts are the same as MB impacts of RP.

3.3.4 Vegetation Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative – Nonstructural 0-25-Year Floodplain Plan (RP)

Implementation of the NED RP takes place at residential and commercial sites that have been previously disturbed. There could be some direct or indirect impacts to existing vegetation resources, such as landscaping vegetation, during construction of nonstructural measures. Best available practical techniques and BMPs would be used to avoid impacts vegetation resources.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative – Comprehensive Small Integrated Restoration Plan (RP)

The RP would restore/nourish/protect acreage in the CSB and the MB.

Marsh Restoration: These measures would restore and/or nourish saline marsh and brackish marsh in both the CSB and the MB. Of these totals, saline marsh and brackish marsh would be temporarily impacted in the CSB and the MB from access required for borrow deposition. See Table 2-17 (chapter 2) for linear feet and acres of dredge pipeline access and flotation channels. These areas would be restored to pre-construction conditions following completion of the restoration activities. Restored/nourished marsh would regenerate and revegetate naturally from seed sources and vegetative sources in the area and contribute to reducing the overall habitat fragmentation in the area as well as provide many different species of fish and wildlife with shelter, nesting, feeding, roosting, cover, nursery, and other life requirements habitat. These marsh habitats would also provide neotropical migrants with essential staging and stopover habitat (Stoffer and Zoller 2004, Zoller 2004). Based on previous coastal restoration actions, it is expected that invasive species would not occur on restored coastal marsh platforms unless the elevation of the marsh platform is too high (i.e., upland-like conditions when tallow trees could invade). See table 2-17 (Chapter 2) for quantities of acres of marsh restored and nourished.

Coastal Restoration Projects Impacted by NER RP Measures: The NER RP measures would be constructed in the immediate vicinity of existing coastal restoration projects See Figure 3-1 for a depiction of existing coastal restoration projects listed in Table 3-4. Specific NER RP marsh restoration measures that could impact existing restoration projects include:

- Marsh Restoration Measure 3c1 (Figure 3-2) is immediately adjacent to Project CS-54 (Cameron-Creole Watershed Grand Bayou Marsh Creation).
- Marsh Restoration Measure 124c (Figure 3-3) would is immediately adjacent to Project CS-59 (Oyster Bayou Marsh Creation and Terracing).

Due to the close proximity of construction, the proposed NER RP measures would be constructed to avoid existing coastal restoration projects by construction of temporary containment/exclusion dikes that would



contain dredged borrow sediments used for construction of the NER RP measure and also prevent dredged effluents from entering the existing coastal restoration project sites. Temporary containment/exclusion dikes would be allowed to degrade naturally to restore connectivity with surrounding areas or they would be degraded by this Project's non-Federal Sponsor in the third year following completion of construction, whichever first occurs. Following completion of marsh restoration, the NER RP measures and existing restoration projects would synergistically interact to provide higher quality transitional marsh habitats in the area

Mitigation Projects Impacted by the NER RP Measures: Mitigation projects (e.g., the creation of marsh and marsh terraces) are designed and constructed to offset anticipated losses from permitted activities. In some instances, NER RP measures would overlap and impact existing mitigation projects. When overlap occurs, NER measures would not be constructed until the mitigation projects satisfy their permitted obligations (see Chapter 4 for NER measure implementation details). Mitigation Manger Kelley Templet with the LADNR, Office of Coastal Management, identified for the PDT existing mitigation projects in the study area constructed by various companies (e.g., oil and gas, Union Pacific, and others) and are designed and constructed to offset unavoidable anticipated losses to wetlands from permitted activities. Figure 3-4 depicts the location of mitigation projects in the area. In most instances, these mitigation projects were developed to provide a sustainable buffer from wave action and storm surge generated by tropical storm and hurricane events. Where overlap occurs, proposed NER RP measures would not be constructed until the mitigation projects satisfy their permit obligations. The permitted mitigation projects, the anticipated expiration date of the mitigation permit, and the specific NER RP measure that would overlap some portion of the permitted mitigation project is provided in Table 3-5. Impacts to the mitigation projects would be avoided by tiering construction of NER RP features until after the mitigation permit obligations have been satisfied.

Shoreline Protection: These measures would protect barrier island habitat in the CSB and saline and brackish marsh in the MB. These shoreline protection measures would restore an important geomorphic framework for preventing further fragmentation and loss of interior wetlands used as habitat by many different species of fish and wildlife. See table 2-17 (Chapter 2) for quantities of length and project details associated with each shoreline protection measure. The NER RP shoreline protection measure 5a (Holly Beach Shoreline Stabilization-Breakwaters) would be located immediately offshore of the projects CS-31 (Holly Beach Sand Management) and CS 33 (Cameron Parish Shoreline). Construction of Measure 5a would work synergistically with these existing restoration projects by providing additional protection to inland marsh resources.

Chenier Reforestation: Measures would reforest chenier forests in the CSB and MB. Measure CR is a series of chenier ridge reforestation features located along existing chenier ridges situated within Cameron and Vermilion Parishes (see NER Fact Sheets Appendix K). Reforestation would help ensure the viability of the cheniers into the future thereby offering continued natural protection to sensitive chenier areas. The measure would consist of invasive species control and planting native species seedlings to achieve a 50 percent canopy cover. Prior to planting, an application of 64 ounces of Clearcast® would be sprayed over the top of hardwoods to control invasive species, primarily Chinese tallow (*Triadica sebifera*), if needed. Typical invasive plants that may be eliminated or controlled but are not limited to this list are Chinese tallow, Chinese privet, cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky chickweed, purple nutsedge, and mimosa trees. However, invasive species are presently limited on the cheniers due to ongoing farming activities. It is not anticipated that the use of the herbicide would result in any adverse impacts to water quality resources.

Up to 50 percent of the measure acreage would be planted with live oak (*Quercus virginiana*) and hackberry (*Celtis occidentalis*). Bare-root seedlings would be planted on 10x10-foot spacing (435 trees per acre), which assumes 57% survival. For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one year survivorship criteria. Trees established through natural recruitment may be included in this tally; however, no less than 125 hard mast-producing seedlings per acre must be present. Surviving hard mast seedlings must be representative of the species composition and percentage identified in this Plan. Exotic/invasive species may not be included in this tally. By Year 5 (four years following successful attainment



of the one-year survivorship criteria) the perimeter would be virtually free (approximately 5% or less on an acre-by-acre basis) of exotic/invasive vegetative species.

Fencing would be installed to exclude cattle and reduce deer herbivory. Fencing would be 7.5 feet tall, and fence posts would be installed in concrete with a small tractor using an auger bit and portable cement mixer. Approximately 150,000 linear feet of fencing would be required, however fencing would not be required for the CR-509c and CR-509d measures, since they are located in a remote area along the coast where there is currently no cattle grazing.

The developing plant community must exhibit characteristics and diversity indicative of a viable native forested chenier. The proposed reforestation would provide critical stopover habitat for migratory neotropical birds. See table 2-17 (Chapter 2) for planting details associated with the chenier reforestation feature. The proposed reforestation would provide critical stopover habitat for migratory neotropical birds. Typical invasive plants that may be eliminated or controlled but are not limited to this list are Chinese tallow, Chinese privet, cogon grass, Johnsongrass, Japanese privet, Japanese honeysuckle, common ragweed, rescuegrass, sticky chickweed, purple nutsedge, and mimosa trees. However, invasive species are presently limited on the cheniers due to ongoing farming activities.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts are the same as the MB component of the RP.

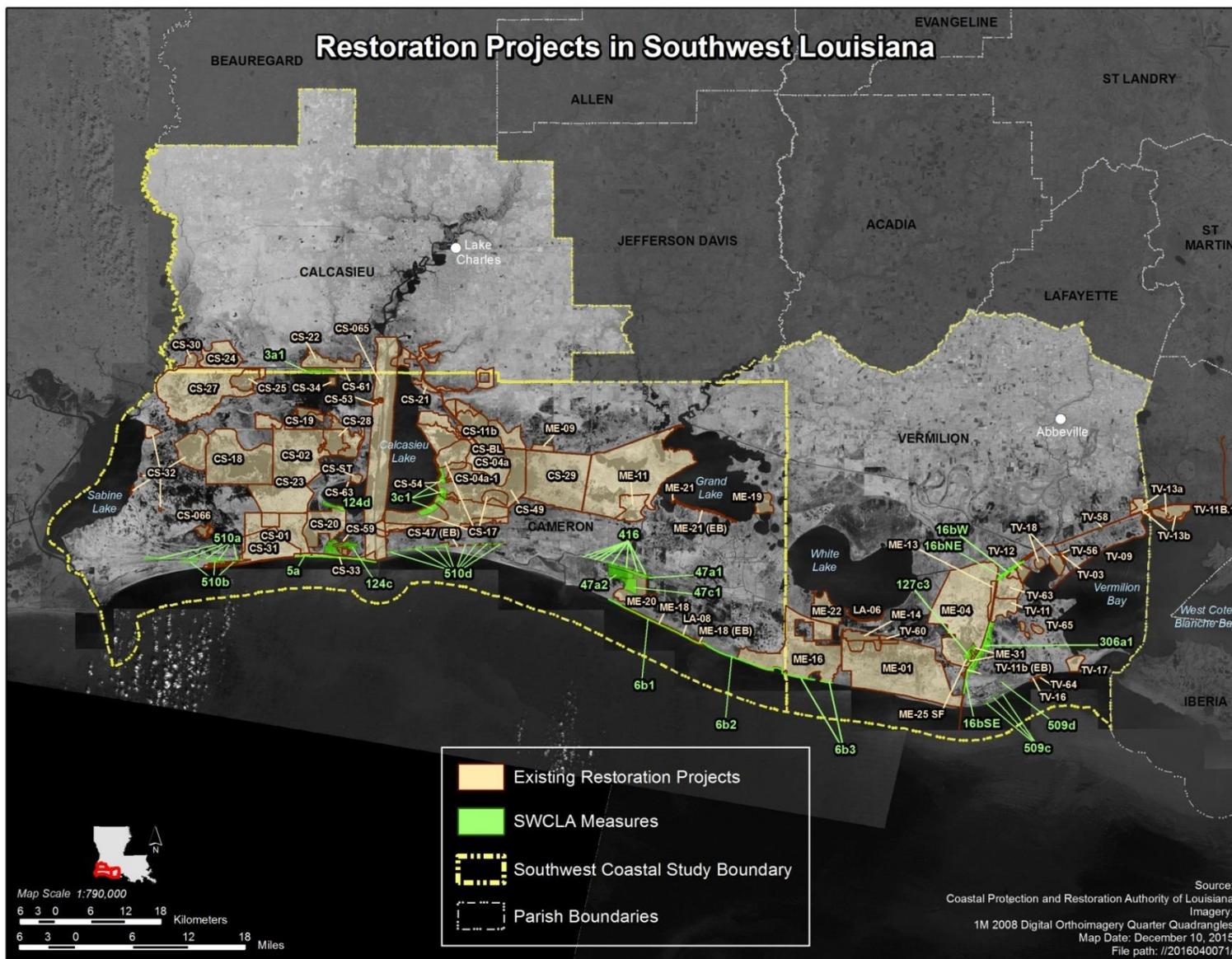


Figure 3-1. Ecosystem Restoration Activities and proposed NER RP Projects in Southwest Coastal Louisiana Project Area.



Table 3-4. List of Ecosystem Projects Displayed in Figure 3-1. (*projects would be impacted/benefitted by the NER RP measures)

<p>CS-01 Holly Beach Breakwaters Project CS-02 Rycade Canal Marsh Management CS-04a Cameron-Creole Maintenance CS-04a-1 Cameron-Creole Structure Automation CS-11b Sweet Lake/Willow Lake Hydrologic Restoration CS-17 Cameron Creole Plugs CS-18 Sabine National Wildlife Refuge Erosion Protection CS-19 West Hackberry Vegetative Planting Demo CS-20 East Mud Lake Marsh Management CS-21 Highway 384 Hydrologic Restoration CS-22 Clear Marais Bank Protection CS-23 Replace Sabine Refuge Water Control Structures CS-24 Perry Ridge Shore Protection CS-25 Plowed Terraces Demonstration CS-27 Black Bayou Hydrologic Restoration CS-28-1 Sabine Refuge Marsh Creation, Cycle 1 CS-28-2 Sabine Refuge Marsh Creation, Cycle 2 CS-28-3 Sabine Refuge Marsh Creation, Cycle 3 CS-28-4-5 Sabine Refuge Marsh Creation, Cycles 4-5 CS-29 Black Bayou Culverts Hydrologic Restoration CS-30 GIWW - Perry Ridge West Bank Stabilization *CS-31 Holly Beach Sand Management (impacted by NER RP Measure 5a) CS-32 East Sabine Lake Hydrologic Restoration *CS-33 Cameron Parish Shoreline Restoration (impacted by NER RP Measure 5a) CS-34 Marcantel Supplemental Beneficial Use Disposal Area CS-47 Trosclair Road Repairs CS-49 Cameron-Creole Freshwater Introduction CS-53 Kelso Bayou Marsh Creation</p>	<p>CS-53 Kelso Bayou Marsh Creation *CS-54 Cameron-Creole Watershed Grand Bayou Marsh Creation (impacted by NER RP Measure 3c1) *CS-59 Oyster Bayou Marsh Creation and Terracing (impacted by NER RP Measure 124c) CS-61 Brannon Ditch CS-63 Sabine Shellbank Stabilization CS-65 Calcasieu Ship Channel Salinity Controls CS-66 Cameron Meadows Marsh Creation and Nourishment CS-BL Blind Lake CS-ST Sabine Terraces</p> <hr/> <p>LA-06 SP Foundation Improvements Demo LA-08 Bio-Engineered Oyster Reef Demo</p> <hr/> <p>ME-01 Pecan Island Freshwater Introduction ME-04 Freshwater Bayou Wetland Protection ME-09 Cameron Prairie National Wildlife Refuge Shoreline Protection ME-11 Humble Canal Hydrologic Restoration ME-13 Freshwater Bayou Bank Stabilization ME-14 Pecan Island Terracing ME-16 Freshwater Introduction South of Highway 82 ME-18 Rockefeller Refuge Gulf Shoreline Stabilization ME-19 Grand-White Lakes Landbridge Protection ME-20 South Grand Chenier Marsh Creation ME-21 Grand Lake Shoreline Protection ME-22 South White Lake Shoreline Protection ME-25 Marsh Creation Near Freshwater Bayou ME-31 Freshwater Bayou Marsh Creation</p>	<p>TV-03 Vermilion River Cutoff Bank Protection TV-09 Boston Canal/Vermilion Bay Bank Protection TV-11 Freshwater Bayou Bank Protection TV-11b Freshwater Bayou Bank Stabilization TV-11b.1 Acadiana Gulf of Mexico Access Channel TV-12 Little Vermilion Bay Sediment Trapping TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1 TV-13b Oaks/Avery Structures TV-16 Cheniere Au Tigre Sediment Trapping Demonstration TV-17 Lake Portage Land Bridge TV-18 Four Mile Canal Terracing and Sediment Trapping TV-56 Four-Mile Canal Storm Surge Reduction Construction TV-58 Boston Canal TV-60 Front Ridge Chenier Terracing/Protection TV-63 Cole's Bayou Restoration TV-64 Cheniere au Tigre TV-65 Rainey Audubon Wildlife Sanctuary Earthen Terraces</p>
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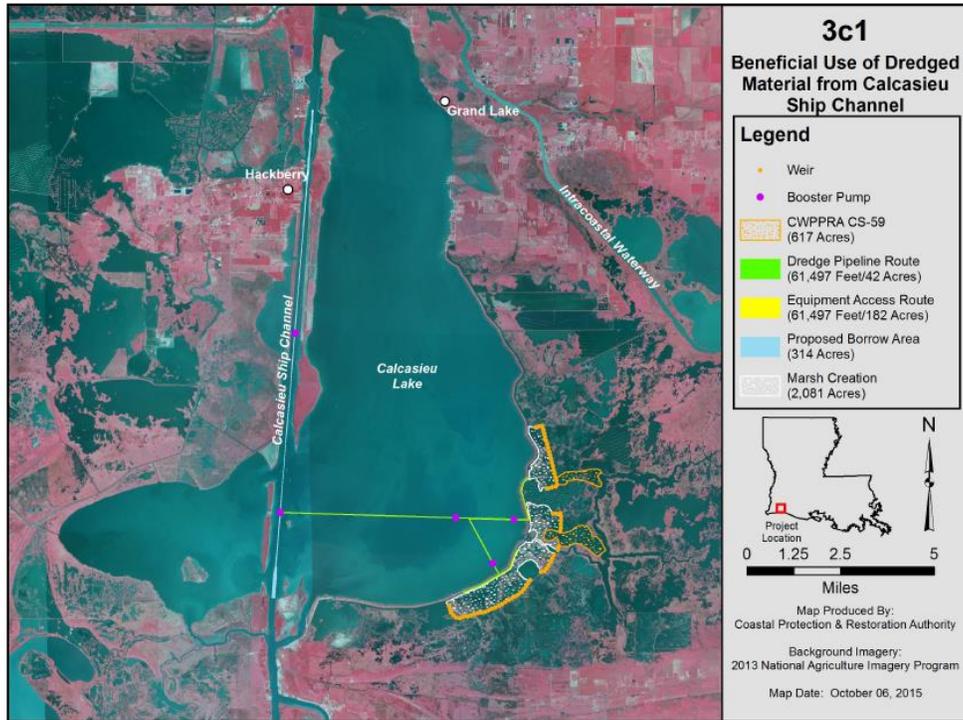


