SECTION II

MISSISSIPPI RIVER & TRIBUTARIES PROJECT

A. MR&T SYSTEM INFORMATION

1. General MR&T Information. The MR&T Project is the largest FRMS in the world. It protects the 36,000-square-mile Lower Mississippi River Valley (LMRV) from periodic overflows of the Mississippi River. Figure II-1 shows the major river systems that comprise the Mississippi River drainage basin. The MR&T System is designed to convey the project design flood (PDF), represented by the maximum event that had a reasonable probability of occurring from a meteorological viewpoint.

Figure II-1. Major River Systems within the Mississippi River Basin

The MR&T System includes an extensive levee system; floodways to divert excess flows past critical reaches; channel improvement and stabilization features to protect the integrity of flood risk management measures and to ensure proper alignment and depth of the navigation channel; and a system of reservoirs to regulate flows and backwater areas to provide storage during extreme events. Additionally, there are tributary basin improvements including levees, headwater reservoirs, and pumping stations that expand FRM coverage and improve drainage into adjacent areas within the alluvial valley. The main stem levee system begins at the head of the alluvial valley at Cape Girardeau, MO, and continues to Venice, LA, near the Gulf of Mexico on the right descending bank and to Bohemia, LA on the left descending bank. Figure II-2 identifies and provides the general locations of the primary MR&T System components. The MR&T levee system includes 3,787 miles of authorized embankments and floodwalls. Of this, nearly 2,216 miles are along the main stem Mississippi River, and the remaining levees are backwater, tributary, and floodway levees.

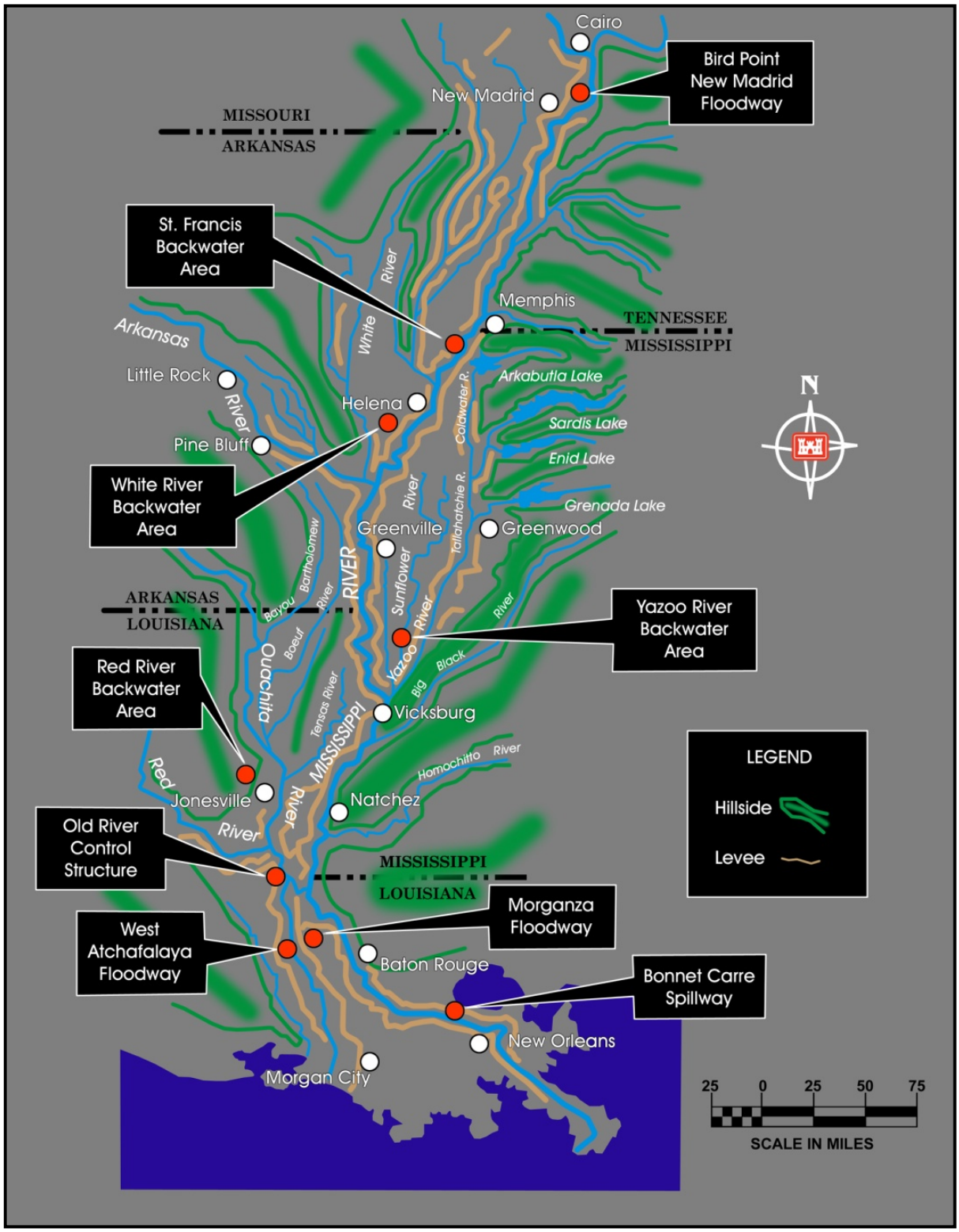

Figure II-2. General Locations of Primary Mississippi & Tributaries System Components

2. Physical Infrastructure and Operational Strategy. MR&T FRMS components consist of completed and uncompleted structures and improvements. The individual structures are operated as a system in accordance with the MR&T Flood Control Plan, to reduce overall flood risks throughout the LMRV. The design and operational strategy for the MR&T System does not attempt to entirely exclude the river from its natural floodplain. Instead, it accommodates the natural tendency of the river during extraordinary floods by incorporating floodway and backwater features that are not utilized during small and more frequent flood events.

Levees are the backbone of the MR&T Flood Control Plan. They protect the vast expanse of the developed alluvial valley from periodic overflows of the Mississippi River. The grade and section of the present levee system dwarf those of the system that was overwhelmed during the 1927 flood (figure II-3.) In addition to higher and wider levees, the MR&T levee designs incorporate technological advancements that account for the type, condition, and moisture content of material used in the construction of the levees. The design levee grades provide for freeboard – the distance between the PDF flow line and the top of the levee. The presently approved freeboard is 3 feet on the Mississippi River levees below Cairo, IL, to the Old River Control Complex (ORCC), 3 to 5 feet from the ORCC to Venice, LA, 3 feet on the Bonnet Carre guide levees and no freeboard to 2 feet of freeboard on the Atchafalaya Basin Floodway System levees. Levee grades between Cape Girardeau and Cairo and along the south banks of the Arkansas and Red rivers provide for a three-foot minimum freeboard over the maximum tributary flood meeting the maximum flood of record on the Mississippi River, with provisions to ensure that the same flood meeting the PDF will not overtop the levee.

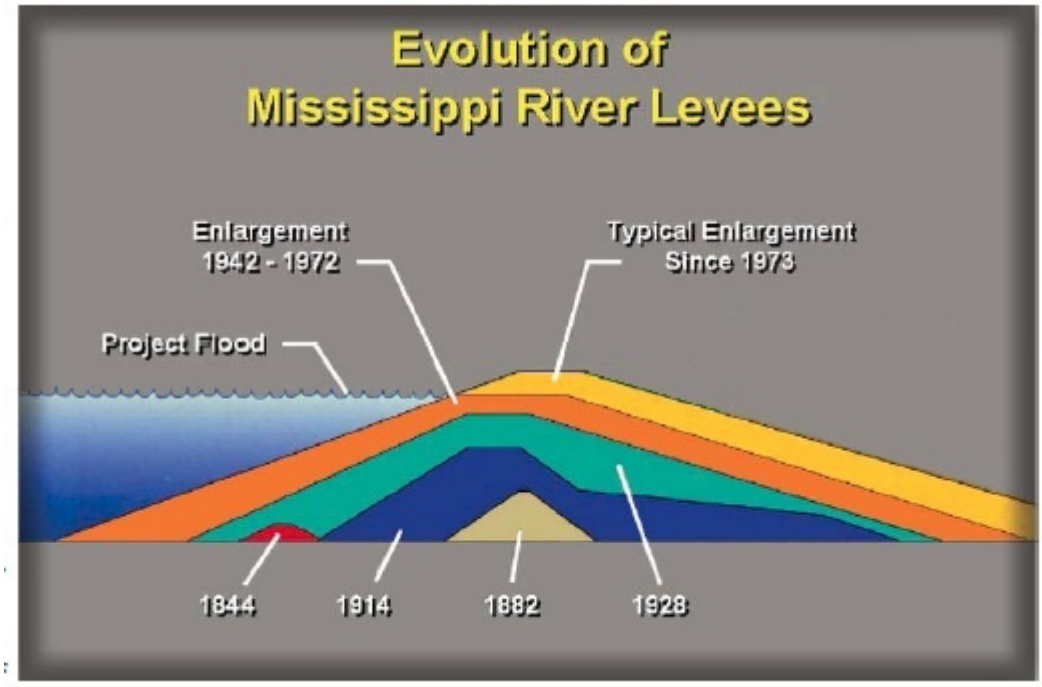

Figure II-3. Evolution of Mississippi River Levees (1844-Present)

