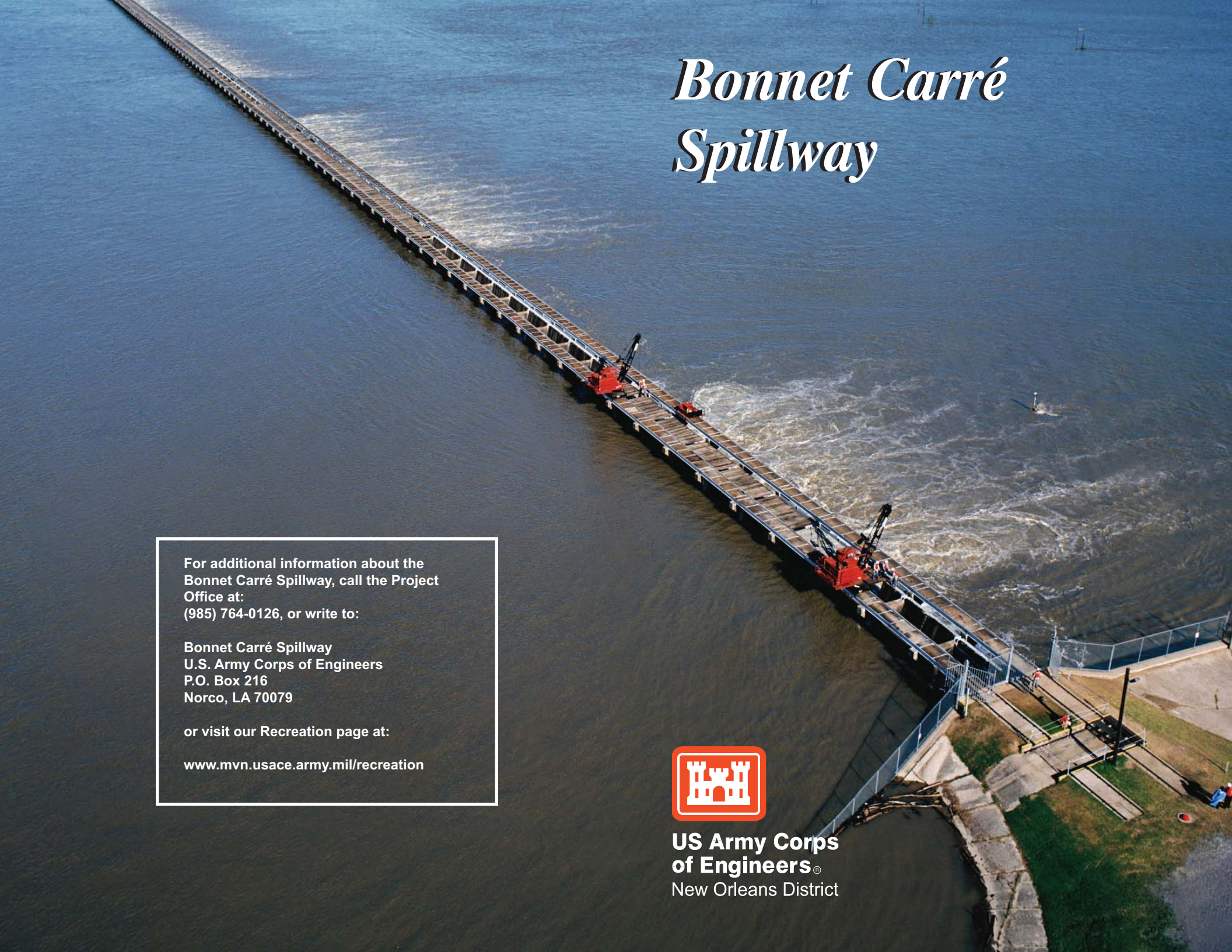
Bonnet Carré Spillway



For additional information about the Bonnet Carré Spillway, call the Project Office at:
(985) 764-0126, or write to:

Bonnet Carré Spillway
U.S. Army Corps of Engineers
P.O. Box 216
Norco, LA 70079

or visit our Recreation page at:

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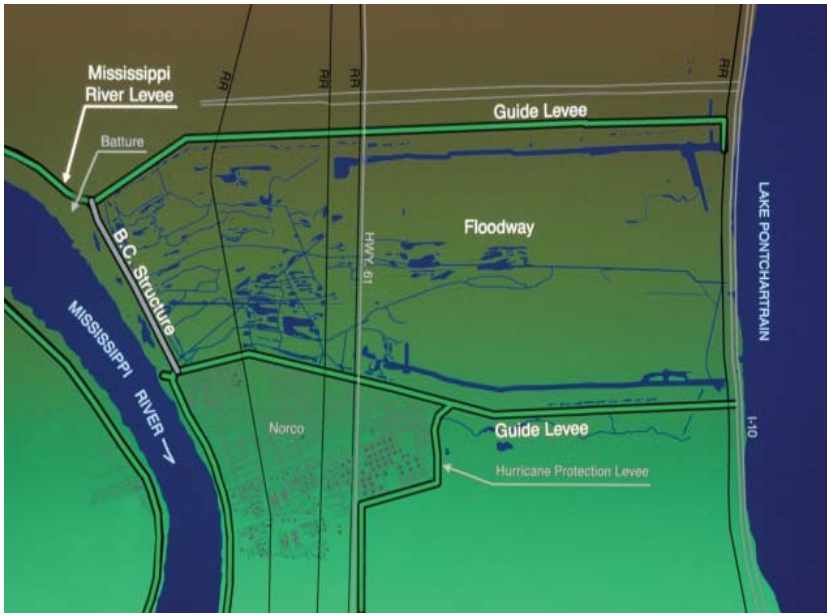
US Army Corps of Engineers®
New Orleans District

Bonnet Carré Spillway



Map of Bonnet Carré Spillway (top), and aerial of the spillway in operation during the the flood of 1975. The view is from the Mississippi River with Lake Ponchartain in the background.

Directions to the Bonnet Carré Spillway: West on I-10 from New Orleans to I-310. Take the Norco-Destrehan exit, head west (right) on River Road for 6 miles.

Recreation continues even during project operations.

hauling areas, wetlands, forested areas, and small to large bodies of ponded water. These public lands and waters provide opportunities for fishing, crawfishing, hunting, dog training, camping, wildlife viewing, boating and picnicking.

ATV and motorcycle riding is a popular activity in the spillway.

More specialized activities include ATV and motorcycle riding in designated areas, mountain biking, retriever dog field trials and model airplane flying competitions. The spillway also contains two boat-launching sites, provided by St. Charles Parish, which furnish access to the spillway's various waterways and western Lake Pontchartrain. These recreational activities are made possible through a number of partnerships. Among the most valuable partners are volunteers who assist in the management of the project's recreational and natural resources.

Cultural Resource Values

Partial headstone and coffin adornment unearthed from Kenner Cemetery.

A cultural resource inventory of project lands at Bonnet Carré was completed in several phases between 1986 and 1991. The result of these efforts was the listing of two properties on the National Register of Historic Places. One is the Kenner and Kugler Cemeteries Archeological District. This district consists of two African-American cemetery plots which date to the early 19th century and continued to receive interments until federal purchase of the property in 1928. The cemeteries are located near the spillway structure. The Corps has established buffer zones to protect these important historic sites from project operations. The other National Register property in the project area is the spillway structure itself. The structure is significant as an engineering landmark and for its important historical association with flood control on the Lower Mississippi River.

Recreation Values

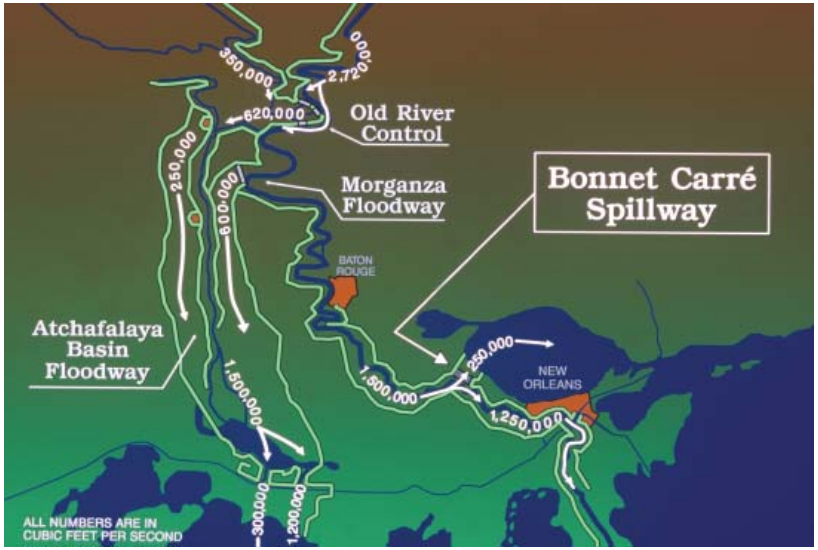
The largest developed recreation site in the spillway is located along the lower guide levee adjacent to Highway 61.