Figure 3-2. NER RP Measure 3c1 Adjacent to CWPRA Project CS-54 Cameron Creole Watershed

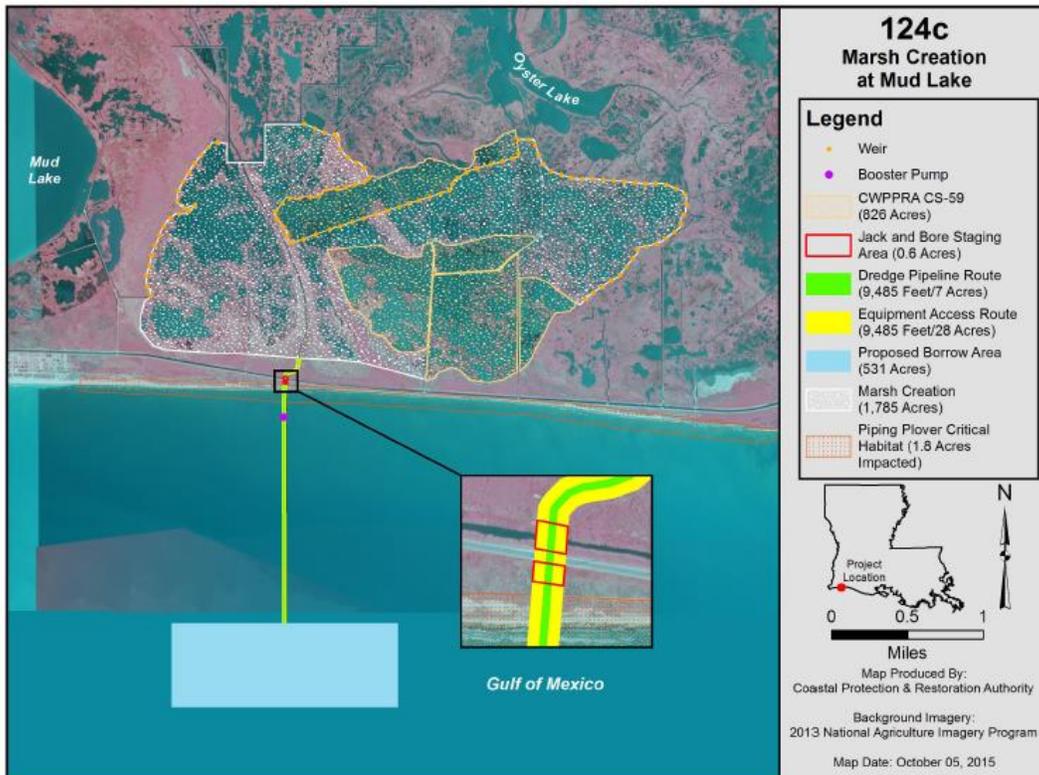


Figure 3-3. NER RP Measure 124c Adjacent to CWPRA CS-59 Oyster Bayou Restoration

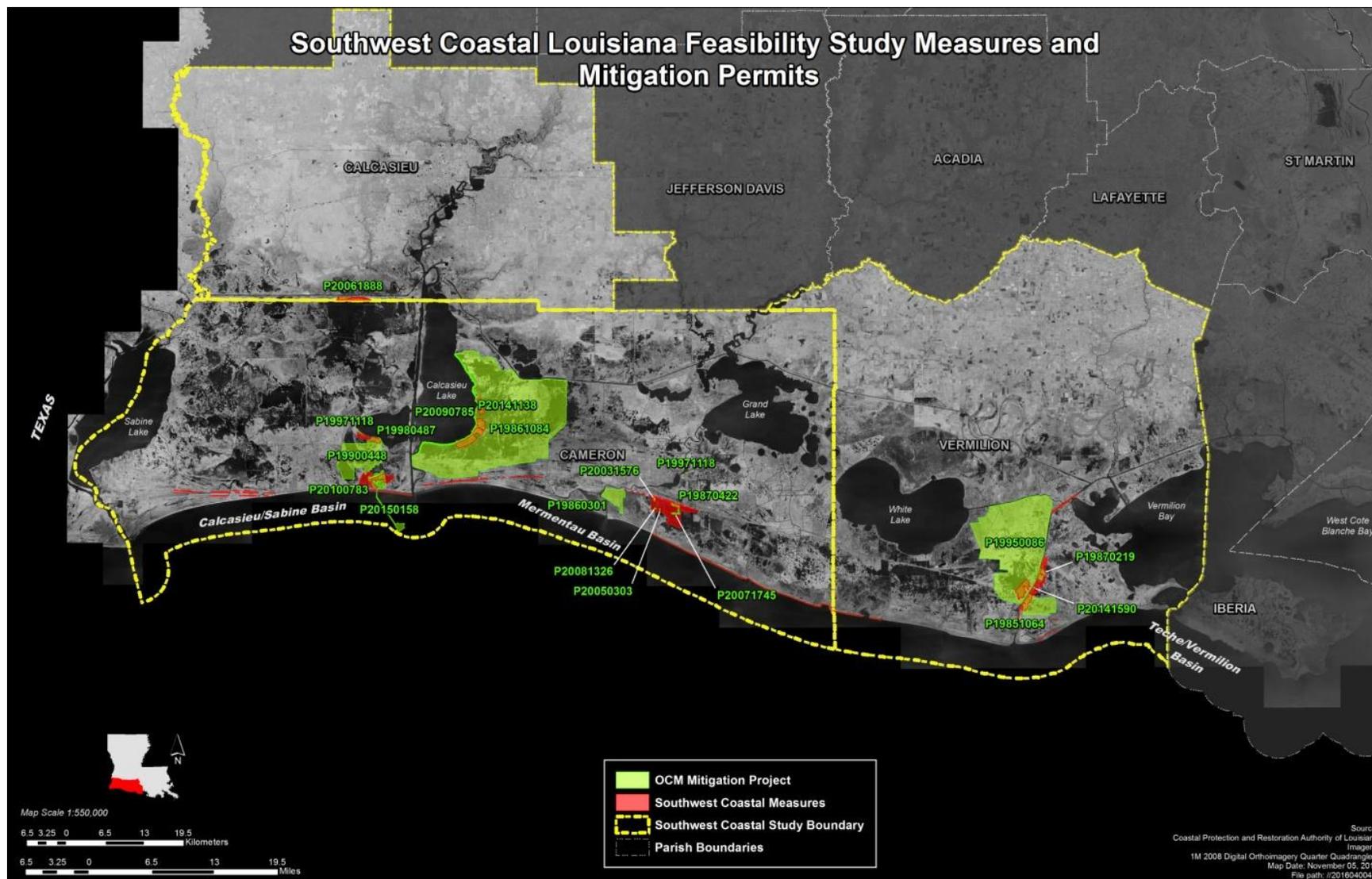


Figure 3-4. Permitted Mitigation Projects and Southwest Coastal Louisiana Study Measures





Table 3-5. Existing Mitigation Projects Impacted by NER RP Measures

Permit #	Description	NER RP Feature	Permittee or Owner	Expiration Date (permit completion date + 20 years)*	Mitigation Project Description
Tier I Features					
P20061888	Terraces at GIWW N of Black Lake	3a1	Gulfport Energy Corporation	11/30/2032	Proposed construction of 5,358 linear ft of terraces south of the GIWW and north of Black Lake.
P19900448	Marsh Management Plan area	124d	Apache Louisiana Minerals	11/13/2016	Install and maintain water control structures for CTU 1 and 2. In CTU 1, 64,000 linear ft of smooth cordgrass plantings. In CTU 2, 32,470 linear ft of boundary levee are to be repaired. Various water control structures are to be repaired or replaced.
P19971118	West Cove Planting Project	124d	Union Pacific Resources	7/28/2022	West Cove Planting Project; 5,000 ft of plantings of <i>Spartina alterniflora</i> .
P19950086	Marsh Management Plan area	127c3	Vermilion Corporation	4/1/2021	Eight water control structures will be installed; a riprap levee will be constructed; five double flapgated culverts and one earthen plug will be installed; two earthen plugs will be constructed.
Tier II Features					
P20141590	Spoil Placement	306a1	Hilcorp Energy Company	4/8/2040	Dredging of 15,430 cubic yards of native material to construct slip for the purpose of installing a drill rig, well protector and pilings. The dredged material will be pumped into a shallow pond adjacent to the proposed drill site using a temporary discharge pipe. An additional 301 cubic yards of material will be displaced to construct containment berms.
Tier III Features					
P20141138	Rip-rap Grand Bayou	3c1	CPRA	1/29/2040	Installation of 21,000 tons of riprap along the Calcasieu Lake Shoreline near the Peconi, Mangrove and Grand Bayou water control structures.
P19870422	Marsh Management Plan area	47a2	T. Bonsall	2/3/2023	Construction of a levee and multiple water control structures (South of Upper Mud Lake).
P20031576	Mitigation for P20031304	47a2	Kash Oil & Gas, Inc.	3/31/2029	Constructed 4,803 linear feet of terraces and planted with <i>Spartina alterniflora</i> .
P20081326	Mitigation for P20080132	47a2	PetroQuest Energy, L.L.C.	11/25/2033	Construct and plant 2,897 linear ft of wave dampening terraces that will capture re-suspended sediments and protect fragile shorelines by planting plugs of smooth cordgrass on both sides of constructed terraces.
P20071745	Mitigation for 20070883	47c1	Manti Operating Company	3/5/2025	Construction of ten 500-foot terraces, eight 300-foot terraces, two 200-foot terraces and eight 400-foot terraces (6.1 acres). Plantings of <i>Spartina alterniflora</i> rows on each side of the terraces.
*Expiration Date: if permit completion date is greater than 20 years, then implementation of measure would be similarly delayed.					



3.3.5 Wildlife Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No significant impacts to most wildlife resources except commensal vermin (e.g., rats, mice, pigeons, etc.) that thrive in association with human habitations and, which, typically disrupt the natural habitats

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Shallow open water would be restored to brackish marsh and saline marsh in the CSB, and open water would be restored to brackish marsh in the MB. Additional nourishment could occur adjacent to the marsh restoration sites. The CEMVN has determined that the proposed action “may affect but will not likely adversely affect” the Sprague's pipit and would have no effect on the red-cockaded woodpecker or critical habitats and would not adversely impact other species of concern that could potentially be found in the Project area. See table 2-17b (Chapter 2) for feature details associated with each marsh restoration measure.

The proposed restoration/nourishment in these basins would result in improved habitat conditions for several species of wildlife including migratory and resident waterfowl, shorebirds, wading birds, and furbearers. Migratory waterfowl utilizing the area would benefit from a greater food supply resulting from the increased abundance and diversity of emergent and submerged species. Habitat for the resident mottled duck would also improve considerably as the marsh platform would provide more desirable nesting habitat. Intertidal marsh and marsh edge would also provide increased foraging opportunities for shorebirds and wading birds. Small fishes and crustaceans are often found in greater densities along vegetated marsh edge (Castellanos /and Rozas 2001, Rozas and Minello 2001), and many of those species are important prey items for wading birds such as the great blue heron, little blue heron, great egret, black-crowned night-heron, and snowy egret. Mudflats and shallow water habitat restored by the deposition of dredged material would provide increased foraging opportunities for shorebirds such as least sandpipers, killdeer, and the American avocet. Those species feed on tiny invertebrates and crustaceans found on mudflats which are exposed at low tide and in shallow-water areas of the appropriate depth. Furbearers (such as nutria and muskrat) which feed on vegetation would benefit from the increased marsh acreage in the Project area. Representative furbearers such as the mink, river otter, and raccoon have a diverse diet and feed on many different species of fishes and crustaceans. Those species often feed along vegetated shorelines which provide cover for many of their prey species. The loss of open water habitat with construction of these measures would not be expected to adversely affect species that currently utilize these habitats as there is ample open water habitat in the basins. Wildlife species currently utilizing the shallow open water and vegetated shorelines in the Project area are highly mobile and/or suited to semi-aquatic life and should not be affected during construction.

Shoreline Protection: The installation of segmented offshore breakwaters and shoreline rock revetment would work to protect the marshes behind these structures from wave induced erosion and help maintain wildlife populations dependent on this habitat type. The potential for unintended adverse consequences, such as alteration of sedimentation patterns, associated with shoreline protection measures has been assessed and determined not significant. Some existing habitat would be converted to rock revetment thereby reducing the available wetland habitat for wildlife species and resulting in the demise of more immobile wildlife species. However, these impacts would result in a minimal overall impact to wildlife populations in the area and would work to protect the adjacent habitat these species depend on for survival that could be lost in the future if the revetment was not installed. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.

Chenier Reforestation: Existing chenier habitat in the CSB and the MB would undergo invasive species control and reforestation with construction of the proposed action. See table 2-17b (Chapter 2) for specific feature details associated with chenier reforestation features. Implementation of these measures would increase the diversity of the existing habitat and the quality of the available foraging, resting and nesting habitat necessary for numerous terrestrial and avian wildlife species and essential for neotropical migrants. Construction would



be minimally invasive (no earthwork is required) and some species may temporarily avoid these Project measures during construction, but would quickly return once construction is complete.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts to wildlife resources would be similar to those discussed for the NER RP except to a lesser extent.

3.3.6 Fisheries and Aquatic Resources

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan

The nonstructural measures should have no direct, indirect, or cumulative impacts to these resources.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Impacts in the construction footprint, and construction activities using earthen materials to restore and nourish marsh would directly impact fisheries and aquatic resources by the elimination of benthic, oyster, and fishery habitat or the conversion of shallow open water habitats to less valuable deep water borrow areas. Additionally, direct mortality or injury of fisheries and benthic species could occur due to burial or increased turbidity. Borrow areas are identified from Calcasieu Ship Channel, and the Gulf of Mexico. See table 2-17b (Chapter 2) for borrow quantities associated with each marsh restoration measure. Improved marsh habitats and increased SAV could have positive indirect impacts on juvenile fishes, shrimp, crabs, and other species by increasing food and cover if they are able to access the area. The two main limiting factors in SAV colonization are depth and turbidity, not seed source. When marshes are restored the shallow open water that is left is more conducive for SAV colonization due to the shallower depth. Also due to the marsh the fetch is reduced so turbidity is reduced thus improving the likelihood of SAV colonization. The conversion of open water to marsh is generally considered a benefit to aquatic species.

During marsh restoration, effluent from the dredge discharge pipe would be directed to adjacent fragmented marsh for nourishment. Dredging and construction activities would smother sessile and slow-moving benthic and suspension/filter feeders and force more mobile fish and aquatic organisms to move from the dredging, disposal and construction areas. It is expected that benthic and suspension/filter feeders would re-colonize the newly deposited dredged material at marsh restoration sites within 1-3 years due to its similarity with the existing substrate in the disposal areas. The conversion of shallow open-water to marsh habitat would prevent some larger fishery and aquatic organisms from immediately re-entering the disposal area (marsh restoration/nourishment sites). Following dredging and construction activities, larger fishery and aquatic organisms would gain access to the newly restored marsh and tidal pools during normal water flows and tides. Marsh is considered to have a higher ecological value than shallow open-water in this coastal ecosystem that is presently experiencing widespread coastal land loss.

Benthic, plankton, suspension/filter-feeding species, visual predators and other fishery and aquatic organisms could have short-term and localized adverse indirect effects caused by increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels from dredging and construction. Benthic organisms could be smothered. Suspension/filter feeding organisms could be impacted due to clogging of the gills and feeding mechanisms which could either cause death or reduce growth and reproduction. Visual predators would have a reduced success rate at catching prey due to lower visibility levels. Mobile species would be forced to relocate away from the dredging and construction area. Following dredging and construction activities, turbidity and suspended sediment levels, water temperature, and dissolved oxygen levels would return to pre-construction conditions. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction.