The integrity of the levee system is also bolstered by advancements in the design, construction, installation and maintenance of seepage control measures, to include landside berms, drainage trenches, drainage blankets, and relief wells. Additionally, more than 1,000 miles of articulated concrete mattress revetment, over 300 miles of dikes and numerous hard points, chevrons and bendway

weirs associated with channel improvement efforts maintain a stable channel protecting the levees from erosion and assuring the reliability of the navigation channel.

At critical stages or flow rates, other features are activated to control and convey floodwaters and relieve stress on the levees. The first key feature is in the vicinity of Cairo, IL. When the river reaches critical stages on the Cairo gage, the BPNM floodway is operated to divert up to about 550,000 cfs and prevent flood stages from exceeding the design elevation of the levees and floodways at and near Cairo, IL, the levees along the west bank above Birds Point, and the east bank levee adjacent to the floodway.

There are two major reservoirs—Kentucky and Barkley Lakes— on the Tennessee and Cumberland rivers that are not features of the MR&T project, but are authorized to reduce flood stages on the Mississippi River in the vicinity of and downriver from Cairo. Because of the close proximity of the reservoirs to the confluence of the Mississippi and Ohio rivers, regulation of the reservoirs has a predictable influence on the operation of the BPNM floodway. The 1944 FCA directs the Tennessee Valley Authority (TVA) to regulate the release of water from the Tennessee River into the Ohio River in accordance with instructions from the Corps. Objectives developed by the Great Lakes and Ohio River Division (LRD) for the Kentucky-Barkley reservoir outflows have priorities to safeguard the Mississippi River levee system, to reduce the frequency of use of the BPNM floodway and to reduce the frequency and magnitude of flooding of lands along the lower Ohio and Mississippi rivers which are unprotected by levees. When floods threaten the flood control features along the upper reaches of the MR&T project, the MRC president and the LRD commander—a position that also serves as a member of the Mississippi River Commission—work together to regulate releases from Barkley and Kentucky lakes with the concurrence of the general manager of the TVA to accomplish these objectives.

Between the lower end of the BPNM floodway and the Red River, a combination of flood control reservoirs, backwater areas and a comprehensive channel improvement and rectification programs supplement the levee system in passing floods. Backwater areas are located at the mouths of the St. Francis, White, Yazoo, and Red Rivers. Significant portions of the upper sections of these backwater areas receive protection from overflows of the Mississippi River afforded by the mainline levees. The lower portions of these areas serve as natural storage during larger floods. The backwater levees are designed to naturally overtop when flood stages along the main stem of the Mississippi River reach specified levels. When flood stages subside, floodwaters within the backwater areas drain through floodgates or is pumped. The channel rectification program improves the carrying capacity of the main channel and lowers the flood flow line through the use of cutoffs (severing large bends from the river) and corrective dredging.

From the Red River backwater to the Gulf of Mexico, the MR&T flood control plan uses a more elaborate system to manipulate flood waters. The first key component of that reach is the ORCC. Construction of the ORCC began in 1954 to prevent the Atchafalaya from capturing the Mississippi River. The complex is designed to maintain the 1950 latitude flow distribution between the Mississippi River and the Atchafalaya/Red River System of 70 percent to 30 percent, respectively.

Approximately 30 miles downstream from the ORCC, the Morganza Floodway provides for additional diversion of floodwaters. Governed by a 3,900-foot long and a 125-bay intake structure, the floodway can divert up to 600,000 cfs from the Mississippi River to the Atchafalaya basin when the Mississippi River flows below Red River Landing are projected to exceed 1,500,000 cfs.

The West Atchafalaya floodway extends along the west side of the Atchafalaya River Basin. The floodway contains an eight-mile long fuseplug section of levee at its head. When the fuseplug section crevasses or when the west bank Atchafalaya River levee overtops, the floodway can divert up to 250,000 cfs. Under the present water control plan, the West Atchafalaya Floodway would be the last feature of the flood control system to be used. The Atchafalaya River, the Morganza floodway, and the West Atchafalaya floodway converge at the lower end of the Atchafalaya River levees to form the Atchafalaya basin floodway. This floodway receives flow from the Red River and from the Mississippi River via the ORCC and the Morganza Floodway; it is designed to carry 1,500,000 cfs, the combined flow of the West Atchafalaya Floodway, Atchafalaya River, and Morganza Floodway. The Atchafalaya Basin Floodway has two outlets, Lower Atchafalaya River, with a project flood flow of 919,000 cfs, and Wax Lake Outlet, with a project flood flow of 581,000 cfs. The Avoca Island levee and Levees West of Berwick provide measures of risk reduction below Morgan City to communities such as Franklin, Calumet, and Patterson.

The MR&T Flood Control Plan provides additional control of the system below the Morganza floodway through the Bonnet Carré spillway, located approximately thirty miles above New Orleans, LA. The 7,200-foot long spillway structure is governed by 350 intake bays and connects to a six-mile long floodway that empties into Lake Pontchartrain. The floodway is designed to divert up to 250,000 cfs from the Mississippi River, to ensure the peak discharge flow at New Orleans does not exceed 1,250,000 cfs.

3. MR&T Project Design Flood. The PDF used for the original design of the MR&T Project, following the 1928 FCA authorization, was a combination of separate analyses conducted by the US Weather Bureau (now the National Weather Service) and the MRC. The discharges and flood stages developed by the agencies were very similar, but because the Weather Bureau analyzed the "maximum possible" flood in comparison to the Commission's analysis of the "maximum probable" flood, differences in the estimates emerged. Where such differences did occur, the higher stage was used in putting together the final PDF design.

The PDF has been re-evaluated and/or revised several times. Development of the current PDF began in 1954, when the Senate Committee on Public Works requested another thorough examination of all components of the MR&T Project. Pursuant to that request, the MRC and the Weather Bureau again conducted a cooperative study. This study incorporated previously unavailable data regarding the sequence, severity and distribution of past major storms and investigated 35 different hypothetical combinations of actual storms that produced significant amounts of precipitation and runoff. The Weather Bureau arranged the historical storms sequentially to mimic frontal movements and atmospheric situations that were consistent with those occurring naturally to determine the most feasible pattern capable of producing the greatest amount of runoff on the LMR. This included the consideration of storm transpositions, storm intensity adjustments, seasonal variations, and storm mechanics. In simpler terms, the Weather Bureau developed the project design storm series from various combinations of storms and resultant floods—referred to as hypo floods— represented by the maximum event that had a reasonable probability of occurring from a meteorological viewpoint.

The studies revealed that Hypo-Flood 58A had the most probable chance of producing the greatest discharge on the LMR from Cairo to the Gulf of Mexico. Three severe storms comprised Hypo-Flood 58A. The first storm is the 1937 storm that struck the Ohio and LMR basins, with runoff increased by 10 percent. It is followed 3 days later by the 1950 storm over the same general area. This storm is followed 3 days later by the 1938 storm, with its center transposed 90 miles to the north and the rainfall pattern rotated by 20 degrees to maximize its coverage over all the tributary basins on the lower Mississippi River.