Over the years, the Bonnet Carré Spillway has developed into an extensively used outdoor recreation area with more than 250,000 visitors enjoying the spillway each year. Corps Park Rangers work on-site to manage the recreational and natural resources of the project, and provide assistance and interpretive services to the visiting public.

Introduction

The Bonnet Carré Spillway is a vital element of the comprehensive plan for flood control in the Lower Mississippi Valley. This multi-state plan, called the Mississippi River and Tributaries Project (MR&T), provides flood protection for the alluvial valley between Cape Girardeau, Missouri, and the mouth of the river.

Due to the wide expanse of the project and the complex problems involved, the plan contains an array of features. The MR&T provides for levees to contain flood flows, floodways such as the Bonnet Carré to redirect excess flows away from the Mississippi River, plus features such as channel improvement and stabilization for efficient navigation and protection of the levee system. It also involves reservoirs and pumping plants for flood control drainage.



Floodways and flow distribution during major floods in the lower Mississippi River Valley.

The Bonnet Carré Spillway is the southernmost floodway in the MR&T system. Located in St.Charles Parish, Louisiana, the spillway protects New Orleans and other downstream communities during major floods on the Mississippi River. This protection is accomplished by diverting a portion of the floodwaters into Lake Pontchartrain and thence into the Gulf of Mexico, bypassing New Orleans. This spillway was first opened during the flood of 1937, and seven times thereafter through 2004 to lower river stages at New Orleans.

The Bonnet Carré Spillway consists of two basic components: a control structure along the east bank of the Mississippi River and a floodway which conveys the diverted floodwaters to the lake. The control structure is a mechanically controlled concrete weir which extends for over a mile and a half parallel to the river. Confined by guide levees, the floodway stretches nearly six miles to Lake Pontchartrain.

In addition to its flood control function, the project's nearly 8,000-acre floodway is the site of diverse and extensive recreational activities. Also of importance are the fish and wildlife benefits derived from the floodway's varied habitats and the introduction of fresh water and nutrients into the Lake Pontchartrain estuary.

High altitude view of the spillway (center) stretching from the Mississippi River to Lake Pontchartrain, looking down river.

A Look Back at Floods in the Lower Mississippi Valley

In its natural condition, the Mississippi River regularly overflowed its banks and meandered back and forth across the floodplain. For thousands of years, Native Americans accepted the whims of the river and adapted to its patterns. The arrival of European settlers in the early 1700s, however, brought a radically new perspective on the river's habits. The river's tendency to flood was a serious hindrance to settlement and development—a problem which demanded solutions.

within the floodway. These deposits are removed by private contractors and local government agencies for use as fill material in residential and industrial developments. Because most of the surrounding region is near or below sea level, this sediment is a valuable local resource.

In addition to the infrequent operation of the spillway for flood control, a small portion of the Mississippi River leaks through the timbers of the spillway about every other year. This minor diversion of fresh water normally occurs for a few weeks in the spring or early summer when the river is high enough to exceed the elevations of the spillway weir but not high enough to warrant project operation. These minor diversions are termed leakage events (less than 10,000 cfs in comparison to a spillway opening with its design flow of 250,000 cfs).

The introduction of fresh water during leakage events simulates the natural cycle of overbank flooding and provides numerous ecosystem benefits to the aquatic and terrestrial resources in the spillway. These benefits include improved water circulation in the spillway's water bodies, nutrient introduction and restocking of fishery resources. Recreational crawfishing, for example, increases significantly due to the optimal conditions produced by these events. These frequent, small-scale diversions of Mississippi River water are also beneficial to the Lake Pontchartrain estuary.