Waterbottoms used for borrow could cause the conversion of shallow open water habitats to less valuable deeper water borrow areas. Depending on the depth of the borrow area, this deeper water habitat could over the long term provide a refuge during extreme water temperature spikes. It is not anticipated that dredged borrow sites would cause hypoxic conditions. In addition there would be a short term direct adverse impact to



benthic species as well as the habitat of other aquatic species as 953 acres of water bottom is deepened and then refilled for the temporary floatation access channels. There could be direct mortality or injury of fisheries and benthic species due to both the digging and relocating of the material and burial of species that have colonized the area during the work. Restored transitional estuarine marsh habitats and increased SAV could have positive indirect impacts on juvenile fishes, shrimp, crabs, and other species by increasing EFH which provides food and cover to the area. The conversion of open water to marsh is generally considered a benefit to aquatic species. See table 2-17b (Chapter 2) for specific feature details associated with each marsh restoration measure. The best available practical techniques and BMPs would be utilized during construction to avoid, minimize and reduce potential adverse impacts to fishery and aquatic organisms.

Shoreline Protection: Impacts in the construction footprint would include the elimination of benthic and fishery habitat and the conversion of existing sandy shallow open water habitats to rock habitat which will only partially be submerged. Additionally, shallow mud bottoms would be converted to rock with the MB components in Fortify Spoil Banks of the GIWW and Freshwater Bayou measure. There would be a short-term direct adverse impact to benthic species as well as the habitat of other aquatic species as water bottoms are deepened and then refilled for the temporary floatation access channels. There could be direct mortality or injury of fisheries and benthic species due to both the digging and relocating of the material and burial of species that have colonized the temporary floatation access area during the construction. There could also be short-term indirect adverse impacts to plankton, benthic populations, suspension/filter-feeders and other fisheries caused by increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels from construction activities. Benthic organisms could be smothered. Suspension/filter feeding organisms could be impacted due to clogging of the gills and feeding mechanisms which could either cause death or reduce growth and reproduction. Visual predators would have a reduced success rate due to lower visibility levels. Mobile species would be forced to relocate away from the dredging and construction area. Following construction, turbidity and suspended sediment levels, water temperature, and dissolved oxygen levels would return to pre-construction conditions. These temporary and localized impacts would be minimized and controlled by utilizing the best available practical techniques and BMPs during construction. Rock substrate is known to provide benefits to some aquatic species by providing them a refuge from predation. They also provide a hard substrate for oyster spat to settle on. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.

Chenier Replantation: There would be no direct, indirect, or cumulative impacts on these resources.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan
Impacts are the same as the MB component of the RP.

3.3.7 Essential Fish Habitat (EFH) HSDRR (NED) Plans

Modified Plan 8 - Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

No direct, indirect, or cumulative impacts are expected to this resource from implementation of this action.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Both the CSB and MB components would convert open water and degraded marsh (combination of estuarine marsh and estuarine mud bottoms EFHs) to transitional, intertidal, estuarine marsh (marsh edge, SAV, marsh ponds, and inner marsh EFHs). See table 2-17b (Chapter 2) for specific feature details associated with each marsh restoration measure. Construction activities using earthen materials to create marsh could bury EFH substrates or temporarily change environmental conditions, including turbidity and salinity, in the water column. The Project would increase SAV and adjacent intertidal marsh vegetation (marsh restoration areas) in some areas. However, increases in SAV colonization would be limited by depth and turbidity, not seed source. When marshes are restored the shallow open water that is left is more conducive for SAV colonization due to the shallower depth. Also due to the marsh the fetch is reduced so turbidity is reduced thus the likelihood of SAV colonization. In addition, there would be a short term direct adverse impact to estuarine mud bottoms



as water bottoms are deepened and then refilled for the temporary floatation access channels. The floatation access for measure 3c1 would temporarily traverse the Calcasieu Lake Public Oyster Area with the dredge pipeline floated over the public oyster area, but no oyster reef EFH would be impacted by the measure. Any identified oyster reefs would be avoided. Dredging and construction activities to restore and nourish marsh would bury existing EFH substrates and temporarily change environmental conditions, including: short-term and localized increased turbidity, total suspended sediments, and water temperatures and lower dissolved oxygen levels in the water column. However, these effects would be short-term and localized and the area would return to pre-construction conditions following completion of dredging and construction activities. The proposed action would provide indirect positive effects by increasing SAV and estuarine marsh EFH. The CSB components and MB components would also nourish existing marsh and terraces in areas adjacent to the marsh restoration sites. There would be long term indirect positive impacts to marsh (marsh edge, SAV, marsh ponds, and inner marsh EFH). Waterbottoms identified for borrow include areas within the CSC and the Gulf of Mexico for the CSB. If the dredged material from the CSC is obtained during maintenance events there would be no additional EFH impacts. Borrow in the Gulf would convert Gulf water EFH to deeper Gulf water EFH. High-energy offshore Gulf borrow areas could naturally refill with material over time.

Shoreline Protection: Both the CSB and MB components would convert open water (combination of estuarine mud bottoms, Gulf waters, marsh edge, offshore, beach, coastal, and sand EFH) to rock which is not considered EFH in coastal Louisiana. In addition there would be a short term direct adverse impact to the aforementioned EFH as water bottoms are deepened and then refilled for the floatation channels. See table 2-17b (Chapter 2) for specific feature details associated with each shoreline protection measure.

Chenier Reforestations: Reforesting chenier ridges would have no direct, indirect, or cumulative impacts on EFH as these areas are far removed from waters with EFH. In addition, reforestation would use the best practical techniques and BMPs to avoid potential adverse impacts associated with non-point source storm water runoff associated with construction into adjacent marsh and water areas.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts would be same as the MB component of RP.

3.3.8 Threatened and Endangered Species, and Other Protected or Species of Concern HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

The CEMVN has determined that the proposed action “may affect but will not likely adversely affect” the Sprague’s pipit and would have no effect on the red-cockaded woodpecker or critical habitats and would not adversely impact other species of concern that could potentially be found in the Project area. However, the presence, as defined by the guidelines provided by USFWS, of threatened or endangered species would render that structure ineligible to participate in the project. Furthermore, direct impacts to species of concern would be avoided in accordance with the Bald and Golden Eagle Protection Act (BGEPA), MBTA, and the Marine Mammal Protection Act (MMPA) by implementing recommendations from USFWS and the National Marine Fisheries Service (NMFS) and utilizing the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to threatened and endangered species. Further consultation would occur as measures are implemented if construction has not been conducted within one year of signing the Record of Decision (ROD). Adverse direct and indirect impacts would be avoided in accordance with the Endangered Species Act (ESA), Bald and Golden Eagle Protection Act, the BGEPA, the MBT and MBTA and the use of best management practices (BMPs) (see also Appendix A) and recommendations from USFWS (see Appendix A, Annex G for final USFWS CAR). Potential minimal indirect impacts could occur to the candidate species, Sprague’s pipit, including the temporary displacement of any birds that may be present during construction activity and noise. However, the best practical techniques and BMPs would be utilized during construction to avoid, minimize and reduce potential adverse impacts to this species. However, the presence of candidate species would render that structure ineligible to participate in the project.

Species of Concern: Depending on the final designs of the NED RP, there could be a potential for minimal indirect impacts to colonial nesting water birds. These impacts could include the temporary displacement of



any birds that may be present due to construction activity and noise. It is assumed the birds would relocate to adjacent foraging/roosting grounds. Nesting birds would not be impacted as no work would take place within a rookery. Additionally, during nesting season, work would be required to take place outside of the USFWS and LDWF-declared buffer zones (Appendix A, Annex K). Work within the buffer zones may only take place during non-nesting season (September 1 to February 15). There would be no impacts to the bald eagle as no known nests are located near any Project measures. If an eagle's nest is found within the Project area, a no-work zone would be implemented (Appendix A, Annex K).

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

The CEMVN has determined that the proposed action “may affect but will not likely adversely affect” the piping plover or its critical habitat, red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemp's Ridley sea turtles; would have no effect on the red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the Project area. Furthermore, direct impacts to species of concern would be avoided in accordance with the BGEPA, MBTA, and the MMPA by utilizing the best available practical techniques and BMPs during construction to avoid, minimize and reduce potential adverse impacts to threatened and endangered species (see Appendix A, Annex K for information on T&E species in the Project area and Annex G for recommendations from USFWS and the National Marine Fisheries Service (NMFS). Further consultation would occur as measures are implemented if construction has not been conducted within one year of signing the ROD.

Marsh Restoration: Potential temporary and minimal indirect impacts to the West Indian manatee, Gulf sturgeon and all sea turtles identified in Appendix A, Annex K. Temporary dredging and construction-related impacts would result, primarily from noise, water turbulence, increased turbidity, suspended total sediments, and water and the presence of workers in the marsh restoration sites, access routes and borrow sites. However, these typically mobile species would temporarily avoid the area where construction-related activity is taking place. Critical habitat for piping plover will be temporarily impacted by placement of the dredge pipeline coming from the Gulf borrow sites and crossing the beach as it is moved to more interior marsh restoration sites (measures 47a1, 47a2, 47c1 and 124c. See table 2-17b (Chapter 2) for impacts to critical habitat in acres associated with each marsh restoration measure. Timing of dredge pipeline placement and removal will be coordinated with USFWS. Loggerhead critical habitat would not be impacted as the borrow sites are within approximately three miles offshore. Beneficial impacts would be the increase in wetland habitat which is utilized by the whooping crane.

Shoreline Protection: Potential indirect impacts to the West Indian manatee, Gulf sturgeon and all sea turtles listed in Appendix A, Annex K would be temporary and minimal. Temporary construction related impacts would be due to noise, turbulence, and mere presence of workers in the marsh restoration sites, access routes, and borrow sites and would likely result in the species avoiding the area temporarily. Permanent impacts would be the hindrance of access by sea turtles, to thousands of linear feet of shoreline. However, sea turtles do not typically use the beaches of Louisiana and it is assumed that they could easily go around the breakwater as it would not be contiguous. Loggerhead critical habitat would not be impacted as the shoreline protection measures are approximately 150 feet from the shore. Indirect beneficial impacts would be the protection of thousands of linear feet of shoreline which is designated piping plover critical habitat and also used by the Red knot. See table 2-17b (Chapter 2) for flotation footprint of associated with each shoreline protection measure.

Chenier Reforestation: There could be potential minimal indirect impacts to Sprague's pipit if reforestation of grasslands occurred. It is assumed that the birds would relocate to adjacent or nearby suitable foraging/roosting area.

Species of Concern: There is the potential for minimal indirect impacts to colonial nesting water birds. Impacts could include disturbance of roosting or foraging birds due to construction activity and noise. It is anticipated nesting birds would not be impacted as no work would take place within a rookery. Additionally, during nesting



season, work would be required to take place outside of the USFWS and LDWF declared buffer zones (Appendix A, Annexes K & Q). Work within buffer zones may only take place during non-nesting season (September 1 to February 15). In addition to these potential adverse impacts, marsh restoration would beneficially impact colonial nesting water birds by providing additional foraging grounds. No impacts to the bald eagle, as no known nests are located near any Project measures. If an eagle's nest is found within the Project area, a no-work zone must be implemented. Bottlenose dolphins could be found in the vicinity of shoreline protection measures, but with the utilization of the best management practices for reducing entrapment of this species (see Appendix A, Annex K), no indirect impacts are anticipated.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts to T&E resources would be similar to those discussed for the NER RP except to a lesser extent.

3.3.9 Cultural and Historic Resources

The following alternatives have the potential to impact cultural and historic resources, and the CEMVN has elected to fulfill its obligations under Section 106 of the NHPA of 1966, as amended, through the execution and implementation of two Programmatic Agreements as provided for in 36 CFR Part 800.14(b). (See Appendix A, Annex F). Cultural resources investigations and consultation would be required prior to implementing the recommended plans in order to identify cultural and historic resources, including historic properties, and assess potential impacts and/or adverse effects to historic properties. The CEMVN will seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. The information provided below is detailed in the report titled *Cultural Resources Assessment and Research Design for the Southwest Coastal Louisiana Project, Calcasieu, Cameron, and Vermilion Parishes, Louisiana* (Wells and Hill 2016) on file with the Louisiana Division of Archaeology.

HSDRR (NED) Plan

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, districts, and properties that may be of religious and cultural significance to Indian tribes, as well as any unrecorded cultural and historic resources that may be identified during subsequent cultural resource investigations.

The designated eligible NED RP structures have not been assessed for significance and NRHP eligibility. These structures and any additional resources located within an Area of Potential Effect (APE) will be identified and assessed following the determination of the APE for each participating NED RP structure. It is possible that some of the structures and other resources identified within an APE shall be considered eligible for listing in the NRHP. Four historic districts within the study area are listed in the NRHP, although none of the preliminarily eligible NED RP structures are located within the boundaries of an NRHP historic district. Thirty-six NRHP listed standing structures are located within the study area, most of which are located within a mile of one or more preliminarily eligible NED RP structures. Sixteen of the preliminarily eligible NED RP structures are located within the boundaries of a local historic district, 14 within the Downtown Development District of the Charlestown Cultural District and two within the Margaret Place Historic District, as designated by the City of Lake Charles.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

CSB - There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, and properties that may be of religious and cultural significance to Indian tribes, including 15 previously recorded archaeological sites and 39 previously inventoried standing structures, as well as any unrecorded cultural and historic resources that may be identified during the cultural resources investigations. Five historic cemeteries have also been documented in the vicinity of the proposed features. The previously recorded sites include one potentially eligible for listing in the NRHP, four not eligible for listing in the NRHP, and ten of undetermined eligibility. Of the 15 previously recorded sites, eight have prehistoric components, and seven have historic components.



Marsh Restoration: Eight sites have been recorded and 27 structures inventoried within a mile of the proposed features 3a1, 3c1, 124c, and 124d. Three prehistoric sites (two undetermined and one ineligible) are located within a mile of 3c1, and one ineligible prehistoric and four historic sites (three undetermined and one ineligible) are located within a mile of 124d. No resources have been recorded within the proposed borrow areas. High probability areas have been identified located within the boundaries of the marsh restoration features, and there is the potential that archaeological sites could be altered or destroyed by Project activities. If the USFWS obtains authorization and funding, then impacts of these measures to cultural resources would be the responsibility of the USFWS.

Shoreline Protection: One ineligible historic site has been recorded within a mile of the proposed feature 5a. There is the potential that archaeological sites could be altered or destroyed by Project activities.

Chenier Reforestation: Nine sites have been recorded and 11 structures inventoried within a mile of the proposed features 510a, 510b, and 510d. Two of the sites, one structure, and one cemetery are within or immediately adjacent to 510a, and three of the sites are within or immediately adjacent to 510d. Two prehistoric sites (one potentially eligible and one undetermined) and two historic sites (one undetermined and one ineligible) are located within a mile of 510a. Two prehistoric sites (one potentially eligible and one undetermined) and one ineligible historic site are located within a mile of 510b. Two prehistoric sites and three historic site of undetermined eligibility are located within a mile of 510d. Cheniers are high probability areas, and there is the potential that archaeological sites could be altered or destroyed by Project activities.

MB - There is the potential for direct and indirect impacts to previously recorded archaeological sites, buildings, structures, and properties that may be of religious and cultural significance to Indian tribes, including 22 previously recorded archaeological sites and 33 previously inventoried standing structures, as well as any unrecorded cultural and historic resources that may be identified during the cultural resources investigations. Two historic cemeteries have also been documented in the vicinity of the proposed features. The previously recorded sites include one eligible for listing in the NRHP, one potentially eligible for listing in the NRHP, four not eligible for listing in the NRHP, and 16 of undetermined eligibility. Of the 22 previously recorded sites, 20 have prehistoric components, and three have historic components.

Marsh Restoration: Nine prehistoric sites have been recorded and 17 structures inventoried within a mile of the proposed features 47a1, 47a2, 47c1, 127c3, and 306a1. Two of the sites are within or immediately adjacent to 306a1. Six prehistoric sites (one potentially eligible and five undetermined) are located within a mile of 47a1, and three prehistoric sites (one potentially eligible and two undetermined) are located within a mile of 47a2. Three prehistoric sites of undetermined eligibility are located within a mile of 306a1. No resources have been recorded within the proposed borrow areas. High probability areas have been identified within the boundaries of the marsh restoration features, and there is the potential that archaeological sites could be altered or destroyed by Project activities.