To convert Hypo-Flood 58A into the PDF, the MRC developed the flood flows that would occur from the three storms and routed them through the tributary systems under three conditions: unregulated by reservoirs; regulated by reservoirs that existed in 1950; and regulated by the reservoirs that existed at that time, plus those proposed to be constructed in the near future (1960 timeframe). The flood flows were then routed down the Mississippi River to determine the peak discharges at key locations. The MRC selected the 58A flood with near future reservoirs condition, referred to as 58A-EN (existing or near completion), as the basis for the PDF flowline and adopted it as the PDF in 1956. See Appendix A for a list of the "future reservoirs".

Following the 1973 flood, the MRC once again reviewed the adequacy of the PDF. The review concluded that the thorough approach used in 1955 was based on sound technology that remained reliable by current standards. The PDF discharges developed in 1955 have remained unchanged to present day except for the distribution of PDF flows through the lower Atchafalaya and Wax Lake outlets in the Atchafalaya Basin. The distribution of these two flows has changed over time as documented in the Atchafalaya Flowline Report in 2010. Figure II-4 provides a simplified illustration of the current PDF.

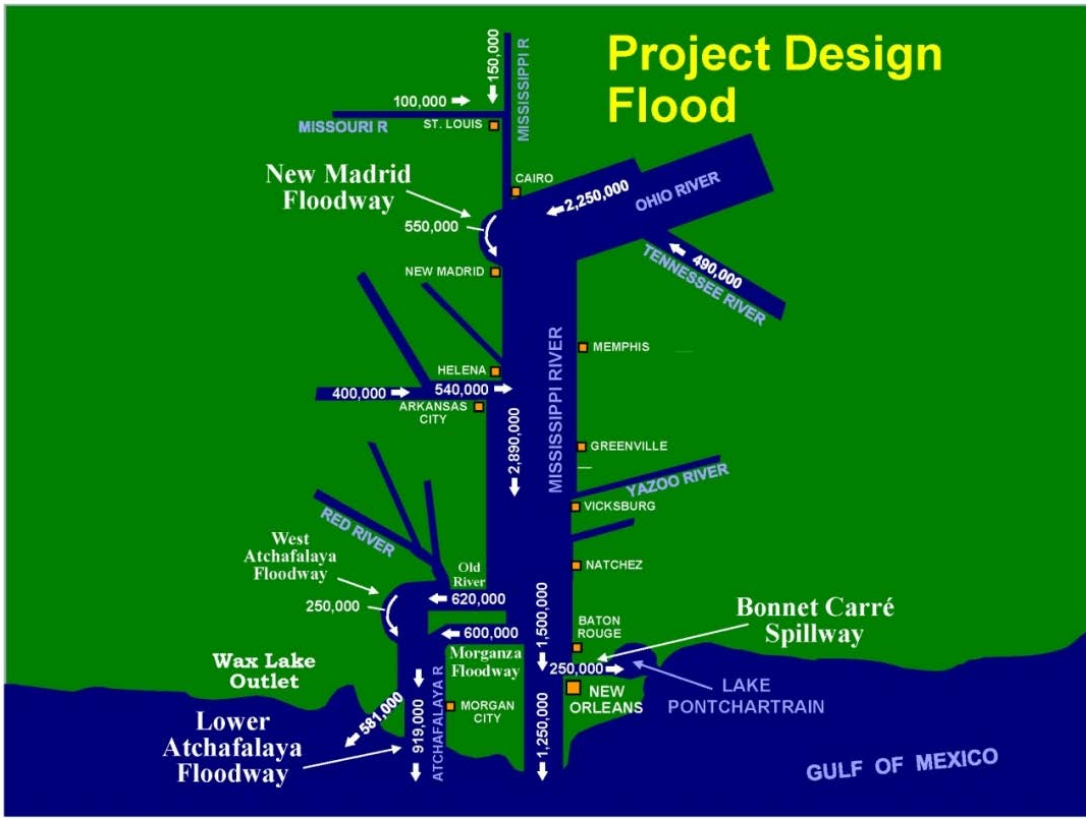

Figure II-4. Current Project Design Flood Diagram

B. MR&T BACKGROUND

1. Geology. The LMR lies within the Central Gulf Coastal Plain physiographic province. A northward extending lobe, the Mississippi Embayment of this province follows the axis of the Mississippi Basin and comprises the northern part of the LMRV (Schumm et al. 1982). Virtually all LMRV landforms and deposits are the result of fluvial, eolian, or marine processes.

The LMRV varies in width between 40 and 110 miles and includes parts of Missouri, Illinois, Tennessee, Kentucky, Arkansas, Mississippi, and Louisiana. The topography of the 53,000 square mile LMRV is characterized by a flat to slightly undulating surface underlain by alluvial and terrace deposits. Average floodplain elevations in the LMRV decline from about 325 feet mean sea level (msl) in extreme southern Illinois to about 40 feet msl at the northern edge of the deltaic plain. The average down valley slope is only 0.6 feet/mile. Average relief in the upper part of the LMRV is about 25 feet and declines progressively southward. Uplands bordering the LMRV typically attain elevations of about 200 feet above those of the adjacent floodplain. Upland elevations also steadily decline southward.

Soils in the LMRV range up to 300 feet in depth and consist mainly of sands and silt, grading progressively to very fine sands and silts in the lower portion of the area with extensive deposits of clay scattered through these formations. Typical of streams flowing through alluvial valleys, the LMR developed a highly sinuous course, creating numerous meander loops, bends, and oxbow lakes. Historically, the river shifted its channel frequently and reworked parts of its alluvial meander belt, thus contributing to the complexity of the soils structure and hydrology of the area (Saucier 1994).

One distinct feature of the LMRV is the formation of natural levees along the banks of rivers and the associated backwater deposits dominated by dense alluvial clays that historically supported extensive wetland areas. The banks of the river can be as much as 10 to 15 feet higher than the lowlands farther back from the river. Because of these natural levees, drainage within the floodplain, frequently flows away from the Mississippi River to lower elevations near the valley walls, except near tributary confluences. Bottomland drainage is provided by streams running parallel to the river and joining it through major tributaries or at points where the river meandered close to the valley wall. The clays that formed these features have low permeability and limit the ability of rainwater to infiltrate the ground surface (Kleiss et al. 2000).

2. Flood-Related History. French settlers began constructing the first levee on the Mississippi River in 1717 to protect the fledgling City of New Orleans from high water. That original levee was only 3 feet high and 5,400 feet long. The French, and later the Spanish, extended the modest levee system up the river, but progress was slow with the bulk of the work left to the landowners along the river. By 1802, the levees extended as far north as Baton Rouge; by 1849, they had almost reached the mouth of the Arkansas River along the west bank. Each landowner built his section of levee according to his own design and capability. In 1850, the Swamp Lands Act transferred low lying lands to the states, the sale of which allowed the states to fund levee construction. Levee boards were set up in the various counties along the river, and the Corps of Engineers provided technical guidance. The Civil War interrupted all progress on the levees and navigation improvements along the LMR.

Ongoing flooding and navigation issues led to the creation of the MRC in 1879. Public opinion at that time was opposed to Federal intervention for protection of private property in times of flood. Between 1879 and 1917 appropriations for flood control were publicly proclaimed to be for navigation, but progress on the levees continued. The floods varied in stage and duration and each one led to changes in how levees were constructed and provided impetus for more coordinated levee systems.

The FCA of 1917 appropriated $45 million with three provisions: 1) levees were authorized for the purpose of flood control; 2) local interests had to contribute 1/3 of the cost of levee construction; and 3) the MRC was authorized to use funds on the tributary streams to protect the Upper Mississippi River Basin from flooding. Work continued on the levee system and in 1926 the MRC believed “the day when the Lower Mississippi Valley would be safe from the ravages of floods was within sight.”

The most important historical flood, with respect to the MR&T System, was the Flood of 1927. The Flood of 1927 began with heavy rains that pounded the central basin of the Mississippi in the summer of 1926. By September, swollen tributaries were pouring through Kansas and Iowa. From December 1926 to April 1927, heavy rains continued throughout the central areas of the basin. There were three flood waves on the lower Mississippi in January, February and April, increasing in magnitude each time. In February, the White and Little Red Rivers broke through the levees in Arkansas, flooding more than 100,000 acres with 10 to 15 feet of water. 5,000 people were left homeless**.**

The April rains were very intense and river stages rose rapidly. By April 9, more than one million acres of land were flooded, and the rain continued to fall. On April 19, a levee near New Madrid, MO, burst, flooding an additional one million acres. Portions of seven states (Missouri, Illinois, Kentucky, Tennessee Arkansas, Louisiana, and Mississippi) were under water.