Crawfish are abundant in the spillway, largely due to the infusion of fresh water and nutrients during high water on the Mississippi River.

Effects of Mississippi River Floodwaters

During operation of the spillway (about once every 10 years), materials suspended in the Mississippi River's water are deposited in the floodway and lakes Pontchartrain and Borgne. In addition, the vast input of fresh water into these brackish and saline lakes has an immediate, short-term, adverse environmental effect.

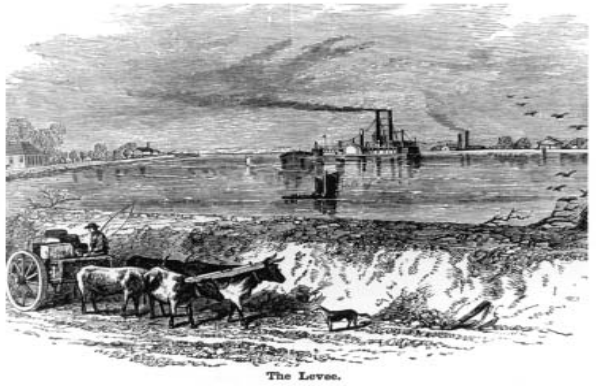
New Orleans District monitors water quality and fishery impacts in Lake Pontchartrain during project operations.

The long-range effect, however, is extremely positive because it simulates the natural flooding cycle of the river and provides a replenishment of valuable nutrients to the ecosystem. Spillway openings are strongly associated with increased oyster, crab and other fisheries production in lakes Pontchartrain and Borgne for several years after flood events.

With each opening, the river deposits an average of 9 million cubic yards of sediment, mostly silts and sand,

Diverted flood waters enter Lake Pontchatrain, providing valuable nutrients to the ecosystem.

Early inhabitants began constructing earthen embankments (called levees) along the river's banks to contain the flow and protect residents and developed property. Levees were built to protect New Orleans as early as 1718. At the turn of the 19th century, a crude system of levees extended for 100 miles upriver of New Orleans, with individual landowners constructing and maintaining the levees.



By the early 1800s, levees provided a measure of protection.

By the 1830s, states were becoming involved in flood control on the river through both direct funding and by the creation of levee boards. These boards took over levee construction and maintenance with funds acquired from taxes on riverfront landowners.

Early levee construction

Despite these efforts, flooding continued throughout the 19th century with major floods in 1844, 1850, 1858, 1862, 1865, 1867 and 1874. Some of these floods were immense, causing great misery and destruction along the river. As a result of these floods and the ravages caused by the Civil War, the levee system was in a devastated condition by the 1870s, and appeals for federal involvement grew with each flood event.

For many years the U.S. Army Corps of Engineers was responsible for keeping the river open for navigation, but had little role in flood control until Congress established the Mississippi River Commission (MRC) in 1879. The MRC, headquartered in Vicksburg, Mississippi, was charged with developing and implementing a comprehensive plan to improve navigation and prevent destructive floods. Engineering studies of the river were undertaken and many improvements to navigation were accomplished. In the area of flood control, the MRC assisted local levee boards by developing reliable levee standards and new construction techniques. Actual construction of flood control features by the MRC, however, was severely limited by Congressional directives.

Breaking through the levee just above New Orleans, the river at Ames Crevasse in 1891 flooded much of western Jefferson Parish.

Initial federal involvement significantly improved flood protection but it was still less than satisfactory. Major floods in 1882 and 1892 plagued the valley as levees were overtopped or crevassed (collapsed, creating a break in the levee). These disasters and the rising flood heights between the levees caused many to question the total reliance on building levees to contain the river's flood waters. Other approaches to improving flood protection—reforestation of the floodplain, cut-offs to speed up the river's flow, reservoirs to hold back floodwaters, and floodways to divert flows away from the main channel—were suggested but always rejected by the MRC in favor of a "levees only" policy.

Natural Resources in the Spillway

The diversity and abundance of productive habitats in the floodway support a wide variety of wildlife including game species, commercially important furbearers and alligators, endangered species, and numerous nongame species that are important ecologically.