Shoreline Protection: Nine sites have been recorded within a mile of the proposed features 16b, 6b1, 6b2, and 6b3. Five of the sites are within or immediately adjacent to 6b2, including an NRHP listed site, and one site is within or immediately adjacent to 6b3. Three prehistoric sites of undetermined eligibility are located within a mile of 16b. Four prehistoric sites (one undetermined and three ineligible) and one NRHP listed historic site are located within a mile of 6b2. One prehistoric site of undetermined eligibility is located within a mile of 6b3. There is the potential that archaeological sites could be altered or destroyed by Project activities.

Chenier Reforestation: Eleven sites have been recorded and 39 structures inventoried within a mile of the proposed features 416, 509c, and 509d. Three of the sites, ten structures, one of which is potentially eligible for listing in the NRHP, and one cemetery are within or immediately adjacent to 416, and two sites are within or immediately adjacent to 509d. Eight prehistoric sites, one with a historic component (one potentially eligible and seven undetermined) and one ineligible historic site are located within a mile of 416. Two prehistoric sites of undetermined eligibility are located within a mile of 509d. Cheniers are high probability areas, and there is the potential that archaeological sites could be altered or destroyed by Project activities.



Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts would be the same as those described for the MB component of the RP.

3.3.10 Aesthetics (Visual Resources)

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There would be minimal impacts on visual resources due to elevating residential structures. Most viewsheds would not significantly change when individual or small groups of residential structures are elevated. However, in those viewsheds with relatively homogenous low-elevated residential structures, elevating residential structures up to 13 feet may disrupt the symmetry of the existing viewshed. Under Louisiana Civil Code Art 701, the Servitude of View, the owner of the dominate estate has the right to prevent the raising of constructions on the servient estate that would obstruct the existing view.

Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Construction of the marsh restoration measures would not adversely impact the Visual Resources. The primary difference is in how the marsh is restored. With the use of dredge material from the CSC, where impacts would be minimal, visual resources would be greatly and positively impacted. Those areas along the Creole Nature Trail would positively impact the byway creating enhanced view sheds for travelers. Other areas, such as those located along the Intracoastal Waterway and Freshwater Bayou Canal have less visual significance because those areas are remote with limited access. Construction of marsh habitat may have temporary negative impact to the Aesthetic resources in the Project area. Initial construction of the marsh would temporarily alter open water to bare mud flats, which may be considered aesthetically unpleasant. With dewatering and natural colonization of marsh plants, based on previous experience with beneficial use of dredged material and marsh restoration, it will take approximately one to three years before the marsh becomes fully established with vegetation.

Shoreline Protection: These elements do have public visual significance and their protection and restoration would add an element of form, line and color to the shoreline of Louisiana. Visually, manmade measures like breakwaters would not have positive effects on the viewscape of undeveloped and natural beach. Measures such as this are necessary to ensure that the beach remains as it is. Many of these areas are remote and public access is very limited.

Chenier Reforestation: Visually, these measures are the most significant of any other in the study area. Cheniers aid in the form and function of developing the design elements of the landscape. As small hillocks or ridges, they offer the variation in terrain that makes the viewshed interesting and memorable. They offer islands of oasis for different plant materials to develop and add texture and color to the land. In most cases, they allow taller trees to grow in a region which adds the necessary framing elements to the landscape to give it artistic quality and character. Most of the designated chenier restoration measures are located directly adjacent to the Creole Nature Trail and would considerably and positively add to existing design elements already described under marsh restoration.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts would be the same as those described for the MB component of the RP.

3.3.11 Recreation

HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (RP)

There are no direct impacts from structure elevation on recreational resources. A direct impact from flood proofing park buildings is the recreational use would be temporarily unavailable during flood proofing work. An indirect impact of elevating structures on building costs of future recreational camps could result in fewer camps being constructed.



Ecosystem Restoration (NER) Plans

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (RP)

Marsh Restoration: Any direct impacts to recreational fishing, hunting, and other recreational resources would be temporary and occur during construction. Recreationalists may have to circumvent a marsh restoration Project area when traveling to a destination due to construction limiting or delaying access. In general, measures that create marsh habitat and improve hydrology of wetlands are more likely to improve recreational fishing opportunities by enhancing the sustainability of productive nursery habitats.

Shoreline Protection: Any direct impacts to recreational fishing and hunting would be temporary and occur during construction activities. Shoreline protection Projects should help protect recreational resource lands from effects of coastal storm surge and minimize the loss of valuable fishery habitat.

Chenier Reforestation: Restoration of natural ridges would improve bank stabilization and potentially provide additional habitat for deer, small game and birds, which could be beneficial for hunting and bird watching. Restored ridges would also enhance protection of adjacent swamps and marshes during coastal storms, which could also potentially benefit recreational resources and infrastructure such as boat launches.

Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan

Impacts would be the same as those described for MB component of the RP. Appendix A (Annex N: Recreation) provides more details on direct, indirect, and cumulative impacts of the RP and the Mermentau Small Integrated Restoration Alternative on these resources.

3.4 Cumulative Impacts

The historic and existing conditions for the significant resources involving both the NED and NER plans are presented in Chapter 1. The direct and indirect impacts of the No Action Alternative (Future Without Project Conditions) on significant resources is also presented in Chapter 1. The direct and indirect impacts for each of the NED and NER Plans, as compared to the No Action Alternative, is presented in Chapter 3 (sections 3-1 to 3-3). Cumulative impacts are the effects on the environment that result from the incremental direct and indirect impacts of the proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such actions. Cumulative impacts can result from actions that individually are minor, but collectively result in significant actions taking place over time (Section 1508.7 40 CFR Parts 1500-1508). For example, the incremental impacts of the proposed NER RP measures when added to other past, present and reasonably foreseeable future wetland restoration projects throughout the study area could significantly modify an entire basin's habitat diversity. The Council on Environmental Quality's (CEQ) "Considering Cumulative Effects Under the National Environmental Policy Act" (CEQ 1997) provides an 11-step framework for cumulative effects analysis (CEA) that was utilized to conduct the cumulative impact assessment for this study.

The following describes the cumulative effects or impacts for each alternative NED and NER plan by describing both the spatial (United States, Louisiana, and Study Area) and the temporal (past, present and reasonably foreseeable future (50-year period of analysis) actions of other nonstructural flood risk reduction and ecosystem restoration projects as compared to the impacts of the proposed actions presented in Chapter 3 (sections 3-1 to 3-3). The action detailed in this section are limited to those of the Federal, State and Local governments as there are no relevant private or public actions related to either the NED or NER actions.

3.4.1 HSDRR (NED) Plans

Modified Plan 8 Alternative - Nonstructural 0-25-Year Floodplain Plan (NED RP)

As described in detail in Chapter 4, the NED RP proposes implementing nonstructural measures across the 4,700 square mile study area to reduce coastal storm surge damages to 3,462 residential structures, 342 commercial structures and public buildings, and 157 warehouses through the combined voluntary elevation of residential structures, dry flood proofing of non-residential structures, and construction of localized storm surge risk reduction measures around warehouses. To assess the cumulative impacts for the NED RP, the incremental direct and indirect impacts of implementing the NED RP, as detailed in Chapter 3 above, are considered



together with other past, present and reasonably foreseeable future nonstructural risk reduction projects which are identified and described below. The cumulative impacts are summarized in Table 3-6.¹

Nonstructural Risk Reduction Measures throughout the United States:

Contributions to national economic development (NED outputs) are increases in the net value of the national output of goods and services, expressed in monetary units, and are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed and also of those that may not be marketed. For any storm surge risk reduction plan, the NED outputs can be used to measure the cumulative effect to the Nation's economy. To that end, the cumulative effects can be seen in the thousands of miles of levees, nonstructural measures and hazard mitigation programs in place throughout the nation and the region. The measure of NED outputs within the study area would also contribute to the measure at the National level. Therefore there is no reason to perform computations of outputs beyond the study area.

Evaluations of the study alternatives eliminated all structural alternatives which could have had local, regional, or National environmental impacts. The remaining nonstructural alternatives developed eligibility criteria which eliminated any structure for which implementation of the nonstructural measure would have resulted in an impact to wetlands, threatened and endangered species, or the deposition of fill materials into the waters of the United States. For these reasons the evaluations of cumulative impacts is confined to the study area.

Reasonably foreseeable ongoing programs:

It is reasonably foreseeable that the FEMA Hazard Mitigation Assistance (HMA) (<http://www.fema.gov/hazard-mitigation-assistance>) grants programs would continue to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. Currently, FEMA administers the following HMA grant programs:

- [Hazard Mitigation Grant Program \(HMGP\)](#) assists in implementing long-term hazard mitigation measures following Presidential disaster declarations. Funding is available to implement projects in accordance with State, Tribal, and local priorities.
- [Pre-Disaster Mitigation \(PDM\)](#) provides funds for hazard mitigation planning and to implement mitigation projects before disasters. The program goal is to reduce overall risk to the population and structures, while at the same time, also reducing reliance on Federal funding from disaster declarations.
- [Flood Mitigation Assistance \(FMA\)](#) provides annual funds so that measures can be taken to reduce or eliminate risk of flood damage to buildings insured under the NFIP.

Nonstructural Risk Reduction Measures throughout Louisiana:

The conceptual 2012 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens. The 2012 State Master Plan's appendix F2 Nonstructural Implementation Strategy includes the following nonstructural strategies: 1) flood proofing of residential and commercial properties, 2) elevation of residential properties, and 3) voluntary Acquisitions of residential properties. In addition, programmatic measures such as land use planning, building codes, and education that can reduce risk to future buildings within communities will be integral to the nonstructural program (source: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi_msiI0ovLAh_VCWT4KHcrSD-sQFggqMAE&url=http%3A%2F%2Fcoastal.la.gov%2Fwp-

¹ The cumulative impacts of the [Plan 8 Alternative – Nonstructural 100-Year Floodplain](#) are similar to, but greater in scale, to the cumulative impacts identified in connection with the NED RP alternative because of the larger numbers of structures that would be included in the Plan 8 Alternative. Hence a discussion of the cumulative impacts associated with the Plan 8 alternative will not be further detailed.



[content%2Fuploads%2F2014%2F03%2FAppendix_F2_NonstructuralStrategyFINAL.pdf&usg=AFQjCNE3WYY2tiNH924gwCffvwwbH8uLNA](http://www.fema.gov/hazard-mitigation-assistance); accessed February 22, 2016).

Past and Present Actions:

Following Hurricanes Katrina, Lili, Rita, Gustav, Ike, and Issac many residents were required to meet certain building requirements to meet floodplain management ordinances. Some individuals met these building requirements at personal expense. Many others utilized the FEMA Hazard Mitigation Assistance (HMA) (<http://www.fema.gov/hazard-mitigation-assistance>) grants programs (including: HMGP, PDM and FMA programs) to provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from past, present and future disaster damages in Louisiana.

Nonstructural Risk Reduction Measures throughout the Study Area:

Past and Present Actions:

Within the study area the only known Federal program addressing reduction in damages from hurricane storm surge events is FEMA's Hazard Mitigation Assistance (HMA), as expressed in the FEMA Federal Insurance and Mitigation Administration (FIMA) policy guidance. The key purpose of Hazard Mitigation Grant Program (HMGP) is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster. HMGP funding is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas (see <http://www.fema.gov/media-library/assets/documents/85146>). The amount of HMGP funding available to the Applicant is based on the estimated total Federal assistance, subject to the sliding scale formula outlined in Title 44 of the Code of Federal Regulations (CFR) Section 206.432(b) that FEMA provides for disaster recovery under Presidential major disaster declarations. As described in greater detail at the above referenced website, the following project types are eligible under the HMA programs:

- Property Acquisition and Structure Demolition;
- Property Acquisition and Structure Relocation;
- Structure Elevation;
- Mitigation Reconstruction; and
- Dry Flood proofing.

Table 40 in the Economic Appendix D indicates a total of 51,857 structures in the study area. Of these, 46,860 residential structures, 3,432 non-residential structures, and 1,565 warehouses are within the 100-year floodplain. Above the 100-year floodplain are 36,190 residential structures, 2,429 non-residential structures, and 835 warehouses that are above the 100-year floodplain. Many of these structures are located on naturally higher elevations. However, based on personal communications, some of the structures in the study area that are above the 100-year floodplain have already been elevated or subjected to other nonstructural risk reduction via FEMA grants or at personal expense. Personal communications with many different residents in the study area's Parishes of Calcasieu, Cameron and Vermilion during public meetings and hearings for the Draft and Revised Draft Integrated Feasibility Report and EIS revealed many of residents (total numbers unknown) have previously or are in the process of elevating their structures at personal expense or through grant assistance programs such as FEMA's Hazard Mitigation Assistance following Hurricanes Katrina, Rita, Gustave, and Ike. It is reasonably foreseeable that many of these self-proclaimed self-reliant residents would continue to stay in the area and raise their structures or take other measures to reduce hurricane storm surge damages. For example, in Calcasieu Parish 61 structures received residential mitigation grants in various forms, including: 24 structures were acquired; 22 structures were elevated; 5 structures were pilot reconstruction; 5 structures were wind retrofitted; 3 structures were provided shutters; 1 structure was provided drainage, and 1 structure was



provided roof repair (personal communication Laurie T. Cormier, Calcasieu Parish Police Jury, February 23, 2016).

Reasonably foreseeable ongoing programs:

There are ongoing programs within the region that may be implemented during the period of analysis, however, at the time of this report construction specific information is not available. A brief discussion of these programs follows.

As referenced above as an ongoing program throughout Louisiana, the conceptual 2012 State Master Plan recommends a comprehensive nonstructural program as part of its strategy to reduce the flood risk for Louisiana citizens. The 2012 State Master Plan's appendix F2 Nonstructural Implementation Strategy includes the following nonstructural strategies: 1) flood proofing of residential and commercial properties, 2) elevation of residential properties, and 3) voluntary Acquisitions of residential properties. In addition, programmatic measures such as land use planning, building codes, and education that can reduce risk to future buildings within communities will be integral to the nonstructural program (source: http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&ved=0ahUKEwi_msiI0ovLAh_VCWT4KHcrSD-sQFggqMAE&url=http%3A%2F%2Fcoastal.la.gov%2Fwp-content%2Fuploads%2F2014%2F03%2FAppendix_F2_NonstructuralStrategyFINAL.pdf&usg=AFQjCNE3WYY2tiNH924gwCffvwwbH8uLNA; accessed February 22, 2016).

Reasonably Foreseeable Actions:

There are no reasonably foreseeable nonstructural risk reduction projects/actions identified within the study area.

CEQ's recommends 11 Steps for Cumulative Effects Analysis. These steps are the end of this section. Some considerations specific to NED analysis are as follows:

- Regulatory thresholds have been identified (e.g., air quality and water quality standards) including the factors for managing and identifying cultural resources and the requirements (including age of the structure (50 years) that could trigger eligibility for listing on the national register of historic structures. This latter example is of particular importance considering the 50-year period of analysis due to the numerous structures in the area that could potentially qualify as a historic or national register structure over the course of the period of analysis.
- Generally, current trends in the human environment such as employment, business and industrial activity, and community and regional growth tend to mirror the increases demonstrated in populations and housing. Only Cameron Parish has had a population decline.
- During plan formulation the alternatives were modified, removed and new alternatives added to avoid, minimize and reduce potential significant Project-induced effects. For example several structural levees were considered but were later screened out due to a failure of benefits to exceed costs.
- For the NED RP, a notice of construction completion (NCC) for a participating structure would be provided to the non-Federal sponsor upon completion of the flood proofing measure for that structure. Although the non-Federal sponsor will have certain OMRR&R obligations, among other things, to inspect and to ensure no encroachment upon the Project purpose or functionality, there is no post construction monitoring or adaptive management for the NED RP. It is the responsibility of the owner to OMRR&R the flood proofing improvements to his/her property.

3.4.2 Ecosystem Restoration (NER) Plans

Coastal Ecosystem Restoration in Study Area:

The processes of coastal wetland loss in the Study Area can result from the gradual decline of marsh vegetation due to inundation and saltwater intrusion, as well as from storm surge events; both of which can eventually



lead to complete loss of marsh vegetation. As marsh vegetation is lost, underlying soils are more susceptible to erosion and are typically lost as well, leading to deeper water and precluding marsh regeneration. Significant accretion of sediments is then required in order for marsh habitat to reestablish. Perhaps the most serious and complex problem in the study area is the rate of land and habitat loss. Table 1-10 displays land area changes in chenier plain basins from 1932-2010 (Couvillion et al. 2011). The effects of recent hurricanes have accelerated marsh loss. Table 1-11 includes estimates of wetland loss attributed to the major hurricanes of 2004 to 2008 in the Chenier Plain and throughout coastal Louisiana. More recently, Palaseanu-Lovejoy et al. (2013) estimated wetland loss in the Hackberry area located in the southwestern part of the chenier plain that was impacted by Hurricane Rita (2005) and Ike (2008). Persistent land loss in the Hackberry area due to Hurricane Rita was approximately 5.8% and increased by an additional 7.9% due to Hurricane Ike. It is expected that the chenier plain has sustained more persistent land loss with intermediate and brackish marshes experiencing the most land loss, while saline marshes were less impacted and fresh marshes showed evidence of vegetation seasonality change and regrowth, which concealed the hurricane impacts.