At Mounds Landing near Greenville, MS, a flood surge blew out another levee. Swirling eastward, the flood ravaged 2.7 million acres of farmland before rejoining the mainstem of the Mississippi at Vicksburg, MS. The levee break at Mounds Landing was the greatest single crevasse ever to occur on the Mississippi River. It flooded an area 50 miles wide and 100 miles long with up to 20 feet of water. It put water over the tops of houses 75 miles away. There were numerous breaks in the levees on the west bank of the river, also, inundating lands as far west as Monroe, LA. The flood continued south and west toward the City of Melville and the fast-running Atchafalaya River. It swept through town leaving much of it severely damaged.

By August 1927, when the flood finally subsided, the disaster had displaced about 700,000 people. It is not known exactly how many died in the great disaster. Historians once estimated the death toll at 250 victims, but deaths due to disease and exposure after the immediate flood are hard to tally; some estimates exceed 1,000 deaths. Twenty-six thousand square miles were inundated to depths up to 30 feet, levees were crevassed, and cities, towns and farms lay waste. Crops were destroyed and industries and transportation paralyzed.

At a time when the Federal budget barely exceeded $3 billion, the flood, directly and indirectly, caused an estimated $1 billion in property damage. It was a disaster of tremendous proportion, awakening the national conscience to the need for a comprehensive program to reduce flood risks within the LMR. The 1927 flood also illustrated that the “levees only” approach was inadequate to control and safely handle the river’s flood flows. Chief Engineer General Edgar Jadwin’s plan differed from the "levees only" approach in three major respects: 1.) the incorporation of floodways to divert peak flows and hold down stages in the main channel; 2.) backwater areas to divert peak flows from the river and store a portion of the flood waters near the peak of the flood resulting in reduced downstream stages; and 3.) designing all works on the basis of a PDF -- a great hypothetical flood derived from examining historic rainfall and runoff patterns.

This initial system of works was formalized in the 1928 FCA, which authorized the Jadwin Plan, or what came to be known as the Mississippi River and Tributaries Project. The features of the plan provided for higher and stronger levees, set back from the main channel where feasible. To avoid significant increases in levee heights, the plan provided for five floodways—the BPNM, Boeuf, Bonnet Carré, and East and West Atchafalaya floodways (note: Boeuf was later substituted by Morganza)—to safely divert excess waters past critical reaches in the levee system to prevent flows from exceeding MR&T levee design elevations. The plan also provided the revetment of caving banks and channel stabilization features to improve navigation.

The 1929 flood tested the new levees. For the first time, all of the mainline levees held.

The Great Flood of 1937 along the Ohio and lower Mississippi River Valleys provided the first test of the entire MR&T flood control project and, more precisely, of the BPNM Floodway. The flood was caused by flow from the Ohio River. Although the Mississippi River above Cairo, IL was at a low stage, the combined flows of the Ohio and Mississippi Rivers surpassed the highest flood stages ever experienced between Cairo and Helena, AR. On January 24 and 25, 1937, the BPNM Floodway was artificially crevassed. At crest stage, the MRC estimated that the Floodway was passing approximately one-fourth of the entire flood discharge at Cairo. If the floodway had not been artificially crevassed, most of the Floodway would still have been flooded as a result of natural crevasses and overtopping along the frontline levee. Major floods along the Lower Mississippi River followed in 1945, 1950, 1973, 1975, 1979, 1983, 1997 and 2008. The Bonnet Carré Spillway was operated for each of these floods, but the Morganza Floodway was operated only in 1973.

The PDF flows are greater in magnitude than those of both the 2011 and 1927 floods from Cairo, IL to Red River Landing. At Cairo, IL, the PDF is estimated at 2,360,000 cfs. The 1927 Flood was about 91% of the PDF at the mouth of the Arkansas River and about 76% of the PDF at the latitude of Red River Landing, amounting to 3,030,000 cfs at the latter location about 60 miles below Natchez, MS. Based on stage and flow rates, the 2011 Flood was approximately 85 percent of the PDF through large portions of the MR&T System. It is worth noting that the MR&T System was approximately 89% complete during the 2011 Flood. Thus, it likely could not pass the PDF prior to nor after the 2011 Flood (until it is completed).

Figure II-5 displays a comparison of the inundation extents of the 1927 and 2011 Floods.

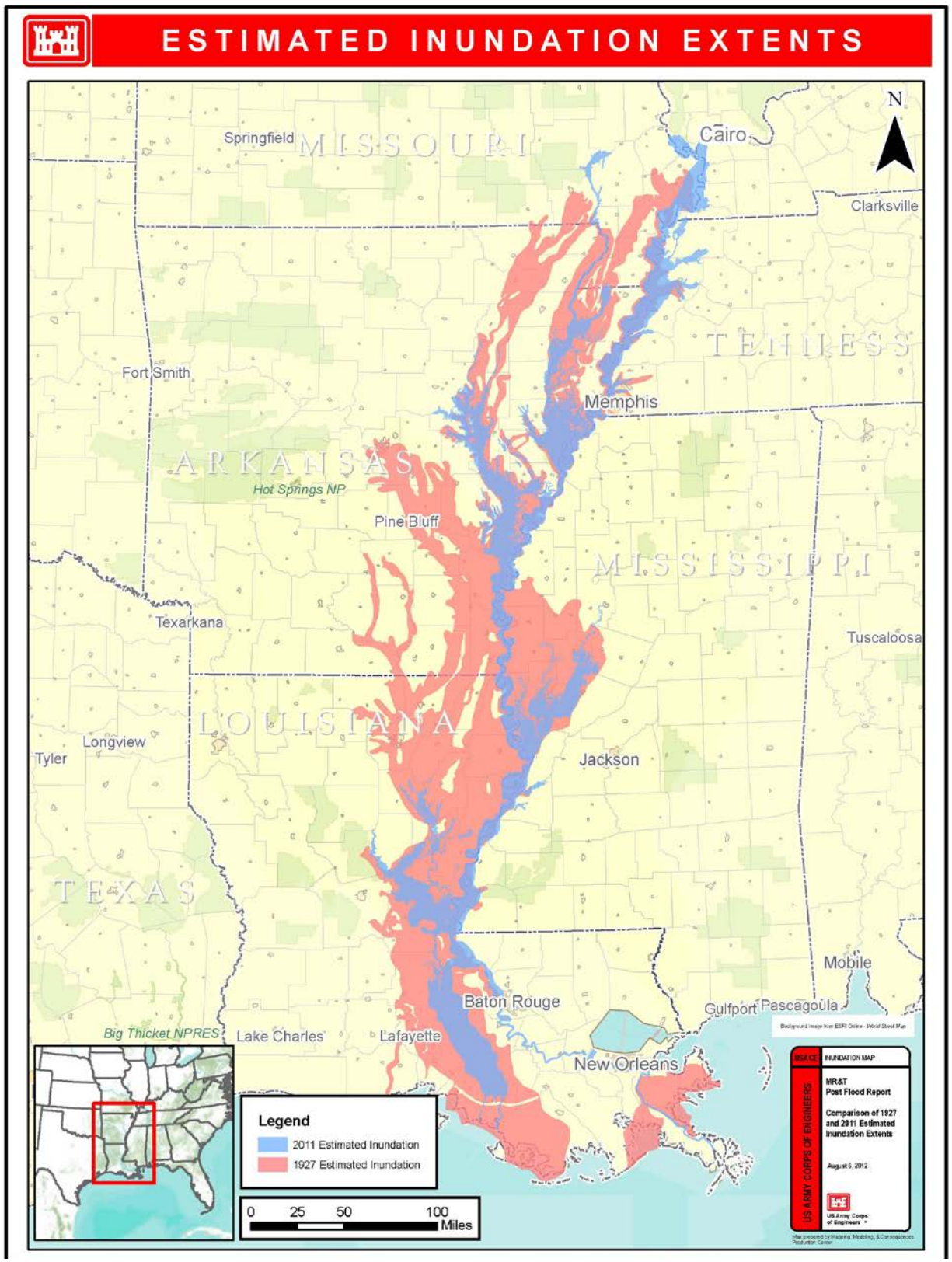

Figure II-5. Inundation Comparison: 1927 Flood vs. 2011 Flood

3. MR&T Project Status. Since 1928, the Federal Government has invested approximately $13.9 billion in the MR&T Project. In 2008, it was estimated that $500 million was needed annually to permit efficient completion of programmed construction and operation and maintenance. Prior to 2011, the MR&T received one-third to one-half of its funding through Congressional adds. In 2008, which was typical of this era, the total Project allocation was $387,402,000, broken down as:

- $196,601,000 (50.7%) - construction (re-evaluation studies, PED, & construction)
- $181,700,000 (47%) - maintenance
- $9,101,000 (2.3%) - planning

Prior to the 2011 Flood, the MR&T System was approximately 89 percent physically complete with a remaining balance-to-complete cost of approximately $3 billion and an estimated date of completion of 2031. The priorities for the known deficiencies change over time are tracked and regularly reassessed in Master Plans for the Mississippi River Levee System and Channel Improvements Program.

Prior to the flood, some reaches of the mainline Mississippi River Levees could not safely convey the PDF, and other reaches were in need of work to prevent failures due to seepage or deficient cross sections. Additionally, channel improvements were needed to assure that alignment of the Mississippi River remained stable to provide a dependable navigation channel and to prevent the meander of the river from destroying MR&T System features.

Detailed information related to the incomplete portions of the levee system is provided in Appendix B. It is worth noting in this report that many of the deficiencies that were identified as high priorities prior to the 2011 Flood are associated with significant flood fight issues and damages that are discussed in subsequent sections of this report. Many of these pre-existing deficiencies were identified as high priorities prior to the 2011 flood. Some had designs underway to repair the deficiency and construct as funding allowed. The magnitude of this flood further deteriorated the conditions, expanded the scope of the deficiency, and/or revealed unacceptable vulnerabilities thus elevating the need for repairs and supplemental funding to expedite construction.

4. Environmental Conditions. The LMRV extends from its northern extent at Cape Girardeau, MO to its southern delta and covers 36,000 square miles of diverse forest, grasslands, swamps, and marshes. The LMRV includes the Atchafalaya, Red, Yazoo, Arkansas, White, and St. Francis River Basins, and the Mississippi River Delta plain sub-regions. Each of these has its own unique physiographic character and wildlife community. The LMR is typically defined as the stretch of the river downstream of its confluence with the Ohio River.

a. Terrestrial Resources

i. Land Resources. The LMR leveed floodplain, which includes the floodplain contained between the levees (i.e., the batture) and backwater areas, is a dynamic freshwater ecosystem, often changing markedly in response to the river's annual hydrologic regime. The 2.8 million-acre leveed floodplain (area between the levees) is interspersed with abandoned channels, meander scars, and large expanses of forested wetlands. These areas provide a diverse array of aquatic habitat types and are connected to the river at high water. Table II-1 displays the distribution of primary environments within the floodplain areas.

Table II-1. Distribution of Environments Within the LMRV

Environment	Area (acres) (% total)
Bottom land hardwood forests	981,887 (35 %)
Agricultural Lands	478,345 (17 %)
Open Water	515,656 (18 %)
Backwater Areas	680,800 (24 %)
Other	137,186 (6 %)
Total	**2,793, 874**

Bottom land hardwood forests (BLHF) fill an important ecologic niche in the southern United States, and area valuable source of many natural resources (e.g., timber, recreation) and as the primary habitat for a wide range of organisms. While BLHF make up a sizeable fraction of the leveed floodplain, agriculture and timber harvesting have drastically diminished their national distribution since the time of first European-settlement. The construction of various levee systems, drainage efforts, channelization, and land clearing has altered the natural patterns of surface water drainage within the region, which has affected the distribution of ecosystems, such as BLHF, by increasing water availability in some regions and decreasing it in others. Table II-2 offers some examples of the wealth of flora currently found in BLHFs as well as in backwater wetland areas of the LMR region.

Table II-2. Vegetation Typically Found in Various Environments of the LMRV

Environment	Typical Trees	Typical Understory
BLHF	water oak (*Quercus nigra*); Nuttall oak (*Q.nuttallii*); cherrybark oak (*Q.falcata*); native pecan (*Carya illinoensis*); red maple (*Acer rubrum* var.*drummondii*); sweetgum (*Liquidambar styraciflua*); and eastern cottonwood (*Populus deltoides*).	palmetto (*Sabal minor*); greenbrier (*Smilax rotundifolia*); muscadine (*Vitis rotundifolia*); and poison ivy (*Toxicodendron radicans*).
Backwater Areas/ Wetlands	cypress (*Taxodium distichum*); water tupelo (*Nyssa aquatic*); water oak; green ash (*Fraxinus pennsylvanica*); red maple; and black willow (*Salix nigra*).	buttonbush (*Cephalanthus occidentalis*); lizardtail (*Saururus cernuus*); water hyacinth (*Eichhornia crassipes)*; sedges; and rushes.

The LMRV contains many different types of wetlands including those found within forested areas, river valley backwater areas, and around areas of open water. The Atchafalaya River Basin within the LMRV contains over a 500,000 acres of wetlands alone, making it the largest "river swamp" in North America. Over 40 percent of our Nation's coastal wetlands are found in Louisiana. Some of these coastal wetlands rely upon the Mississippi River for freshwater, sediments, and nutrients. Wetlands surrounding the Mississippi River are prime winter foraging grounds for many species of birds that rely heavily on the Mississippi flyway for migration. Approximately 70 percent of the Nation's migratory waterfowl travel through the Mississippi flyway annually. Unfortunately, much of the coastal wetlands within the Mississippi River delta region are decreasing in area (wetland loss rate of 16.57 mi^2 per year, trend analyses 1985 - 2010) due to land loss and submergence caused by both natural and anthropogenic subsidence and altered surface water hydrology.

ii. Wildlife Resource. The BLHF and coastal wetland ecosystems are extremely productive wildlife and fisheries habitat (table II-3). For example, 34 mammalian, 164 avian, 39 reptilian, and 20 amphibian species have been documented within the backwater wetlands near the junction of the Red, Atchafalaya, and the Mississippi Rivers. The activities relating to the abundant wildlife resources within the

LMR ecosystem, such as hunting and eco-tourism, are a significant source of revenue for the surrounding local economies.

Table II-3. Animals Typically Found in Various Environments of the LMRV

Environment	Typical Wildlife
BLHF	white-tailed deer, raccoon, woodpeckers, owls, various songbirds, rabbits, mice, wild turkey, and squirrel.
Agricultural Lands	cottontail rabbit, mourning dove, raccoon, coyote, and opossum.
Open Water	migratory, waterfowl, herons, egrets, and wood ducks
Backwater Areas/Wetlands	muskrat, nutria (invasive), swamp rabbit, mink, river otter, and beaver

Three threatened or endangered (T/E) animal species are found throughout the LMRV; the Louisiana black bear (*Ursus americanus luteolus*), the interior least tern (*Sterna antillarum*), and the pallid sturgeon (*Scaphirhynchus albus*). The endangered fat pocketbook mussel (*Potamilus capax*) is also found in the river. An additional 16 T/E species are also found along the Mississippi River delta plain, such as the piping plover (*Charadrius melodus*), West Indian manatee (*Trichechus manatus*), and five species of sea turtle (e.g., *Leatherback (Dermochelys coriacea*). The Louisiana black bear's habitat primarily includes the Tensas River basin, the upper Atchafalaya River Basin, and the coastal St. Mary and Iberia parishes in Louisiana. The bear favors large cypress and tupelo trees for winter denning, and there is an effort to protect areas where these trees are abundant. It is estimated that agricultural development along the Mississippi River has reduced the bear's natural geographic range by 80 percent. The interior least tern was listed as an endangered species in 1985, and while its range includes riverine areas throughout the interior United States, relatively large populations frequent the Mississippi River between Cape Girardeau, MO southward to Vicksburg, MS.

b. Aquatic Resources

i. Water Resources. The aquatic resources of the LMRV include the main stem of the Mississippi River, its tributaries and floodplain side-channels, and both natural and man-made surface water impoundments (e.g., floodplain pools, borrow pit ponds, oxbow lakes, reservoirs, and estuaries). The Mississippi River and its side channels compose the majority of the aquatic area of the region for most river discharges.