Game mammals include the gray squirrel, fox squirrel, swamp rabbit, feral hogs and whitetail deer. Common furbearers include the otter, mink, nutria, muskrat, raccoon, opossum and beaver. Common nongame mammals include nine-banded armadillo, southern flying squirrel and marsh rice rat.

Alligators can be observed in the floodway's many ponds.

Wood ducks are numerous in the flooded forests off Highway 61.

The forested wetlands and shallow margins of permanent water bodies provide excellent feeding and resting areas for American coot and dabbling ducks, such as the wood duck, mallard and the mottled duck. Diving ducks, such as the lesser scaup, are most common in Lake Pontchartrain and adjacent open water areas of the floodway. Other game birds occasionally found in the floodway include American woodcock and common snipe.

A great diversity of nongame birds seen in the spillway include sea birds, shorebirds, wading birds, songbirds and raptors. Numerous species of reptiles and amphibians are also found in the area.

The diversity of water bodies in the floodway supports a wide range of finfish and shellfish. Sport fishing and crawfishing are popular in the freshwater and brackish water habitats.

Environmental Values

Wildflowers enliven the lakeside of the structure during spring high water.

Habitats in the floodway include bottomland hardwood forests, cypress swamps, canals and ponds, and disturbed areas. Bottomland hardwoods are located near the river and grade into cypress-tupelogum swamps closer to Lake Pontchartrain. The forested areas were logged in the past and second-growth timber covers the wooded areas.

The floodway acts as a catch-basin for non-indigenous plants when floodwaters are released from the Mississippi River. The introduction of seeds, rhizomes and other plant propagates establishes new species and an ever-changing plant environment.

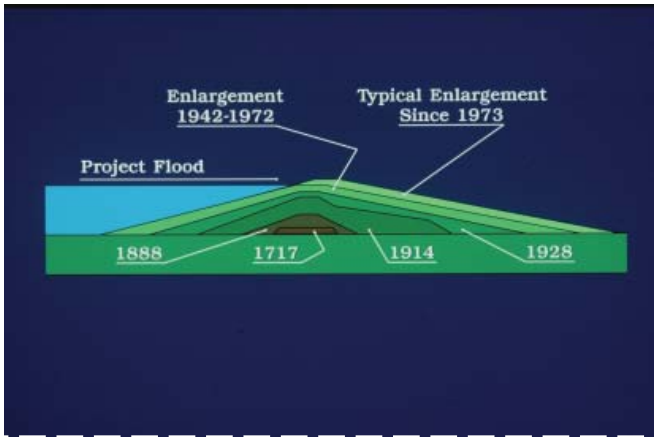
Beautiful cypress stands grow near the lake shore.

The floodway's habitat diversity makes it a butterfly haven.

Even with improved levees, flooding continued to plague communities along the river.

The role of the MRC grew with each flood, finally culminating in the Flood Control Act of 1917 which authorized the MRC to construct an extensive program of flood protection with cost-sharing by states and local interests. The program maintained the “levees only” approach and included new levee construction and strengthening of existing levees to standards set three feet above the high water of 1912.

By the end of 1926, the improved levee system had successfully passed several major high water events. These successes convinced the MRC and the public that the flood control problem was nearly solved.



Levees have grown in size and effectiveness over time.

Domestic animals huddle on the remaining levee crests in the submerged town of Bordelonville during the flood of 1927.

The Great Flood of 1927

The false sense of security in the Lower Mississippi Valley vanished in the flood of 1927, a natural disaster of great proportions. This tremendous flood extended over nearly 25,000 square miles, killed more than 500 people and drove more than 700,000 people from their homes. Thirteen crevasses in the main Mississippi River levees occurred, demonstrating that even the largest and strongest levee would not alone protect from flooding.

With MRC approval, Gov. Simpson gave the "go ahead" to dynamite the Caernarvon levee below New Orleans to create an artificial crevasse during the 1927 flood. The effort not only saved the city, it also blew away the "levees only" policy of the MRC.