According to the Louisiana Recovery Authority's 2006 "The Rita Report", the devastation Hurricane Rita left behind made it the third most expensive natural disaster in US history (source: <http://lra.louisiana.gov/assets/docs/searchable/reports/RitaReportFinal091806.pdf>). The Rita Report estimated almost \$600 million dollars of damage to agriculture, forestry and fishing. More than 200,000 acres of fresh water and intermediate marshland was inundated with saltwater threatening native species on already-threatened environmentally sensitive wetlands. Hence, the southwest coastal Louisiana area, like the remainder of coastal Louisiana has been and will continue to be subjected to stresses which will continue the decline of environmental resources.

It is anticipated that future conditions in the Study Area would include persistence of current sedimentation and erosion patterns. Existing hydrologic alterations would continue to affect water levels and salinities and continue influencing land loss at similar or increased rates. RSLR would expose additional shoreline areas to erosive forces into the foreseeable future. Table 1-18 displays net land area change projections by basins in the study area (Couvillion et al. 2013). The Study Area basins would experience the following net changes between 2010-2060: -146.5 km² for Calcasieu/Sabine Basin, -146.5 km² for Mermentau Basin, and -67.0 km² for Teche/Vermilion Basin. These results suggest that a net wetland loss in coastal Louisiana as well as the Study Area over the next 50 years would likely occur regardless of uncertainties in parameters that influence coastal wetland loss.

Plan CM-4 Alternative - Comprehensive Small Integrated Restoration Plan (NER RP)

Cumulative impacts for the NER RP would be the incremental direct and indirect impacts of implementing the NER RP marsh restoration, shoreline protection and chenier reforestation measures (summarized below) in addition to other past, present and reasonably foreseeable future coastal and other ecosystem restoration projects described below. Alternative Plan: M-4— Mermentau Small Integrated Restoration Plan is a separable increment of the NER RP so impacts would be the same as described for the Mermentau Basin component of the NER RP. Therefore Plan M-4 is no longer discussed. Following presentation of other present and reasonably foreseeable ecosystem restoration programs and projects, the cumulative impacts are summarized in Table 3-6.

Over the 50-year period of analysis, the NER RP would protect, restore, and nourish a net total of 14,035 net acres of emergent marsh (including 7,900 net acres from the nine marsh restoration measures and 6,135 net acres from the five shoreline protection measures). At the end of the 50 year period of analysis, the marsh restoration and shoreline protection measures together would achieve a total net ecological benefit of 4,430 AAHUs; with 2,700 AAHUs from the nine marsh restoration measures, and 1,738 AAHUs from the five shoreline protection measures. Whereas the chenier restoration measures would restore a total of 1,413 net acres with 538 AAHUs. The positive cumulative impacts of implementing the NER RP would be the additive and, in some instances, the synergistic effects of restoring and nourishing sites over the 50-year period of analysis, an estimated 7,900 net acres and 2,700 AAHUs. The five shoreline protection measures would span approximately 251,528 linear feet, and are anticipated to protect/stabilize approximately 6,135 net acres and



1,738 AAHUs. Although not impacting waters of the United States, the approximately 1,413 net acres from 35 reforestation sites in Cameron and Vermilion Parishes would be reforested over the 50 year period of analysis, resulting in 538 AAHUs. The only significant long-term adverse cumulative impact of implementing the NER RP measures is the conversion of existing degraded marsh and shallow open water to transitional estuarine marsh habitat, breakwaters, and rock-lined shoreline protection habitats.

Coastal Ecosystem Restoration in the United States:

Dahl and Stedman (2013) reporting on the status and trends of wetlands in conterminous United States coastal watersheds from 2004 to 2009 indicate that in 2009, there were an estimated 41.1 million acres of wetlands in the coastal watersheds of the United States. This area represented 37.3 percent of total wetland area in the conterminous United States. Between 2004 and 2009, wetland area in the coastal watersheds of the United States declined by an estimated 360,720 acres. The average annual rate of change was an estimated loss of 80,160 acres, a 25 percent increase in the rate of wetland loss from the previous reporting period. The increase in the rate of coastal wetland loss was statistically significant ($p = 0.007$) when results from this study were compared to the coastal wetland loss estimates from the 1998 to 2004. Erosion and/or inundation are the primary causes of saltwater wetland losses in the Gulf of Mexico. In addition, saltwater impacts have been adversely affected by the cumulative effects of oil and gas development, hurricanes and other coastal storm events.

While the Coastal wetlands loss is occurring across the nation, and is significant as a national resource, the connections between other national coastal restoration projects and those occurring within the region is limited or nonexistent. For this reason, the resources of concern and the remainder of this analysis will focus on those resources within the study area and those that are transient to or affected by this study area.

Past and Present Actions: Regional, Louisiana, and Study Area

The below list is not exhaustive, but provides a representative sample of coastal ecosystem restoration efforts that cumulatively effect coastal wetland loss within the region. The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Current Federal initiatives call for a wide range of restoration actions, including improving or restoring 25,000 miles of stream corridor; which contributes to the success of neo-tropical migratory species (sources: <http://www.nwd-mr.usace.army.mil/rcc/MRFTF/docs/USACE-NFPC%20Nonstructural%20Measures%20Definitions.pdf>; and <http://water.epa.gov/type/wetlands/restore/principles.cfm>; accessed January 22, 2016).

- Coastal Impact Assistance Program (CIAP) is authorized by the Outer Continental Shelf (OCS) Lands Act, as amended; 31 U.S.C. 6301-6305. The intent of the program is to disburse funding to eligible producing states and coastal political subdivisions for the purpose of conservation, protection, or restoration of coastal areas including wetlands; mitigation of damage to fish, wildlife, or natural resources; planning assistance and the administrative costs of complying with these objectives; implementation of a federally-approved marine, coastal, or comprehensive conservation management plan; and mitigation of the impact of outer Continental Shelf activities through funding of onshore infrastructure projects and public service needs. Louisiana's CIAP Program, administered by the Department of Interior, provides approximately \$500 million dollars to Louisiana and includes a total of 103 projects state-wide, with 11 state projects, 17 state/parish projects and 75 parish projects. Examples of CIAP projects recently completed or under construction are presented below.
 - East Grand Terre Island Barrier Island Restoration
 - Barataria Land Bridge Dedicated Dredging created more than 2,000 acres of marsh
 - Marcantel Beneficial Use created 440 acres of marsh
- CWPPRA Program – There are currently 149 active CWPPRA projects throughout coastal Louisiana. In September 2015, 101 projects had been completed, benefiting over 97,401 acres. 21 projects are currently



under active construction with 22 additional projects approved and in the engineering and design phase of development (source: <https://lacoast.gov/new/About/FAQs.aspx>; accessed November 23, 2015).

- CS-04a Cameron-Creole Maintenance
 - CS-11b Sweet Lake/Willow Lake Hydrologic Restoration
 - CS-17 Cameron Creole Plugs
 - CS-18 Sabine National Wildlife Refuge Erosion Protection
 - CS-19 West Hackberry Vegetative Planting Demonstration
 - CS-20 East Mud Lake Marsh Management
 - CS-21 Highway 384 Hydrologic Restoration
 - CS-22 Clear Marais Bank Protection
 - CS-23 Replace Sabine Refuge Water Control Structures at Headquarters Canal, West Cove Canal, and Hog Island Gully
 - CS-24 Perry Ridge Shore Protection
 - CS-25 Plowed Terraces Demonstration
 - CS-27 Black Bayou Hydrologic Restoration
 - CS-28-1 Sabine Refuge Marsh Creation, Cycle 1
 - CS-28-2 Sabine Refuge Marsh Creation, Cycle 2
 - CS-28-3 Sabine Refuge Marsh Creation, Cycle 3
 - CS-28-4-5 Sabine Refuge Marsh Creation, Cycles 4 and 5
 - CS-29 Black Bayou Culverts Hydrologic Restoration
 - CS-30 GIWW - Perry Ridge West Bank Stabilization
 - CS-31 Holly Beach Sand Management
 - CS-32 East Sabine Lake Hydrologic Restoration
 - CS-054 Cameron-Creole Watershed Grand Bayou Marsh Creation
 - CS-59 Oyster Bayou Marsh Creation and Terracing
 - ME-04 Freshwater Bayou Wetland Protection
 - ME-09 Cameron Prairie National Wildlife Refuge Shoreline Protection
 - ME-11 Humble Canal Hydrologic Restoration
 - ME-13 Freshwater Bayou Bank Stabilization
 - ME-14 Pecan Island Terracing NMFS Sediment and Nutrient Trapping
 - ME-16 Freshwater Introduction South of Highway 82
 - ME-18 Rockefeller Refuge Gulf Shoreline Stabilization
 - ME-19 Grand-White Lakes Landbridge Protection
 - ME-20 South Grand Chenier Marsh Creation
 - ME-21 Grand Lake Shoreline Protection
 - ME-22 South White Lake Shoreline Protection
 - TV-03 Vermilion River Cutoff Bank Protection COE Shoreline Protection
 - TV-04 Cote Blanche Hydrologic Restoration
 - TV-09 Boston Canal/Vermilion Bay Bank Protection
 - TV-12 Little Vermilion Bay Sediment Trapping
 - TV-13a Oaks/Avery Canal Hydrologic Restoration, Increment 1
 - TV-14 Marsh Island Hydrologic Restoration
 - TV-15 Sediment Trapping at "The Jaws"
 - TV-16 Cheniere Au Tigre Sediment Trapping Demonstration
 - TV-17 Lake Portage Land Bridge
 - TV-18 Four Mile Canal Terracing and Sediment Trapping
 - TV-21 East Marsh Island Marsh Creation
- Louisiana Coastal Area (LCA), Ecosystem Restoration Study (USACE 2004) recommends 15 near-term measures aimed at addressing the critical restoration needs. The components recommended for authorization include five critical near-term ecosystem restoration measures, a demonstration program consisting of a series of demonstration projects, a beneficial use of dredged material (BUDMAT) program,



and a science and technology program. The five critical near-term ecosystem restoration measures, demonstration projects, and BUDMAT projects are all subject to the approval of feasibility level of detail decision documents by the Secretary of the Army. The January 31, 2005 Chief's Report approved the Near-Term Plan substantially in accordance with the 2004 LCA Study. Title VII of the Water Resources Development Act of 2007 (WRDA 2007) (Public Law 110-114) authorized an ecosystem restoration Program for the Louisiana Coastal Area substantially in accordance with the Near-Term Plan. Some of the LCA projects have not yet been authorized for construction, and some of those that have been authorized for construction but no longer have a local non-federal sponsor. LCA projects that are completed or are currently under construction include:

- LCA West Bay Marsh Creation Tier 1 project, which is part of the LCA's Beneficial Use of Dredged Material (BUDMAT) Program
- LCA Baratarria Basin Barrier Shoreline Caminada
- LCA Baratarria Basin Barrier Shoreline Shell Island
- LCA Terrebonne Basin Barrier Shoreline Whisky Island
- LCA Amite Diversion Canal modification
- The 2012 Louisiana's Comprehensive Master Plan for a Sustainable Coast, (source: http://issuu.com/coastalmasterplan/docs/coastal_master_plan-v2?e=3722998/2447530; accessed November 23, 2015) indicates that the CPRAB has, since 2007:
 - Benefited 19,405 acres of coastal habitat
 - Moved over 150 projects into design and construction
 - Constructed projects in 20 parishes
 - Constructed 32 miles of barrier islands/berms

- USACE Navigation projects, Beneficial Use of Dredged Material Program

The CEMVN removes, on average, about 75 million cubic yards (CY) of shoal material from Federal navigation channels every year. Of this annual total, about 19 million CY is removed from projects located too far from potential beneficial use disposal sites to be economically feasible. The Mississippi River Deep Draft Crossings account for about 18 million CY of this total of this annual total, about 16 million CY consists of "fluff" material that is not usable/suitable for marsh restoration the Atchafalaya River and Calcasieu River bar channels account for this "fluff" material. Thus, of the 75 million CY that the CEMVN dredges every year, only about 40 million CY are actually available for beneficial use placement.

On average, about 16.0 million CY of dredged material is beneficially used on an annual basis. This equals about 40 percent of all dredged material removed annually in CEMVN that is actually available and suitable for beneficial use placement. The majority of this beneficial use is funded by the O&M budget. The remainder is paid for by CWPPRA, LCA BUDMAT, Continuing Authorities Program - Section 204, or by Contributed Funds depending on availability. To date (1976-2015), the CEMVN has used dredged material to create/restore:

- a. Approximately 61 square miles of coastal habitat in Louisiana.
- b. Approximately 32,623 acres of wetland habitat.
- c. Approximately 3,495 acres of bird nesting islands, beach/shoreline, and barrier island habitat.
- d. Approximately 3,000 acres of scrub/shrub, maritime forest ridge, grassland habitat (Southwest Pass).

Channel-by-channel breakdown of beneficial acres created/restored by Federal navigation projects:

- a. Calcasieu River = 3,320 acres
- b. Mermentau River = 242 acres
- c. Freshwater Bayou = 344 acres
- d. Atchafalaya River = 8,996
- e. Houma Navigation Canal = 143 acres
- f. Port Fourchon = 309 acres
- g. Baratarria Bay Waterway = 1,079 acres
- h. Tiger Pass = 624 acres
- i. Baptiste Collette = 1,828 acres



- j. South Pass = 1,971 acres
 - k. Southwest Pass = 17,591 acres
 - l. MRGO = 2,591 acres
 - m. Berwick Bay Harbor = 59 acres
 - n. Tangipahoa River = 21 acres
- The State of Louisiana, Division of Administration, Office of Community Development, CDBG Program helps communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. There are presently 10 different CDBG projects in coastal Louisiana, including levee repairs, water assimilation, bulkhead, flood control, and terracing projects. The scale of this program past and present is such that the cumulative impact in the region is not significant.
 - The Mississippi Coastal Improvements Program (MsCIP) consists of structural, nonstructural and environmental project elements, including restoration of 1,280 square miles of Mississippi sound aquatic restoration 30,000 acres coastal habitat restoration. Some of the completed projects include (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/images/PlaceMap07Dec2015.jpg; accessed February 22, 2016):
 - Hancock County Beaches
 - Harris County Beaches
 - Hancock County Streams
 - Jackson Marsh
 - Gautier Coastal Streams
 - Franklin Creek Floodway
 - West Ship Island
 Projects with construction underway include:
 - Camille Cut
 - East Ship Island, South
 - Cat Island Restoration
 - Houston-Galveston Navigation Channels, Texas (HGNC) project is a collection of beneficial uses sites under one project scope in Galveston Bay, Texas. The Port of Houston Authority and the US Army Corps of Engineers, Galveston District along with 6 local state and federal agencies developed a plan to contain the material dredged from the channel constructing 1,720 hectares (4,250 acres) of intertidal marsh and islands that supported vegetation and bird habitats.

Reasonably foreseeable ongoing programs: Regional, Louisiana, and Study Area

There are ongoing programs within the region that may be implemented during a period of analysis, however, at the time of this report construction specific information is not available. A brief discussion of these programs follows.