The aquatic health and water quality within many LMRV aquatic ecosystems have been degraded due to several anthropogenic causes including: 1) agricultural runoff containing pesticides (e.g., atrazine and metolachlor) and fertilizers; 2) river engineering for flood management and navigation (i.e., channelization, levee construction); 3) aquifer depletion (which lowers summer base-flows beyond acceptable limits for many aquatic organisms); and 4) altered fluvial sedimentation regimes (e.g., impounding sediment behind dams, increasing sediment yields due to deforestation). Additionally, coastal aquatic areas are affected by canal construction, oil and gas exploration, sediment diversion, sea level rise, subsidence, and storm damages.

Table II-4 displays median water quality values for the Mississippi measured near Vicksburg, MS. These values typically do not significantly vary in space for the lower river reaches. Nutrients, originating from agricultural fertilizer, are the primary driver of hypoxic conditions (when dissolved oxygen dips below 2 parts per million [or 2 mg/L]) observed in the Gulf of Mexico. Approximately 90 percent of the Mississippi River's nitrate load originates from non-point sources within its upper basin and the Ohio River valley. Recently observed hypoxia in Mississippi Sound and Gulf Coast waters east of the Mississippi River may be

linked to operation of the Bonnet Carré Spillway in 2008 and 2011 (Gundersen et al., 2012). A water-quality monitoring program for both the Mississippi River (employing five permanent water-quality measuring stations) and Atchafalaya River (employing two permanent water-quality measuring stations) has been established by the US Geological Survey (USGS) NASQAN program. Louisiana currently permits approximately 300 industrial and municipal sites to discharge wastewater into the Mississippi River, while it is used as the primary source of municipal water supply for approximately 1.5 million people.

Table II-4. Median Water Quality Values for the Mississippi River at Vicksburg During the Spring/Summer Flood Season

Water Quality Metric	Value
Suspended Sediment	~170.0 mg/L [1]
Nitrogen	~2.2 mg/L
Phosphorus	~0.2 mg/L
Metolachlor & Atrazine	~1.0 mg/L

The LMRV aquatic ecosystems have been significantly impacted from the introduction of invasive species. Invasive species threaten the diversity and abundance of native species, the ecological stability of infested waters, and the commercial, agricultural, aqua-cultural, and recreational activities dependent on those ecosystems. Five species of Asian carp [grass carp (*Ctenopharyngodon idella*), common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molotrix*), bighead carp (*H. nobilis*), and black carp (*Mylopharyngodon piceus*)] have invaded much of the LMRV. Common carp have been present since the mid-1800s while the other species have invaded within the last three to four decades. All of these fish have degraded native fish and possibly mussel populations by increasing competition for their food sources and habitat. Silver carp also pose a safety concern to boaters due to their propensity for jumping out of the water in front of moving vessels. Zebra mussel (*Dreissena polymorpha)* infestations have the potential to cause ecological changes in the major rivers of the LMRV as observed in the upper Mississippi River region. Their rapid reproduction, coupled with their ability to consume large quantities of microscopic plants and animals, degrades their local aquatic food web and places valuable commercial and sport fisheries at risk. The LMRV is also presently home of a number of invasive aquatic plants, such as giant salvinia, purple loosestrife, Eurasian watermilfoil, water hyacinth, water lettuce, hydrilla, etc., that quickly establish themselves and often replace native plants.

The coastal estuaries surrounding the Mississippi River delta, which includes areas stretching from Lake Pontchartrain to the Mississippi Sound and west to the Barataria Basin, are an extremely productive and robust ecosystem. Nutrient-rich fresh water from inland rivers, including the Mississippi River, mix with the saline sea water, creating a diverse range of coastal habitats. These areas are highly prized for recreational and commercial fishing for such species as spotted seatrout, blue crab, brown shrimp, and oysters. Many of Louisiana's coastal bays and Gulf waters to the three-mile limit are listed as impaired (i.e., not supporting designated uses) due to causes ranging from mercury in fish tissue to low dissolved oxygen [Louisiana Department of Environmental Quality's s *2010 Water Quality Inventory: Integrated Report (305(b)/303(d))]*.

ii. Fisheries. The waters of the LMRV support over 150 species of freshwater fish. The diversity and abundance of aquatic wildlife typically increases southward with increasing proximity to the river estuary. The mainstem of the Mississippi River may contain over 100 species in a short reach, including minnow, darters, suckers, catfish, and sturgeon. The pallid sturgeon (*Scaphiryhnchus albus*) was federally listed as an endangered species in 1990 and has been observed above New Orleans on the main stem of the river. Gravel bars within the main river are vital spawning habitat for sturgeon and other species of concern, such as paddlefish. While large dike pools in the Mississippi River can support 1,000 pounds of

fish per acre, slackwater areas like borrow pit ponds support up to 600 pounds per acre including uncommon and imperiled wetland species (e.g., pugnose minnow, taillight shiner, paddlefish and alligator gar). Spring floods provide necessary access between swift river water and slower-moving floodplain side-channels and ponds, which fish use for enhanced forage and spawning.

There is a range of native freshwater mussel species present within the LMRV; however, water quality issues and channel modifications have caused significant declines in freshwater mussel populations. Channel responses such as headcutting and knickpoint migration, caused the deterioration of several populations. The fat pocketbook mussel (*Potamilus capax*) was listed as an endangered species in 1976. After the species was listed, populations were located in the St. Francis River and Gilliam's Chute. In recent years, its range has expanded to include other backwater, clayey river channels in southern Arkansas and Mississippi.

The Mississippi River and Atchafalaya River estuaries produce a large fraction of our Nation's fisheries and are critical habitat for gulf coast oysters and other shellfish. The Mississippi River estuary and northern gulf coast are key commercial fishing ground for many salt-water species including bay anchovy *(Anchoa mitchilli)*, Atlantic croaker (*Micropogonias undulatus)*, gulf menhaden *(Brevoortia patronus)*, blue crab *(Callinectes sapidus)*, northern brown shrimp *(Farfantepenaeus aztecus),* and white shrimp *(Litopenaeus setiferus).*

5. Cultural Resources. The alluvial valley of the Mississippi River was one of the most densely populated areas of North America in prehistoric (pre-European contact) times. Consequently, there are thousands of archaeological sites ranging from post-glacial Paleo-Indian to late prehistoric Mississippian cultures. A unique cultural florescence, not found anywhere else, known as the Poverty Point culture also developed in the valley during the late Archaic period, approximately 3,000 thousand years ago. Hundreds of archaeological sites have been listed on the NRHP, and a far greater number have been determined eligible for the NRHP. In addition, the floodplain contains a rich historic archaeological record, including French and Spanish colonial sites, 19th century antebellum mansions associated with the mythic old South (e.g., Oak Alley Plantation), Civil War sites, sharecroppers farms, and a wide variety of 19th and 20th century historic buildings and sites that together form a unique and irreplaceable archaeological record. Remnants of more than 300 nineteenth century plantation sites have been recorded within the MVN alone.

To illustrate the LMRV's unique prehistoric archaeological heritage, it should be noted that around 1,000 A.D., larger, more complex mound sites were erected by late prehistoric Mississippian cultures. The flat-top earthen temple mounds within the large towns of these Mississippian peoples are still evident across the LMRV. In the lower valley, the Emerald Mound site, the second largest Mississippian mound (next to Monk's Mound at Cahokia) lies just north of Natchez and close to the present course of the Mississippi River.

During the early historic (colonial) period the Natchez, the Tunica, the Quapaw, the Choctaw and the Chickasaw constructed village sites in close proximity to the Mississippi River and its major tributaries. While some of these village sites have been preserved, many have been lost. Levee construction, erosion, and other land disturbances (e.g., the great New Madrid earthquake of 1811-1812) have destroyed many prehistoric and historic archaeological sites on the river side of the levee. During the 1830s, the Mississippi River and major tributaries like the Arkansas River served as the major transportation corridor for the forced removal of the Five Civilized Tribes after the Indian Removal Act of 1830.