The Corps of Engineers initiated surveys and preliminary investigations for the Bonnet Carré Spillway in 1928. Construction of the spillway structure began in 1929 and was completed in 1931. The guide levees were completed in 1932, and highway and railroad crossings in 1936. The total project cost was $14.2 million.

Project Statistics

Distance above New Orleans.....32.8 river miles
Length of weir opening.....7,000 feet
Number of bays.....350
Width of bays.....20 feet
Creosoted timbers.....20 per bay
Floodway design capacity.....250,000 cfs
(cubic feet per second)
Length.....5.7 miles
Width at river.....7,700 feet
Width at lake.....12,400 feet
U.S. lands.....7,623 acres
Frequency of operation (est.).....10 years

Spillway Openings (as of 2004)

Date		Bays open	Max. flow (cfs)
1937	*Jan. 30 to Mar. 7285*		*211,000*
1945	*Mar. 23 to May 18*	*350*	*318,000*
1950	*Feb. 10 to Mar. 19*	*350*	*223,000*
1973	*Apr. 8 to June 21 350*		*195,000*
1975	*Apr. 14 to Apr. 26*	*225*	*110,000*
1979	*Apr. 18 to May 21*	*350*	*191,000*
1983	*May 20 to June 23*	*350*	*268,000*
1997	*Mar. 17 to Apr. 18*	*298*	*243,000*

Project Operations

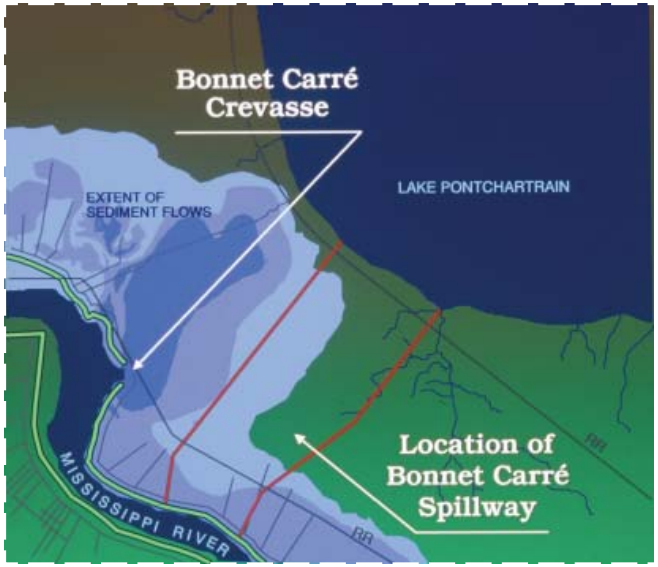
The decision to operate or "open" the Bonnet Carré Spillway is the responsibility of the MRC president who has broad jurisdiction over the entire MR&T project. The MRC president relies heavily on the recommendations of the New Orleans district engineer who is responsible for the actual operation of the Bonnet Carré structure and floodway. Included in the complex decision process are environmental considerations, as well as hydrologic, structural, navigational and legal factors. Essentially, the decision to operate the Bonnet Carré Spillway is made when existing conditions, combined with predicted stages and discharges, indicate that the mainline levees in New Orleans and other downstream communities will be subjected to unacceptable stress caused by high water.

In opening the spillway, each timber is individually lifted and placed atop the structure.

Once the decision is made, actual operation of the structure is relatively simple. Two cranes, which move along tracks atop the structure, are used to individually lift each timber from the required number of bays. The timbers are raised from their vertical position across the weir opening (where together they serve as a dam against the high water) and are laid horizontally on top of the structure for later use in its closing. A complete opening of all 350 bays requires about 36 hours to lift the 7,000 wooden timbers in the structure. If a quicker opening of the structure is ever required, emergency procedures can release 20 timbers at a time and reduce the opening to three hours.

The MR&T Project

To prevent a recurrence of the 1927 flood, Congress authorized the Mississippi River and Tributaries Project (MR&T) in the Flood Control Act of 1928. The "levees only" policy of the past was discarded and the Corps of Engineers adopted a new approach based on improved levees plus floodways, including a controlled spillway to divert flood water into Lake Pontchartrain above New Orleans.



Between 1849 and 1882, the Bonnet Carré crevasses left a large fan-shaped imprint on the landscape.