- Restoration of injuries to natural resources damaged by the 2010 Deepwater Horizon oil spill is presently under the Natural Resource Damage Assessment (NRDA), a legal process under the Oil Pollution Act of 1990 (OPA) and the Louisiana Oil Spill Prevention and Response Act of 1991 (LOSPRA) whereby designated trustees represent the public to ensure that natural resources injured in an oil spill are restored (source: <http://la-dwh.com/AboutNRDA.aspx>; accessed November 25, 2015). Both federal and state NRDA regulations provide a step-by-step process for trustees to determine injuries, to assess damages, and to develop and implement restoration projects that compensate the public for injuries to natural resources impacted by an incident. In general, the NRDA process involves three steps: (1) pre-assessment; (2) restoration planning; and (3) restoration implementation. On July 11, 2011, Governor Bobby Jindal unveiled the “Louisiana Plan” which outlines 13 initial proposed early restoration projects (source: <http://la-dwh.com/LouisianaPlanProjects.aspx>; accessed November 25, 2015). The projects are consistent with Louisiana’s Coastal Master Plan and they support the goal of compensating the public for natural resource injuries resulting from the Deepwater Horizon Oil Spill.
 - On October 5, 2015, the Deepwater Horizon Natural Resource Damage Assessment Trustees released the Deepwater Horizon Oil Spill Draft Programmatic Damage Assessment and Restoration Plan and



Programmatic Environmental Impact Statement (PDARP/PEIS) for public review and comment (source: http://la-dwh.com/PDARP_PEIS/Draft_PDARP_PEIS.aspx; accessed November 25, 2015). The Trustees identified Alternative A as their preferred alternative. Alternative A is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem. The restoration dollars could be used for a variety of restoration approaches. For illustration purposes only, the approximately \$4 billion allocated to Louisiana could be sufficient to create 20,000 to 40,000 acres of coastal marsh in Louisiana along hundreds of miles of shoreline, supporting the diversity of fish, birds, and animals that depend on coastal marsh. Although no NRDA sponsored projects have yet been constructed, it is reasonably foreseeable that the nearly Gulf-coast wide damages would be mitigated.

- The Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) represents a portion of the Congressional response to the Deepwater Horizon oil spill. The Act dedicates 80 percent of all Clean Water Act administrative and civil penalties related to the Deepwater Horizon oil spill to the Gulf Coast Restoration Trust Fund (Trust Fund). RESTORE Act funds are allocated between five buckets: the Direct Component (35%), the Council-Selected Restoration Component (30%), the Spill Impact Component (30%), the Gulf Coast Ecosystem Restoration Science Program (2.5%); and Centers of Excellence Research Grants Program (2.5%). In early 2013, Transocean entered into a plea agreement to pay \$1 billion to resolve federal Clean Water Act civil penalty claims, of which \$800 million will be made available under the RESTORE Act to fund Gulf Coast recovery projects. The process of selecting projects for implementation under the RESTORE Act is anticipated to continue through the period of analysis, until the allocated funds are exhausted. Some projects have been selected and funded for implementation and will be discussed as a part of the reasonably foreseeable actions section below.

Reasonably Foreseeable Actions: Regional, Louisiana, and Study Area

The causes of coastal wetland degradation and loss have been researched extensively and are well documented. Nationwide coastal wetland degradation and loss is expected to continue due to many different, and often interacting factors, including: agriculture, nutrient enrichment, drainage, climate change, human development, silviculture, pollution, invasive species, world-wide eustatic sea level rise, subsidence, navigation channels, oil and gas activities, saltwater intrusion, hurricane and storms, and others. The EPA, reporting on the Nation, states the number of restoration projects grows yearly. Therefore, it is reasonably foreseeable, for this region, that future Federal, state and local initiatives will continue to call for a wide range of restoration actions, including coastal ecosystem restoration.

Couvillion et al. (2013) models for a 2010–2060 simulation period under a “future-without-action” condition, determined that coastal Louisiana is at risk of losing between 2,118 and 4,677 km² of land over the next 50 years. With the extensive coastal ecosystem degradation and coastwide land loss, it is anticipated future focus will be on the desire to implement coastal restoration projects designed to help offset these expected future coastal land losses. These projects could potentially be pursued under the CWPPRA Program, CIAP projects within Louisiana, Louisiana’s Community Development Block Grant Projects (CDBG), Louisiana Coastal Area (LCA) Program, 2012 State Master Plan, State-sponsored projects, and WRDA. Reasonably foreseeable coastal ecosystem restoration projects in Louisiana include:

- The CIAP authorization is subject to a Federal fiscal cap. Within the limitations of its authorization, CIAP will continue to be implemented under the Outer Continental Shelf (OCS) Lands Act. The purpose of the program is to disburse funding to eligible producing states and coastal political subdivisions for conservation, protection, or restoration of coastal areas including wetlands; mitigation of damage to fish, wildlife, or natural resources; planning assistance and the administrative costs of complying with these objectives; implementation of a federally-approved marine, coastal, or comprehensive conservation management plan; and mitigation of the impact of outer Continental Shelf activities through funding of



- onshore infrastructure projects and public service needs (source: <http://www.saj.usace.army.mil/Missions/Environmental/EcosystemRestoration.aspx>; accessed February 22, 2016).
- PO-73-2 - Central Wetlands – EBSTP to A2
 - PO-148 - Living Shoreline
 - TE-63 - Falgout Canal Freshwater Enhancement
 - BA-0161 - Mississippi River Water Reintroduction into Bayou Lafourche
- The MsCIP will continue with structural, nonstructural and environmental project elements to restore coastal Mississippi. Future study elements that are as yet unfunded but included in Public Law 113-121 and may be reasonably foreseeable include the following (source: http://www.sam.usace.army.mil/Portals/46/docs/program_management/mscip/images/PlaceMap07Dec2015.jpg; accessed February 22, 2016):
 - Coast-wide Beach and Dune Restoration
 - Waveland Residential Flood proofing
 - Turkey Creek Ecosystem Restoration
 - Deer Island Restoration
 - Admiral Island Ecosystem Restoration
 - The CWPPRA Program authorization has been extended to 2019. There are 22 projects in the engineering and design phase of development. It is therefore reasonably foreseeable that some CWPPRA projects that are presently in design will be authorized and constructed in the near future (such as).
 - PO-104 - Bayou Bonfouca Marsh Creation
 - ME-20 - South Grand Chenier Marsh Creation Project
 - CS-54 - Cameron-Creole Watershed Grand Bayou Marsh Creation
 - TE-72 - Lost Lake Marsh Creation and Hydrologic Restoration
 - CS-59 - Oyster Bayou Marsh Creation and Terracing
 - ME-21 - Grand Lake Shoreline Protection- Tebo Point
 - The State of Louisiana, Division of Administration, Office of Community Development, CDBG Program helps communities provide a suitable living environment and expand economic opportunities for their residents, particularly in low to moderate income areas. There are presently 10 different CDBG projects in coastal Louisiana, including levee repairs, water assimilation, bulkhead, flood control, and terracing projects. The scale of this program past and present is such that the cumulative impact in the region is not significant.
 - TE-78 - Cut-Off/Pointe Aux Chene Levee
 - TV-60 - Front Ridge Chenier Terracing/Protection
 - TV-0067 - Bayou Tigre Flood Control Project
 - Louisiana Coastal Area (LCA), Ecosystem Restoration Study (USACE 2004) recommends 15 near-term measures aimed at addressing the critical restoration needs. LCA Program — the USACE and the State will continue to partner to construct the Caminada Headland and Shell Island component of the Barataria Basin Barrier Shoreline project.
 - LCA BUDMAT Tiger Pass
 - The Restore Act Council voted on Dec. 9, 2015, to approve the first round of Funded Priorities Lists of projects that it intends to fund with the Council-Selected Restoration Component of funds received from the Transocean settlement. Of the \$241.4 million available for the current Council-Selected Restoration Component, the Council is approving approximately \$156.6 million for funding this FPL, with approximately \$26.6 million reserved for future activities.
 - Jean Lafitte Canal Backfilling
 - West Grand Terre Beach Nourishment and Stabilization
 - Golden Triangle Marsh Creation
 - Biloxi Marsh Living Shoreline
 - Mississippi River Reintroduction into Maurepas Swamp
 - Bayou Dularge Ridge, Marsh & Hydrologic Restoration



- NRDA: The Trustees identified Alternative A as their preferred alternative. Although no NRDA sponsored projects have yet been constructed, it is reasonably foreseeable that the nearly Gulf-coast wide damages would be mitigated. The following project has been selected for construction.
 - TE-100 - NRDA Caillou Lake Headlands

Impacts of the NER RP:

The primary impacts of the NER RP would be related to dredging and construction of the nine marsh restoration measures and the five shoreline protection measures and the reforestation of the 35 chenier reforestation measures. Dredging and construction related impacts are generally temporary and localized and include: increased turbidity and total suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels. Following construction, these temporary and localized effects would return to pre-construction levels. The only significant long term adverse cumulative effects expected from implementing the NER RP measures would be associated with the conversion of existing fragmented marsh and shallow water bottom habitats to transitional estuarine marsh habitat and rocky shoreline protection habitats. However, conversion of fragmented marsh and shallow water bottoms to these transitional estuarine marsh habitat and shoreline protection habitat would provide greater long-term positive benefits when considered within the context of the ongoing extensive land loss throughout coastal Louisiana and the project area which is converting extensive areas of marsh to shallow open water.

a. Additional long term positive cumulative impacts would be related to restoring and protecting important, essential and in some instances critical habitats (e.g., piping plover) used by various terrestrial and aquatic organisms for shelter, nesting, feeding, roosting, cover, nursery, EFH and other life requirements; as well as local increases in productivity. The NER RP breakwater measures would provide protection to designated critical wintering habitat for piping plover which would work synergistically with other barrier shoreline restoration and protection features (e.g., State of Louisiana Caminada Headland Beach and Dune Restoration, Shell Island restoration; CWPPRA projects TE-27 and TE-50 Whiskey Island restoration and other barrier restoration projects). Increased recreational and commercial fishing opportunities provided by marsh restoration measures that would provide important, critical and essential habitats (e.g., piping plover) as well as protection of recreational marsh lands from wave erosion effects by the shoreline protection measures. The cumulative impacts of the proposed action would be a positive increase in visual resources, especially the viewscape, in the form of providing additional acres of marsh wetlands (and chenier ridge) in an area that is otherwise being degraded, fragmented and lost throughout the southwest coastal basin, coastal Louisiana, and the Nation. Restoration of marsh would convert existing view sheds of open water into marsh wetlands interspersed with large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing viewshed.

b. Recreation: Temporary negative impacts of marsh restoration activities due to increased turbidity and possible boating access issues are mediated by the presence of other productive and popular recreation areas throughout the coastal region of Louisiana. Long-term positive cumulative impacts are expected to occur as restoration measures help protect recreational resource lands from effects of coastal storm surge while improving recreational opportunities by enhancing the sustainability of valuable nursery habitats.

c. Visual resources: The continued relative sea level rise could potentially impact the entire area resulting in vast areas of shallow open water as vertical accretion rates fail to keep pace with rising sea levels. Impacts to visual resources would continue throughout not only the project area but coastal Louisiana and the Nation due to the loss of wetlands and conversion of existing habitats to open water habitats. However, wetland restoration efforts such as the CWPPRA, CIAP, and LCA Programs could restore partially the land, would convert existing viewsheds of open water into marsh, wetland, swamp or a variety of landscape types that frame large bodies of open water and use the basic design elements of form, line, texture, color and repetition to create an aesthetically pleasing viewshed.

d. The historic modifications of coastal marshes for agricultural purposes (e.g., draining and filling) and their reclamation for domestic and industrial development have substantially reduced viable wetlands habitat area during the past century (Adam, 1990; Anderson et al., 1992). Longer term, indirect impacts are also



associated with some of these habitat disturbances. For example, the construction of impoundment dikes, water-control embankments, levees, dams for flood control, as well as canals and their associated spoil banks invariably alters the hydrology of these wetland systems, often interfering with normal tidal flooding and drainage, modifying overland water flow, decreasing sediment supply to the marsh surface, and arresting vertical accretion.

e. According to Orson et al. (1985) coastal wetlands can respond to increasing sea level rise in three ways: (1) coastline retreat if the rates of coastal submergence exceed the vertical accretion of the wetland surface; (2) remain stable if sediment input from interior regions equals the rate of coastal submergence so that surface elevations are maintained; or (3) they can expand both vertically and laterally if the rate of coastal submergence is less than the sediment accretion rate. The failure of coastal wetlands to keep pace with sea level rise is generally ascribed to insufficient sediment deposition on the wetland surface leading to accretion deficits (i.e., vertical accretion is less than relative sea level rise). Delaune et al. (1983) and others have documented that, throughout coastal Louisiana wetlands are being replaced at an alarming rate by shallow open water.

CEQ's recommends 11 Steps for Cumulative Effects Analysis. The following describes how the study is consistent with the CEQ's 11-step cumulative effects analysis for both the NED and NER Plans. Some considerations specific to NER analysis are as follows:

- Step 1: This document has identified in previous sections the significant effects and issues associated with implementing the proposed action by documenting the direct and indirect effects of the proposed action on significant environmental resources.
- Step 2: This document has identified the geographic scope of the analysis as the area consisting of Calcasieu, Cameron and Vermilion Parishes including the migratory species frequenting the geographic area.
- Step 3: The time frame of the analysis consisted of the historic, existing, future without project and future with project conditions for the identified significant natural and human environmental resources.
- Step 4: Other actions affecting the significant natural and human resources (the significant resources have been previously described).
- Steps 5 and 6: The responses of each identified significant resource to change has been documented for each identified significant human and natural resource, as have the factors or stressors potentially affecting significant human and natural resources, and if appropriate, their relationship to regulatory thresholds (e.g., air quality standards; threatened and endangered species and their designated critical habitat).
- Step 7: The baseline condition has been documented for each significant human and natural resources including the historic, existing, and future without project conditions (Chapter 1).
- Step 8: The incremental project-induced impacts would be in addition to impacts from other actions such as continued oil and gas exploration/extraction/production/refining, navigation, commercial and recreational fisheries, inhabitation and employment, other coastal protection and restoration activities, and other human activities in the project area.
- Step 9: The magnitude and significance of cumulative effects on identified significant resources are identified for:
 - a. Study area influences,
 - b. Region-wide influences on significant resources.
- Step 10: The plan has been evaluated to ensure steps were taken to avoid and minimize impacts to significant resources. During plan formulation steps were taken to remove, modify or add alternatives to avoid, minimize, reduce, or mitigate potential significant effects.
- Step 11: Monitoring effects of the proposed action and adaptation of management are identified and described in the Adaptive Management and Monitoring (AM&M) Plan (see Appendix A Annex L).

This analysis considers known past, present, and reasonably foreseeable future nonstructural hurricane storm damage risk reduction projects and ecosystem restoration projects over a 50-year period of analysis from 2025 to 2075. Table 3-6 provides a summary of this cumulative impacts analysis.



Table 3-6 Summary of Cumulative Impacts

(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
 (**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Population and Housing Levels	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. United States (US): Population and households increasing. Louisiana (LA): population in 1970 estimated at 3.645 million. Risks of hurricane storm surge impacts to those not provided risk reduction by structural or nonstructural risk reduction measures. Study Area (SA): 1970 populations and number of households in Calcasieu, Cameron and Vermilion Parishes is 196,680 with 57.2 thousand households	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: 2015 populations increasing to 4,605 million. Continued coastal land loss and conversion to open water and loss of forested cheniers. SA: 2012 population 259,918 with 96.2 thousand households. Continued coastal land loss and conversion to open water and loss of forested cheniers.	Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. US: Population and households increasing. LA: Increasing population and households in Louisiana. Continued coastal land loss and conversion to open water and loss of forested cheniers. SA: Increases population and households in Calcasieu, Cameron and Vermilion Parishes. Households likely continue. Risk of hurricane storm surge damages continue. Continued loss of brackish and saline marsh and forested chenier habitats.	US: Population and households increasing. LA: Increasing populations and households. Risks of hurricane storm surge impacts continue to those not provided risk reduction by structural or nonstructural risk reduction measures. SA: Hurricane storm surge related risks reduced for individual households and people located in the 25-year floodplain and in structures that volunteer to participate in nonstructural risk reduction measures. People and households associated with those structures not included in the proposed voluntary nonstructural risk reduction measures would continue to be at risk from hurricane storm surge risk reduction.	US: Population and households increasing. Continued coastal land loss and conversion to open water especially for coastal states. Offset by nationwide coastal restoration efforts. LA: Continued Louisiana coastal wetland loss and loss of forested cheniers offset by coastal restoration efforts such as CWPPRA, LCA, and others described in Sections 1.9 and 3.4. SA: Cumulative impacts would include incremental impacts of proposed action in the SA in addition to other ecosystem restoration throughout the basin, Louisiana, and the Nation being converted or restored from open water back to land mass. Similar projects include diversion projects, marsh, and swamp restoration and nourishment by CWPPRA, LCA and others described in Sections 1.9 and 3.4.
Employment, Business, and Industrial Activity (Including Agriculture)	The leading employment sectors are education, healthcare, petroleum production, and petrochemical refining. Other significant employment sectors include education, manufacturing, accommodations and social services, and retail trade. Employment for the region as a whole grew from 1970 through 2000.	Employment growth was steady from 1970 to 2012 for Calcasieu and Vermilion parishes, although employment in Cameron parish declined since 2000, and is reflected in the population estimates previously described.	Employment is expected to continue to follow the same trend in the study area. However, businesses would face a higher risk of closing periodically due to damages sustained from hurricane storm-surge.	Would lower the risk that hurricane storm-surge damage would cause the businesses included in the recommended plan. This lower risk could shorten the amount of time businesses would need to close following a hurricane.	Land loss would be stabilized, which could result in localized positive effects of maintaining employment and businesses (e.g., recreational and commercial fishing), and industrial activity.
Public Facilities and Services	The Port of Lake Charles is a key center for international trade, and is among the top 15 busiest ports in the nation. A total of 603 public and quasi-public buildings were specifically inventoried in 2012.	The Port of Lake Charles is a key center for international trade, and is among the top 15 busiest ports in the nation. A total of 603 public and quasi-public buildings were specifically inventoried in 2012.	FWOP conditions would include a greater potential for permanent displacement of public facilities and services due to hurricane storm surge events. Public facilities and services are expected to grow with the needs of the population and would follow population growth trends. In addition to the existing 603 public and quasi-public buildings, an additional 193 such facilities are projected by 2080	Would reduce risk of hurricane storm surge-related damages for public facilities and services in the area thereby reducing the number of days a structure is unavailable for use and minimizing the inconvenience to the general public.	Plan CM-4 would have no cumulative impacts on public facilities or services.