Another major category of historic properties is the largely unknown number of 19th century steamboat wrecks, which occurred during the height of steamboat navigation on the Mississippi, described so vividly in Mark Twain's classic *Life on the Mississippi*. In 1988, record low-water levels provided the Arkansas Archaeological Survey with an opportunity to examine a sample of these shipwrecks when the Mississippi River fell to 10 feet below zero on the Memphis gauge and exposed four and a half acres of 19th century water craft remains on the riverbed near Memphis. The Survey's archaeological fieldwork received national media attention and wide publication in academic and popular journals. This high density of previously unknown shipwrecks in the Memphis area would probably be found at other large river towns (e.g., Vicksburg and Natchez, MS) in the Study area. However, most of these steamboat wrecks have never been formally recorded or evaluated for the NRHP. Systematic underwater surveys, using side-scan sonar and magnetometers, have yet to be done in the Mississippi River Valley and its major tributaries.

6. Social/Economic Background. A comprehensive overview of the overall area affected physically or economically by the MR&T Project on the surrounding region is presented in order to provide the context and basis needed to understand and determine flood-related impacts along the lower reaches of the Mississippi River from Cape Girardeau, MO, to the Head of Passes, LA. This synopsis includes a description of the economic base area and its historical significance to the general region; a background of the MR&T Project; and a discussion of other Mississippi River improvements and accomplishments. A special emphasis is given to significant impacts relevant to project implementation. This includes a discussion of project effects regarding the economy, flood damages prevented by the Project, and other related impacts or contributions from the Project.

a. Background. The MR&T Project is vital to overall FRM within the Lower Mississippi River. Because of its low-lying valleys, flooding on the LMR threatens cities, property, and crops along its banks. The mainline levees are also continuously being upgraded to correct deficiencies following major floods (e.g., 1973 and 2011). It is expected, that when all upgrades have been completed, this project will provide FRM to an estimated population of about 6.4 million people in 119 counties and parishes along the Mississippi River.

b. The Economic Base Area. The impacted area encompasses approximately 71,800 square miles of land area considered to be physically, socially, or economically impacted by the MR&T Project. This economic base area used to assess economic impacts of the MR&T was larger than the 36,000-square-mile LMRV because it included full census block areas which may extend beyond the boundaries of the LMRV. This base area extends roughly from Cairo, IL, to the Gulf of Mexico, includes portions of seven states—Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee—and five Corps Districts along the LMR and tributaries region—Little Rock, AR (SWL), , Memphis, TN (MVM), MVN, MVR, MVS, and MVK. Thus, to illustrate socioeconomic impacts to each entity, statistical data will be displayed by both state and District. Other damages and impacts associated with the 2011 Mississippi River flood in these areas are discussed in more detail in Section V.

i. Impacted Areas. The MR&T economic base area begins in the vicinity of the Mississippi River's confluence with the Ohio River. At this point, it includes portions of four states—Illinois, Kentucky, Missouri, and Tennessee. The northernmost portions of the economic base area impacted by flooding are located in the LRL and LRN Districts. Impact areas in the LRL include nearly 1,500 square miles of land within 5 counties while damages in the LRN have the potential to impact approximately 500 square miles in 2 counties. There are about 430 square miles in 2 counties within the MVS. There are also counties that overlap multiple Districts, but they are only counted once.

The portion within the MVM starts at Cape Girardeau and extends southerly along the Mississippi River to Memphis, TN. This segment contains approximately 20,200 square miles of land in 35 counties of 5 states—15 in Arkansas; 4 in Kentucky; 1 in Mississippi; 9 in Missouri; and 6 in Tennessee. To the west, the SWL has approximately 2,000 square miles of land in 3 counties that were subjected to impacts from the flood.

The portion within the MVK stretches from the MVM boundary southward to the Mississippi River's confluence with the Red River in Louisiana. With approximately 31,200 square miles of land area, it comprises about 38 percent of the economic base area. This segment comprises 49 counties and parishes in three states—11 counties in Arkansas, 16 parishes in Louisiana, and 22 counties in Mississippi.

The remaining portion, located in the MVN, accounts for the southernmost portion of the LMR region and the Atchafalaya River Basin. Situated entirely in the State of Louisiana, this section covers approximately 17,300 square miles of land in 29 parishes along the Mississippi River from the Red River to the Gulf. A list of counties/parishes by state and Corps District is provided in table II-5.

ii. Socio-economic Statistics. The objective of the socioeconomic study is to provide a framework from which to help identify and understand the impacts, problems, and needs in the affected areas of the 2011 Mississippi River flood.

There are 119 counties and parishes along the Mississippi River in seven states that impacted by Mississippi River flooding. Socioeconomic statistics for 2010 conditions are presented in table II-6 for each Corps District.

Table II-5. 2010 MR&T Economic Base Area By District, State, and County/Parish

LITTLE ROCK DISTRICT		
ARKANSAS		
Independence	Jackson	Randolph

MEMPHIS DISTRICT										
ARKANSAS		**KENTUCKY**	**MISSISSIPPI**	**MISSOURI**		**TENNESSEE**				
Arkansas	Mississippi	Ballard	DeSoto	Butler	Wayne	Dyer				
Clay	Monroe	Carlisle		Cape Girardeau		Lake				
Craighead	Phillips	Fulton		Dunklin		Lauderdale				
Crittenden	Poinsett	Hickman		Mississippi		Obion				
Cross	St. Francis			New Madrid		Shelby				
Greene	White			Pemiscot		Tipton				
Lawrence	Woodruff			Scott						
Lee				Stoddard						

NEW ORLEANS DISTRICT					
LOUISIANA					
Acadia		Iberville	Orleans	St. James	Tangipahoa
Allen		Jefferson	Plaquemines	St. John the Baptist	Terrebonne
Ascension	East Baton Rouge		Pointe Coupee	St. Landry	Vermilion
Assumption	East Feliciana	Lafayette	Rapides	St. Martin	West Baton Rouge
Avoyelles	Evangeline	Lafourche	St. Bernard	St. Mary	West Feliciana
	Iberia	Livingston	St. Charles	St. Tammany	

ST. LOUIS DISTRICT			
ILLINOIS		**MISSOURI**	
Alexander	Pulaski	Perry	Bollinger

VICKSBURG DISTRICT								
ARKANSAS			**LOUISIANA**			**MISSISSIPPI**		
Ashley	Desha	Ouachita	Caldwell	La Salle	Tensas	Adams	Issaquena	Tate
Bradley	Drew	Prairie	Catahoula	Lincoln	Union	Bolivar	Jefferson	Tunica
Calhoun	Jefferson	Union	Concordia	Madison	West Carroll	Carroll	Leflore	Warren
Chicot	Lincoln		East Carroll	Morehouse	Winn	Claiborne	Panola	Washington
			Franklin	Ouachita		Coahoma	Quitman	Wilkinson
			Grant	Richland		Grenada	Sharkey	Yazoo
						Holmes	Sunflower	
						Humphreys	Tallahatchie	

Table II-6. 2010 Socioeconomic Statistics in the MR&T Area by Corps District [1]

Socioeconomic Category	SWL AR (3 counties)		MVM AR, KY, MO, MS, TN (35 counties)		MVN LA (31parishes)	MVS IL (3 counties)	MVK AR, LA, MS (47 counties)	Total (119)
Land Area (Square Miles)	2,050		20,219		17,295	437	31,162	71,163
Population Density (Persons Per Square Mile)	35.4		101.4		178.6	33.1	36.8	77.1
Total Population, 2010	72,613		2,049,355		3,089,524	14,339	1,148,230	6,374,061
Total Population, 2000	71,752		1,884,869		2,978,795	15,579	1,210,219	6,161,214
Change, 2000-2010	1.2%		8.7		3.7	-7.6%	-5.1%	0.9
Total Number of Households, 2010	28,445		762,995		1,108,307	5,845	418,735	2,324,327
Persons Per Household	2.55		2.69		2.79	2.46	2.74	2.65
Median House Unit Value, 2010 [2]	$70,333		$94,767		$121,683	$98,620	$69,229	$90,926
Total Employment, 2010	21,641		746,759		1,108,395	2,206	321,969	2,200,970
Per Capita Income, 2010 [2]	$17,846		$19,842		$21,970	$17,151	$16,794	$18,720
Household Income, 2010 [2]	$30,821		$39,749		$45,057	$30,003	$31,297	$35,385
Total Value Added by Manufacturing, 2007 (millions) [2]	$1,068.1		$37,054.8		$49,560.6	$885,672	$9,671.6	$983,027.1
Retail Sales, 2007 (millions) [2]	$712.6		$25,287		$40,208.9	$1,216.2	$11,490.9	$78,834.7
Wholesale Sales, 2007 (millions) [2]	$309.7		$38,104		$31,942.3	$186.9	$2,525.8	$73,068.7
Total Number of Farms, 2007	2,332		18,662		12,454	2,682	19,416	55,546
Total Acres in Farms, 2007	803,925		9,062,089		2,947,472	749,266	2,640,206	16,202,958
Total Value of Farm Products Sold, 2007 (millions) [3]	$345.2		$4,092.6		1119.3	$237.3	$3,869.4	$9,663.8