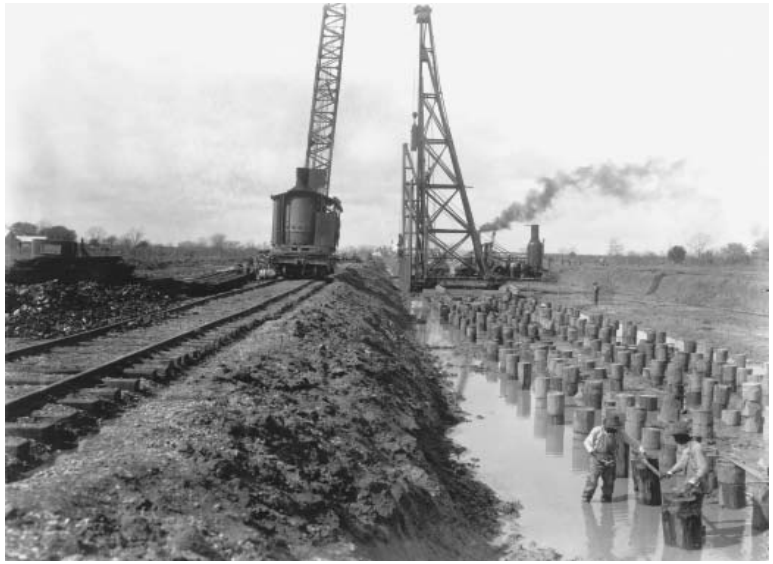
Spillway Site Selection

Earlier studies to determine the best location for a spillway along the lower river had identified one at the site of the 19th century Bonnet Carré Crevasse, about 33 river miles above New Orleans. Between 1849 and 1882, four major crevasses occurred at this location. In fact, during the flood of 1849, a 7,000-foot-wide crevasse at Bonnet Carré flowed for more than six months.

Several problems confronted the Corps of Engineers in designing a controlled spillway to divert a portion of the Mississippi River's flood flows to Lake Pontchartrain. The most critical concern was the possibility that the river might cut a channel through the spillway and thereby divert its course. Also of concern were the poor foundation conditions at the site—would they support the massive concrete structure?

Design and Construction Advances

A series of preliminary investigations were conducted to address the design concerns and ensure an effective and high quality construction project. Three separate studies were performed on-site. The first of these were site and foundation studies to determine the properties of the soil. Piling tests were undertaken to compare the qualities of wooden and concrete pilings. The tests indicated that long timber piles, in the range of 70 feet, would be quite adequate if sufficient numbers were driven under the structure. Untreated piles were selected after examining the Robert E. Lee Monument foundation in New Orleans, which showed that such piles last indefinitely as long as they are kept below the water table.



Thousands of wooden pilings were driven to provide a reliable foundation for the spillway structure.

A temporary hydraulics laboratory was constructed on-site to determine the best shape of the weirs and to test various designs for dissipating the energy of water coming over the weir. To accomplish these design objectives, two wooden flumes (channels) were built: the first, a 1/6th scale model of a single spillway gate opening; and the second, a flume of 1/20th scale permitting the modeling of 22 spillway gates. Tests conducted with these models established the spillway's design parameters and demonstrated the usefulness of modeling in designing large hydraulic structures.

Because of the large quantity of concrete involved in the structure (135,000 cubic yards), it was essential that the concrete mixture produce strong, durable and economic concrete. The Corps established a concrete laboratory to determine optimal mixes of sand, gravel, cement and water quality for the spillway. Tests from the lab proved critical, resulting in a very high strength concrete in the neighborhood of 5,000 pounds per square inch. This was a significant advancement for the time, as typical concrete in the 1930s provided only 2,500 to 3,000 pounds per square inch compressive strength.

The design and construction of the Bonnet Carré Spillway was completed in just two and a half years. However, the urgency to complete the spillway, following the Great Flood of 1927, did not diminish its quality as an effective and enduring flood control structure. Today, the spillway remains as it was originally constructed; no significant modifications to the structure have been needed.

The Bonnet Carré Spillway is an excellent example of engineering design and construction in the era before "high-tech" solutions, and is listed on the National Register of Historic Places.

High strength concrete used in the spillway was an engineering advancement.