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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Transportation	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	The transportation infrastructure includes major roads, highways, railroads, and navigable waterways that have developed historically to meet the needs of the public. Interstate 10 (I-10), an east-west bi-coastal thoroughfare that connects Houston and Baton Rouge, crosses the northern part of the area and is a primary route for hurricane evacuation and post-storm emergency response.	Portions of Interstate 10 and other highways and local roads will continue to be periodically damaged by hurricane storm surge.	Portions of Interstate 10 and other highways and local roads will continue to be periodically damaged by hurricane storm surge.	Would reduce the intensity of almost daily wind-generated wave action which erodes areas adjacent to Highway 82; would reduce the wave action which erodes the southern spoil bank along the GIWW from the south; would protect the shoreline of Freshwater Bayou through the placement of foreshore rock dikes;
Community and Regional Growth	Growth in the study area has been largely steady and follows population trends	Residents currently living in low-lying areas face the prospect of relocating due to the high risk of hurricane storm surge damage.	Income growth and associated community and regional growth are expected to follow trends in national income, local employment, household formation, and the demand for public facilities and services. There would also be a higher potential for unstable or disrupted community and regional growth due to increasing risk of damage from storm surge events.	Would include reduced risk of hurricane storm surge-related damages for those low-lying structures located in the 25 year floodplain thus reducing overall social vulnerability and preserving growth opportunities for communities in the region and enhancing the potential for long-term growth and sustainability.	Plan CM-4 would have no cumulative impacts on Community and Regional Growth.
Tax Revenues and Property Values	Tax revenues from property taxes tend to rise over time with the increase in property values.	Property values in the low-lying areas are likely not rising in value at the same rate as comparable properties facing a lower risk of sustaining hurricane storm-surge damage.	FWOP conditions would include lower tax revenues as property values decline due to higher risk of damage from hurricane storm surge events over time. Higher risk of damage from hurricane storm surge would manifest itself in higher premiums for flood insurance under the NFIP: higher premiums are expected to increase the cost of property ownership and result in correspondingly lower market values	For the properties included in the recommended plan, property values would stabilize as the higher risk of damage from hurricane storm surge is arrested and reduced.	Would facilitate the prevention of land loss, which could result in localized positive effects of maintaining tax revenues and property values



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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Other Social Effects	<p>US: Severe storm surge events threaten the health and safety of residents living in coastal areas. Loss of life, injury, and post flood health hazards may occur in the event of catastrophic flooding.</p> <p>LA and SA: The study area was severely impacted by Hurricane Rita in 2006 and Hurricane Ike in 2008. When facilities that provide critical care or emergency services are impacted by storm surge events, residents are at an even greater risk for experiencing negative health outcomes. Hurricanes Rita and Ike reduced the accessibility and availability of health facilities and services and required additional first-responder (fire and police) protection.</p>	<p>US, LA and SA: Other Social Effects that storm surge has on communities include impacts to health and safety, economic vitality, social connectedness, vulnerability and resiliency and leisure and recreation. Many communities along the eastern seaboard and the gulf coast remain vulnerable to these social effects.</p>	<p>US, LA and SA: Social vulnerability is expected to increase over time if subsidence and sea level rise continue to occur, and the population of coastal communities increases as it is projected to do. The absolute number of socially vulnerable people (e.g., low-income, minority, less-educated, and over the age of 65) at risk for storm surge events will increase. This, in turn, may lead to an increased burden placed on local, state, and federal agencies to ensure that the most socially vulnerable populations have access to resources before, during, and after flood events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.</p>	<p>US, LA and SA: Cumulative impacts include reducing the risks associated with damages to housing units, public facilities, and commercial structures during storm events as well as improving the health and safety of residents living within the study area. The study area's social vulnerability would be reduced under this alternative with the possible exception of populations unwilling to participate or unable to participate in the Project due to ineligible Project costs. Reduced social vulnerability leads to the potential for enhanced long-term growth and sustainability. Also, the area would be at a reduced risk of incurring the costs associated with clean-up, debris removal, and building and infrastructure repair as a result of storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.</p>	<p>US, LA and SA: Restoration projects would reduce the risks associated with habitat damage via saltwater intrusion, shoreline retreat, and loss of geomorphologic infrastructure. The area's social vulnerability would be reduced under this alternative via improved leisure and recreation opportunities, economic vitality, and reduced stress. Thus, the potential for long-term growth and sustainability would be enhanced. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.</p>



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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Community Cohesion	US, LA and SA: Community cohesion is based on the characteristics that keep the members of the group together long enough to establish meaningful interactions, common institutions, and agreed upon ways of behavior. Many areas across the country, state and in the study area are comprised of communities with a long history and long-established public and social institutions including places of worship, schools, and community associations. In 2005 with Hurricane Rita, and again in 2008 with Hurricane Ike, communities in Calcasieu, Cameron, and Vermilion Parishes were inundated by storm surge and social institutions were impacted which affected community cohesion.	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local populations are often forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion.	US, LA and SA: Due to the absence of hurricane storm surge risk reduction measures, and the resulting direct impacts to existing structures, local coastal populations, which are projected to increase in the future, are often forced to evacuate and/or relocate for significant time periods, thereby significantly disrupting temporarily, and in some instances, permanently, community cohesion. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Storm surge risk reduction measures could temporarily affect community cohesion due to the noise and fugitive dust from construction activities, the temporary displacement and relocation of residents during construction, and disruption of businesses during construction. Furthermore, non-residential structures that serve as meeting places for the community could become temporarily unavailable during Project implementation. The nonstructural plan would provide positive benefits to the community and it's cohesiveness by reducing the risk of storm surge damage resulting in fewer evacuations or permanent displacement. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: Restoration impacts would include maintaining the integrity of the coastal landscape that supports ecosystem services that in turn supports human population and activities. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane and storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.
Environmental Justice	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.	US, LA: High poverty rates negatively impact the social welfare of residents and undermine the community's ability to provide assistance to residents in times of need.	US, LA & SA: Institutional recognition of Environmental Justice because of Executive Order 12898 of 1994 (E.O. 12898) and the Department of Defense's Strategy on Environmental Justice of 1995, which direct Federal agencies to identify and address any disproportionately high adverse human health or environmental effects of Federal actions to minority and/or low-income populations.



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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Flow and Water Levels	US & LA & SA: Flows and water levels respond to and are impacted by natural conditions such as hurricane storm surge and man-made conditions. Subsidence and eustatic sea level rise cause landward movement of marine conditions into estuaries, wetlands and fringing uplands.	US & LA: Increased flows and water levels associated with increased runoff due to increasing urbanization and wetland loss. Rate of RSLR increasing over historic conditions. SA: Water control structures operated both passively and actively. Virtually all hydrologic management focuses on controlling salinity and minimizing tidal fluctuations by constructing and operating levees, weirs, and a variety of gated structures. 1990 inventory identified 174 individual water control structures in the interior and along the perimeter of the Calcasieu-Sabine basin.	US & LA & SA: Increased hurricane storm surges; increased flows and water levels associated with increase urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Continued disjointed and uncoordinated operation of water control structures. There are no identified existing or authorized for construction risk structural or nonstructural risk reduction measures in SA.	US & LA: Increased hurricane storm surges; increased flows and water levels associated with increased urbanization and associated runoff and increased wetland loss. Rate of RSLR increasing over historic conditions. Existing and authorized structural and nonstructural hurricane storm surge damage risk reduction projects provide risk reduction. SA: Total level of project-induced impact would be relatively minor and in addition to other existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US: increased flows and water levels associated with increased urbanization and associated runoff and increased wetland loss, and increased hurricane storm surges. Continued coastal land loss and conversion to open water especially for coastal states. Offset by nationwide coastal restoration efforts. LA: Similar to US and including increasing rate of RSLR over present conditions. Continued Louisiana coastal wetland loss and loss of forested cheniers offset by coastal restoration efforts such as CWPPRA, LCA, and others described in Sections 1.9 and 3.4. SA: Cumulative impacts include incremental impacts of proposed action on flow and water levels in the SA in addition to impacts to flow and water levels by other ecosystem restoration throughout the basin, Louisiana, and the Nation. Similar projects include diversion projects, marsh, and swamp restoration and nourishment by CWPPRA, LCA and others described in Sections 1.9 and 3.4.
Water Quality and Salinity	LA & SA: Clean Water Act of 1977, NEPA of 1969, Coastal Zone Management Act, and Estuary Protection Act and institutional recognition to restore and protect water bodies, especially with respect to point sources. Non-point sources still unregulated. LA & SA: Increasing human development adversely impacts water quality. Salinity levels increase inland due to salt water intrusion, due in part to wetland loss, channelization, and oil and gas exploration canals.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA & SA: Continued institutional recognition. Increasing human development, agriculture and oil & gas exploration and industrialization result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: coastal wetland loss results in loss of water purification by wetlands. Channels and oil & gas exploration canal continue to provide conduit for saltwater intrusion and coastal land loss.	US & LA: Continued institutional recognition. Increasing human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects. SA: The NED RP would reduce water quality impacts associated with flooding from storm surge events. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: Continued institutional recognition. Increasing coastal land loss, human development, agriculture, channelization and oil & gas exploration and industrialization continue to result in increased potential for water quality problems and saltwater intrusion. These water quality impacts offset by existing and authorized for construction ecosystem restoration projects throughout the US and LA. SA: NER would have short term, localized and generally minor adverse water quality impacts during construction. There would be long term positive water quality improvements as restored, nourished and protected marsh improves local water quality by sequestering and filtering degraded waters. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.



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Sedimentation and Erosion	US & LA & SA: Flood Control Act of 1928 helps reduce sedimentation of rivers and other water bodies caused by erosion associated with agriculture, human development, industrialization and storms. SA: Sediment delivery by Atchafalaya River and other rivers throughout SA.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. LA: 350 miles of sandy barrier shoreline and gulf beaches lost. SA: White Lake average shoreline erosion rate of 15 feet per year; Grand Lake shoreline erosion rate of 11 feet per year to 32 feet per year; and Sabine Lake about 10 feet per year.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects. SA: continued shoreline erosion and sedimentation.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects SA: No project-induced impacts of NED RP.	US & LA: continued sedimentation and erosion associated with agriculture, human development, industrialization, storms, navigation channels and oil and gas canals. These impacts would be offset by existing and authorized for construction ecosystem restoration projects SA: Increased marsh surface area would increase sediment entrapment when marshes are flooded (e.g., tidal and storm surge). Restored marsh would reduce fetch over open water areas thereby reducing wind generated waves and subsequent erosion. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Soils, Water Bottoms, Prime & Unique Farmlands	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010; SA: land area decreases from 1932 to 2010 with concomitant increase in shallow open water area.	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area decreases from 1932 to 2010 SA consists primarily of wetland type soils and shorelines prone to frequent flooding and not suitable for agricultural use. Prime farmland consist of 941,196 acres, or 34.3 percent of the soils in SA	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages and loss of estuarine marsh habitats	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: no significant impacts of the NED RP on soils, water bottoms or prime and unique wetlands.	US: Institutional recognition of soil and water resources conservation. Prime agricultural land decreases from 1997 to 2012 LA: land area continues to decrease with concomitant increase in shallow open water resulting in greater potential for hurricane storm surge damages to human habitations and loss of estuarine marsh habitats. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested. Total 14,635 acres of water bottoms impacted by borrowing sediments for marsh restoration, placement of shoreline protection rock, and restoring water bottoms to marsh. Marsh restoration and shoreline protection would increase and help stabilize hydric soils. Direct impacts to water bottoms in the marsh restoration footprints in Calcasieu and Mermentau Basins would result in the restoration of existing water bottom habitat to marsh habitat. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.



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 (**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
<p>Coastal Shorelines</p>	<p>US: Institutional recognition of coastal barrier resources. Beach shorelines continue to erode as sea level rises and in many instances subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf coastal shorelines and interior waterbody shorelines continue to erode due to natural and man-induced causes.</p>	<p>US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and their state and local efforts LA: beach shorelines continue to erode as sea level rises and subsidence continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA the average long-term erosion rate at Rockefeller Wildlife Refuge estimated to be 30.9 ft/yr; Gulf shoreline recession rates vary from 4.4 feet per year near Hackberry Beach, 8.7 feet per year at Ocean View Beach, 36.1 feet per year at Mermentau Beach and 52.4 ft/yr at Rockefeller Wildlife Refuge.</p>	<p>US: Institutional recognition of coastal barrier resources continues. Losses offset by federal, state, and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts</p>	<p>US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises in many instances subsidence continues. These impacts offset by federal, state and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. Losses offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on coastal shorelines.</p>	<p>US: Institutional recognition of coastal barrier resources continues. Beach shorelines continue to erode as sea level rises in many instances subsidence continues. These impacts offset by federal, state and local beach nourishment and restoration projects. LA: Gulf shoreline and interior waterbody shoreline losses continue as sea level rises and subsidence continues. These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: 251,528 linear feet of shoreline protection would benefit 6,135 net acres marsh with 1,738 AAHUs. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.</p>



Table 3-6 Summary of Cumulative Impacts

(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
 (**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Vegetation Resources	<p>US: Institutional recognition of Natural Resources. Vegetation resources continue to be lost to human encroachment and development</p> <p>LA: from 1985 to 2010 increasing coastal land loss of -16.57 mile² per year</p> <p>SA: from 1985 to 2010 increasing coastal land loss of - 0.97 square miles per year Calcasieu Basin; -1.30 mile² in Mermentau Basin; -0.45 mile² in Teche-Vermilion Basin</p>	<p>US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development</p> <p>LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year</p> <p>SA: from 1985 to 2010 increasing coastal land loss of - 0.97 mile² per year Calcasieu Basin; -1.30 mile² in Mermentau Basin; -0.45 mile² per year in Teche-Vermilion Basin</p>	<p>US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects.</p> <p>LA: estimated net change between 2010-2060 under moderate sea level rise scenario is - 2100 km². These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts</p> <p>SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km²; in Mermentau Basin -208 km²; and in Teche-Vermilion Basin -67 km²</p>	<p>US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects</p> <p>LA: estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km². These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts.</p> <p>SA: NED RP has no significant direct, indirect or cumulative impacts on vegetation resources.</p>	<p>US: Institutional recognition of Natural Resources continues. Vegetation resources continue to be lost to human encroachment and development. These impacts would be offset by existing and authorized for construction ecosystem restoration projects</p> <p>LA: estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km². These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries, and other state and local efforts.</p> <p>SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.</p>
Wildlife Resources	<p>US: Institutional recognition of natural resources and fish and wildlife resources and its habitats. Wetland dependent wildlife populations respond primarily to natural population-regulating mechanisms.</p> <p>Institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats</p> <p>LA: wildlife habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 mile² per year</p> <p>SA: wildlife habitat losses from 1985 to 2010 increasing coastal land loss of - 0.97 square miles per year Calcasieu Basin; -1.30 mile² in Mermentau Basin; -0.45 mile² in Teche-Vermilion Basin</p>	<p>US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Continued institutional recognition of wildlife and its habitats. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats.</p> <p>LA: wildlife habitats lost from 1985 to 2010 due to increasing coastal land loss of -16.57 square miles per year</p> <p>SA: from 1985 to 2010 increasing coastal land loss of - 0.97 mile² per year Calcasieu Basin; -1.30 mile² in Mermentau Basin; -0.45 mile² per year in Teche-Vermilion Basin</p>	<p>US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects</p> <p>LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is - 2100 km². These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts</p> <p>SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km²; in Mermentau Basin -208 km²; and in Teche-Vermilion Basin -67 km²</p>	<p>US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects</p> <p>LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is - 2100 km². These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts</p> <p>SA: NED RP has no significant direct, indirect or cumulative impacts on wildlife resources.</p>	<p>US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Wildlife resources continue to be adversely impacted and lost due to human encroachment and development of wildlife habitats. These impacts would be offset by existing and authorized for construction ecosystem restoration projects</p> <p>LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km². These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts</p> <p>SA: total 15,448 net acres with 4973 AAHUs of brackish and saline marsh and cheniers restored, protected, and reforested and used by various wildlife species. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.</p>