[1] Statistics presented to represent the closest year to 2010 as available by the US Census Bureau, QuickFacts
[2] US Census Bureau values presented in 2010 dollars
[3] Values updated from 2007 to 2012 dollars
[4] Information not disclosed

c. Demographic Setting. When reviewing the specific demographics of the areas along the Mississippi River, it is evident how the regional economies are reliant, not only on the waters of the River itself, but on the agricultural and industrial bases which have developed as a result of the River. Appendix G, *Economics*, provides a comprehensive discussion with detailed demographic statistics by county. An almost direct correlation exists between the number of persons residing in a specific area and the economic opportunities (especially economic and industrial activity) available in that area. Consequently, economic and industrial activity is used as an indicator of labor requirements and of local demands for community facilities and public services.

i. Population. Population growth is a direct reflection of the economic growth of an area. Population levels are good indicators of the size of an urban area and its land use needs such as residential, commercial, and other urban uses. Population statistics are also the basis for any other economic parameters such as per capita income (PCI), persons per household (PPH), population density, etc. Population for the total area exceeded 6.4 million in 2010, an overall growth of 3 percent over the 6.2 million people reported for 2000. Section V of this Report details totals by county and parish.

Historically, population totals for the overall region have gradually increased. However, there have been some periods of outmigration in localized rural areas where the number of persons moving out of an area was greater than the combined number of immigrating residents and the natural population growth. The Mississippi Delta suffered the greatest reduction in the total number of persons living in the area. However, growth statistics show the overall study area population has increased by over 500,000 people from 1960 to 1990 or 14 percent over the 30-year period.

Population growth within the study area has fluctuated from area to area based on varying factors. In many cases, areas within counties in close proximity to large metropolitan centers have enjoyed substantial population growth. This is evident in reviewing the population trends of counties which encompass large cities. These urban centers offer a diversified economic base of jobs, industry, and services which provide for the basic needs of a large population—employment, income, and housing.

Although the area is predominantly rural, there are over 50 cities situated along the Mississippi River that have populations of 10,000 people or greater (table II-7). There were also over 100 towns with populations between 2,500 and 10,000 people during the last Census. The largest population centers impacted by the MR&T Project are the Metropolitan Statistical Areas (MSA), which are the major commercial, services, and industrial centers for regional areas. Among these are Louisville, Pine Bluff, and West Memphis, AR; Baton Rouge, Monroe, and New Orleans, LA; St. Louis, MO; and Memphis, TN. In addition to their close proximity to the Mississippi River, each of the major metropolitan centers has international air service and is accessible by multiple Interstate and Federal highway systems. Thus, when floods of the magnitude of the 2011 occur, disruptions of numerous services take place.

ii. Housing. Data reported on housing units provide insight into significant social developments that influence the economic activity of an area. According to the latest Census, there were 2.3 million housing units located in the economic base area in 2010. The number of PPH for the MR&T area compares with the national average. Applying the total population to the total number of households, the number of PPH for the 119-county area was estimated to be 2.65 PPH for 2010. The national PPH for 2010 (2.59) is only slightly lower. These numbers reflect a trend (i.e., smaller families) that has been occurring nationally in recent decades.

The total median value of housing units, presented in 2010 dollars, ranged from highs of $203,000 and $201,000 in Plaquemines and St. Tammany Parishes, LA, respectively, to lows of $46,000 and $44,000 in Quitman County, MS, and East Carroll Parish, LA. In comparing state totals, Illinois had the highest housing value at $202,500. The national value for 2010 was reported to be $188,400.

Table II-7. Urban Areas in the Economic Base Area [1]

SWL	MVM	MVN	MVS	MVK
Arkansas	**Arkansas**	**Louisiana**	**Illinois**	**Arkansas**
Batesville	Blytheville	Abbeville	Carbondale	El Dorado
Little Rock	Forrest City	Baton Rouge		Pine Bluff
	Helena-West Helena	Crowley	**Missouri**	
	Jonesboro	DeRidder	St. Louis	**Louisiana**
	Paragould	Hammond		Alexandria
	Searcy	Houma	**Illinois/Missouri**	Bastrop
	Stuttgart	Kenner	Cape Girardeau/	Monroe
		Lafayette	Jackson	Ruston
	Illinois	Lake Charles		Vidalia
	Cairo	Metairie		
	Cape Girardeau-	Morgan City		**Mississippi**
		New Iberia		Batesville
	Missouri	New Orleans		Clarksdale
	Jackson	Opelousas-Eunice		Cleveland
	Kennett			Greenwood
	Sikeston			Greenville
				Grenada
	Missouri/Illinois			Indianola
	Jackson			Natchez
				Tunica
	Kentucky			Vicksburg
	Paducah			Yazoo City
	Tennessee			
	Bartlett-Collierville-			
	Germantown-Memphis			
	Brownsville			
	Dyersburg			
	Humboldt			
	Jackson			
	Martin			
	Kentucky/Tennessee			
	Union City			

[1] Places with greater than 10,000 people

d. Economic Setting. Economic conditions can be described by parameters such as labor force and employment, earnings and income, agricultural activity, and industrial and business activity.

i. Employment. Total employment in the study area represents the number of wage and salary employees and the number of proprietors. Total private nonfarm employment for 2010 was estimated to be approximately 2.5 million people for the total economic base area, a 32 percent growth since 1990. The total employment in the study area in 1990 was estimated at 1.9 million, which was a 33 percent increase over the 1970 employment of 1.4 million. The majority of the economic base employment occurs in counties with large urban populations (e.g., the MSAs of Little Rock, Memphis, New Orleans, and St. Louis).

ii. Income. In 2010, the average per capita income in the economic base area ranged from a low of $11,800 in Lake County, TN, to a high of $29,300 in St. Tammany Parish, LA. Overall, PCIs

for the counties averaged about $19,831 per person in 2010 in the MR&T area. However, the PCI for the majority of the states was much higher, as follows, from highest to lowest:

Illinois	$28,782	Missouri	$24,724
Tennessee	$23,722	Louisiana	$23,094
Kentucky	$22,515	Arkansas	$21,274
Mississippi	$19,977		

In comparison, the national PCI was $27,334 for 2010. Based on detailed socioeconomic studies, the major sectors contributing toward total earnings are the services, transportation, manufacturing, retail trade, government, and farming industries. Although farming and forestry have historically been major enterprises in the past, services and manufacturing have become increasingly important to the economy over the last decades. Much of this is due to increased efforts toward mechanization and industrialization of production processes and the infiltration of a diversity of industries into the region. Services and manufacturing were the leading contributors to earnings in 2010.

iii. Agriculture. Favorable agricultural characteristics have been significant factors in the development of land use patterns in the area. Historically, agricultural resources have been important to the economy of the region. However, along with industrial expansion and the increased commercialization and mechanization of farms, farming operations have followed a national trend of consolidation resulting in fewer farms with larger acreages. In 2007, there were 55,546 farms in the economic base area comprising 16.2 million acres, with an average size per farm of 292 acres.

The total value of farm products sold in 2007 was estimated to be $9.7 billion (indexed to 2012 dollars). As a major contributor to the economies of many counties in the area, agricultural production, especially in the rich Mississippi River Delta lands, remains a viable industry in the region.