Table 3-6 Summary of Cumulative Impacts

(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
 (**Plan M-4 Alternative – Mermentau Small Integrated Restoration Plan cumulative effects are same as impacts identified for the Mermentau Basin component of NER RP)

Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Fisheries and Aquatic Resources	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. Reduction in fisheries habitat, increased catches, gear improvement, catch regulations, Magnuson-Stevens Fishery Conservation and Management Act and amendments, formation of NMFS and LDWF. About 90% of the world's seafood resources have been depleted in the past century; 38% of the depleted species have declined by more than 90%; 7% of the species of fish studied by researchers have become extinct.	US & LA & SA: Institutional recognition of natural resources and fish and aquatic resources and its habitats. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as fish and aquatic organisms nursery and foraging habitat. SA: from 1985 to 2010 increasing coastal land loss of -0.97 mile ² per year Calcasieu Basin; -1.30 mile ² in Mermentau Basin; -0.45 mile ² per year in Teche-Vermilion Basin	US: Institutional recognition of natural resources and fish and aquatic resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km ² ; in Mermentau Basin -208 km ² ; and in Teche-Vermilion Basin -67 km ²	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued fish and aquatic organisms estuarine habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on fisheries or aquatic resources.	US: Institutional recognition of natural resources and fish and wildlife resources and its habitats continues. Fisheries and aquatic resources continue to be adversely impacted due to reduction in fisheries habitat, increased catches, gear improvement, catch regulations. These impacts would be offset by existing and authorized for construction ecosystem restoration projects LA: continued wildlife habitats lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by beach nourishment and restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 9,313 net acres with 3,239 AAHUs of brackish and saline marsh restored, nourished and protected and available for use by fish and aquatic organisms. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Essential Fish Habitat	US & LA & SA: Institutional recognition of decline in EFH quality; passage of Magnuson-Stevens Fishery Conservation and Management Act, as amended, formation of NMFS and LDWF.	US & LA & SA: Institutional recognition of EFH continues. LA: from 1985 to 2010 increasing coastal land loss of -16.57 square miles per year results in loss of coastal estuaries used as transitional estuarine EFH nursery and foraging habitats. SA: from 1985 to 2010 increasing coastal land loss of -0.97 mile ² per year Calcasieu Basin; -1.30 mile ² in Mermentau Basin; -0.45 mile ² per year in Teche-Vermilion Basin results in loss of coastal estuaries used as EFH nursery and foraging habitats.	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: continued transitional estuarine EFH lost with estimated net change estimated net change between 2010-2060 under moderate sea level rise scenario in Calcasieu/Sabine basin is -146.5 km ² ; in Mermentau Basin -208 km ² ; and in Teche-Vermilion Basin -67 km ²	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: NED RP has no significant direct, indirect or cumulative impacts on fisheries or aquatic resources. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US: Institutional recognition of EFH continues. LA: continued transitional estuarine EFH lost with estimated net change with estimated net change between 2010-2060 under moderate sea level rise scenario is -2100 km ² . These impacts offset by restoration projects such as CWPPRA, LCA, NOAA Fisheries and other state and local efforts SA: total 9,313 net acres with 3,239 AAHUs of brackish and saline marsh restored, nourished and protected and available for use by fish and aquatic organisms. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.



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(*NED Plan 8 Alternative – Nonstructural 100-Year Floodplain cumulative impacts would be similar in nature but greater in scale compared to NED RP)
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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Threatened & Endangered Species & Other Protected or Species of Concern	US, LA & SA: The Endangered Species Act of 1973 (ESA), Migratory Bird Treaty Act of 1918 as amended (MBTA), Bald and Golden Eagle Protection Act (BGEPA) and Marine Mammal Protection Act of 1972 (MMPA) help protect the existence of certain species listed under each Act. Listed and protected species habitat is impacted by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US, LA & SA: continued impacts to listed and protected species habitat impacts by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization.	US & LA: continued impacts to listed and protected species habitat impacts associated with agriculture, human development and industrialization. SA: minimum and temporary project-induced impacts such as temporary avoidance of nearby habitat due to noise and construction activity. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: continued impacts to listed and protected species habitat by natural conditions such as hurricane storm surge, saltwater intrusion and subsidence, and man-made conditions such as agriculture, human development and industrialization. SA: beneficial impacts to listed and protected species habitat associate with shoreline protection and the creation of marsh & chenier habitats. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects.
Cultural and Historic Resources	US, LA, & SA: Institutional recognition via the National Historic Preservation Act (and others). Historic and cultural resources subjected to natural processes and man-made actions.	US, LA, & SA: Continued institutional recognition. Human activities as well as natural processes can potentially destroy historic and natural resources. The loss of land threatens the existence and integrity of these resources.	US, LA, & SA: Continued institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: The continued adverse impacts associated with hurricane storm surge and land loss within the SA threatens the existence and integrity of historic and cultural resources that may exist within the SA.	US & LA: Continued institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: Implementing the NED RP could directly and indirectly affect any recorded or unrecorded cultural resource that may exist within the footprint of the project, the project's borrow source, or within any area identified as an area of potential effects (APE). A programmatic agreement (PA) is in place to govern future investigations and activities. In accordance with the PA, to the extent any adverse effect to identified cultural resources cannot be avoided, such impacts will be mitigated. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US & LA: Institutional recognition via the National Historic Preservation Act (and others). Potential loss of historic and cultural resources due to natural and human causes. SA: Implementing the NER RP has a chance to directly and indirectly affect any recorded or unrecorded cultural resource that may exist within the footprint of the project, the project's borrow source, or within any area identified as an area of potential effects (APE). A programmatic agreement (PA) is in place to govern future investigations and activities. In accordance with the PA, to the extent any adverse effect to identified cultural resources cannot be avoided, such impacts will be mitigated. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.



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Significant Resource	Past Actions (Historic Conditions)	Present Actions (Existing Conditions)	The No-Action Alternative (Future Without Project condition)	Cumulative Impacts NED RP: Modified Plan 8 Nonstructural 0-25 year Floodplain Plan*	Cumulative Impacts NER RP: Plan CM-4**
Aesthetics (Visual Resources)	US, LA, & SA: Technical recognition via 1988 USACE Visual Resources Assessment Procedure. Institutional recognition via Wild and Scenic Rivers Act, Louisiana Scenic Rivers Act, Scenic Byways and others. LA & SA: Aesthetic resources negatively impacted by hurricanes Katrina, Rita, Gustav, and Ike	US, LA, & SA: Continued institutional recognition. Visual resources have been destroyed, enhanced, or preserved by human activities and natural processes. LA & SA: Continued wetland loss may have an adverse effect on the visual complexity of the bayous and swamps.	US, LA, & SA: Continued institutional recognition. Continued human population growth and development and other human activities have the potential to destroy, enhance or preserve visual resources. SA: Erosion and land loss could result in the loss of vegetation that may provide a visually complex environment and desirable views and reduce opportunities for viewing wildlife.	US, LA, & SA: Generally, there would be no significant effects on the natural environment. Most effects would be on the human environment. This includes incremental risk reduction achieved by elevating 3,665 residential structures, flood proofing 247 non-residential structures and acquiring 3 residential structures. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA, & SA: Replenishment of the land would convert existing view sheds of open water into marsh, wetland, or a variety of landscape types that frame large bodies of open water and use the basic design elements of form, line, texture, color, and repetition to create an aesthetically pleasing view shed. Temporary impacts due to construction activities. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.
Recreation	US, LA and SA: Recreational features and opportunities vary throughout the coastal zone, habitat and culture playing significant roles in the diversity of activities. From the games and competitions of Native Americans, to the influence of diverse immigrant cultures, traditional recreation in Louisiana has been a product of its people.	US, LA and SA: Federal and State agencies are major providers of recreational opportunities throughout the country and State of Louisiana. There are eight Wildlife Refuges and Conservation Areas in the Study Area, and two State parks. In addition to the high quality recreational fishing and hunting in the parks in the region, several lakes and inland marshes offer opportunities for birding, hunting and catching both freshwater and saltwater species.	US, LA and SA: The continued loss of wetlands/marshes and habitat diversity affects recreational opportunities. Storm surge and saltwater could have a negative impact on freshwater forests and habitats and could reduce recreational resources (e.g., fishing, hunting, bird watching, and other). In general, further degradation of area marshes will continue and its associated negative impacts on recreation activities will increase. Additionally, recreational infrastructure would remain vulnerable to surges. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: By elevating residential recreational structures, such as camps, damage from storm surge is less likely to occur. Additionally, elevated structures should create less debris that must be removed following a storm surge event. These impacts would be in addition to other national, state and local existing and authorized for construction structural and nonstructural hurricane storm surge damage risk reduction projects as described in more detail in Sections 1.9 and 3.4.	US, LA and SA: The cumulative impacts of other ongoing and planned ecosystem restoration measures are expected to be generally beneficial to recreation as the risk of destruction of recreation resources by storm surge is reduced and habitat areas supporting fish and wildlife resources are enhanced. Temporary negative impacts of restoration activities due to construction activities, increased turbidity and possible boating access issues are mediated by the presence of other productive and popular recreation areas throughout the coastal region of Louisiana. Long-term positive cumulative impacts are expected to occur as restoration enhances the sustainability of valuable nursery habitats. These impacts would be in addition to other national, state and local existing and authorized for construction ecosystem restoration projects as described in more detail in Sections 1.9 and 3.4.



3.5 Irreversible and Irretrievable Commitments of Resources Involved in the Implementation of the Recommended Plan

NEPA 40 CFR 1502.16 requires that environmental analysis include identification of “any irreversible and irretrievable commitments of resources which would be involved in the tentatively selected plan should it be implemented.” Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the use of these resources have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a T&E species or the disturbance of a cultural site).

The NER RP would result in the direct and indirect commitments of resources. These would be related mainly to construction components. Energy typically associated with construction activities would be expended and irretrievably lost under all of the alternatives excluding the no action alternative. Fuels used during the construction and operation of dredging equipment and barges would constitute an irretrievable commitment of fuel resources.

For the NER RP, most resource commitments are neither irreversible nor irretrievable. The dredging of borrow material is considered reversible although it is anticipated that the natural infilling of the borrow pits may take several years. Benthic communities would be removed and lost along with the sediment during dredging operations. Benthic communities would also take several years to recover. Fish and plankton would be entrained in the dredge during the dredging of the borrow areas. These losses would be irretrievable. However, most impacts to fish and plankton are short term and temporary and would only occur during dredging and construction activities. For example, access channels that would be dredged and retention dikes that are constructed would be restored to natural conditions after construction.

Other impacts, including disruption of community cohesion, may have longer effects that can be reduced through appropriate enhancement measures and best management practices. There are no irreversible or irretrievable commitments of resources which would preclude formulation or implementation of reasonable alternatives for this Project.

3.6 Relationship between Local Short-Term uses of Man’s Environment and the Maintenance and Enhancement of Long-Term Productivity

NEPA Section 102(2)(c)(iv) and 40 CFR 1502.16 requires that an environmental impact statement include a discussion of the relationship between short-term uses of the environment and the maintenance and enhancement of long-term productivity. This section describes how the RP would affect the short-term use and the long-term productivity of the environment. For the RP, “short-term” refers to the temporary phase of construction of the proposed Project, while “long-term” refers to the operational life of the proposed Project and beyond.

Construction of the NER RP would result in short-term construction-related impacts within parts of the Project area and would include to some extent interference with local traffic, minor limited air emissions, and increases in ambient noise levels, disturbance of fisheries and wildlife, increased turbidity levels, lower DO, and disturbance of recreational and commercial fisheries. These impacts would be temporary and would occur only during construction, and are not expected to alter the long-term productivity of the natural environment.

The NER RP would assist in the long-term productivity of the ecological community in three basins by improving water quality, nutrients, and sediments. This would facilitate the growth and productivity of emergent transitional marsh and the invertebrates, fish, and wildlife that use these habitats. The NER RP would enhance the long-term productivity of natural communities throughout the region. These long-term beneficial effects would outweigh the impacts to the environment resulting primarily from Project construction. With an increase in the wetland habitat quality, fish populations would experience beneficial impacts. These improvements in productivity would beneficially impact long-term commercial and recreational fishing in the study region.



3.7 Mitigation

Mitigation per 40 CFR §1508.20 includes measures to avoid the impact by not taking an action or parts of an action; minimize impacts by limiting the degree or magnitude of the action and its implementation; rectifying the impact by repairing, rehabilitating, or restoring the affected environment; reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and compensating for the impact by replacing or providing substitute resources or environments. The appropriate application of mitigation is to formulate a project that first avoids adverse impacts, then minimizes adverse impacts, and lastly, compensates for unavoidable impacts. No impacts from the NED RP or NER RP have been identified that would require compensatory mitigation. In addition, the CEMVN has determined that the proposed action “may affect but will not likely adversely affect” the piping plover or its critical habitat, Red knot, Sprague's pipit, West Indian manatee, Gulf sturgeon, loggerhead and Kemps Ridley sea turtles; would have no effect on the Red-cockaded woodpecker, green, leatherback, and hawksbill sea turtles or loggerhead critical habitat and would not adversely impact other species of concern that could potentially be found in the Project area. No unique or valuable habitats would be adversely affected. However, the presence of threatened or endangered species would render that structure ineligible to participate in the Project.

To reduce potential fisheries impacts, any clearing and snagging would adhere to the Stream Obstruction and Removal Guidelines (1983); however, no such actions are anticipated.

The Lake Charles Metropolitan Statistical Area is vulnerable to being designated as non-attainment for ozone and particulate matter (PM) in the next few years (personal communication, EPA April 30, 2015). The Imperial Calcasieu Regional Planning & Development Commission, representing Calcasieu Parish, Cameron Parish, the Cities of Lake Charles, Westlake, Sulphur, Vinton, DeQuincy, the Town of Iowa, the Lake Charles Harbor and Terminal District, the Chennault International Airport, the Lake Area Industrial Alliance, the Southwest Louisiana Economic Development Alliance, and the Chamber SWLA has applied for and been accepted by EPA into the EPA Ozone Advance and PM Advance programs. The Advance programs are collaborative efforts between EPA, states, and local governments to enact expeditious emission reductions to help near non-attainment areas remain in attainment of the National Ambient Air Quality Standards. This reflects the sensitivity of ozone and PM levels in the area, and the need for federally-funded projects in the study area to consider air emissions. In addition to all applicable local, state, or Federal requirements, the mitigation measures for potential air quality impacts for reducing impacts associated with emissions of NO_x, CO, PM, SO₂, and other pollutants from construction-related activities would include consideration of the following, as appropriate.

Noise vibration and emissions:

- The use of heavy machinery fitted with approved muffling devices that reduce noise, vibration, and emissions.

Fugitive Dust Source Controls:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate at active and inactive sites during workdays, weekends, holidays, and windy conditions;
- Install wind fencing and phase grading operations where appropriate, and operate water trucks for stabilization of surfaces under windy conditions; and
- Prevent spillage when hauling material and operating non-earthmoving equipment and limit speeds to 15 miles per hour. Limit speed of earth-moving equipment to 10 mph.

Mobile and Stationary Source Controls:

- Plan construction scheduling to minimize vehicle trips;
- Limit idling of heavy equipment to less than five minutes and verify through unscheduled inspections;
- Maintain and tune engines per manufacturer's specifications to perform at EPA certification levels, prevent tampering, and conduct unscheduled inspections to ensure these measures are followed;



- If practicable, utilize new, clean equipment meeting the most stringent of applicable Federal or State Standards. In general, commit to the best available emissions control technology. Tier 4 engines should be used for Project construction equipment to the maximum extent feasible;
- Lacking availability of non-road construction equipment that meets Tier 4 engine standards, the responsible agency should commit to using EPA-verified particulate traps, oxidation catalysts, and other appropriate controls where suitable to reduce emissions of diesel particulate matter and other pollutants at the construction site; and
- Consider alternative fuels and energy sources (e.g., natural gas, electricity and plug-in or battery).