

# LAKE PONTCHARTRAIN BASIN FOUNDATION

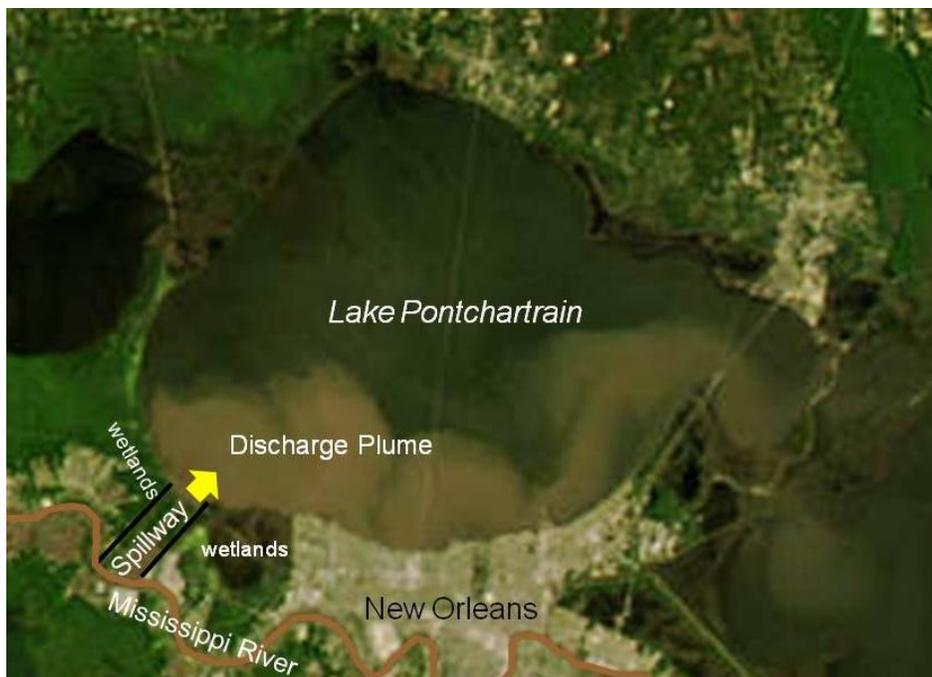
## SAVE OUR COAST SAVE OUR LAKE

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### **A Post-Katrina Assessment of the Bonnet Carré Spillway in South Louisiana: The Bonnet Carré Spillway Wetland Restoration Project**

#### **Summary**

In 2008, the Bonnet Carré Spillway was opened near New Orleans to lower flood water levels in the Mississippi River.<sup>1</sup> This event highlights the opportunity to use the Spillway for boosting flood protection by using the Spillway to deliver water and sediment to restore nearby wetlands. A fraction of the available sediment in the floodwater, if discharged directly into the adjacent wetlands, would have had a profound beneficial effect on the wetlands, which would improve hurricane flood protection to local communities.



*Sediment-laden river water flows through the spillway to Lake Pontchartrain, creating a massive sediment plume in Lake Pontchartrain. Guide levees confine the river water to the spillway, preventing restorative fresh water and sediments to reach adjacent wetlands.*

The Bonnet Carré Structure and Spillway have the capacity to deliver sediments, fresh water, and nutrients into the adjacent wetlands, but this would require modification to the existing guide levees. When the Bonnet Carré Spillway is open, river water is confined to the spillway by the guide levees thus preventing restoration benefits to adjacent wetlands. During such events, only a modest modification to the guide levees could create sufficient discharge into the adjacent wetlands. Discharge needed to create overland flow (pulse) is estimated to be 4000 cfs for each adjacent wetland area. This represents just 3% of the design capacity of the Spillway. Thus, shunting of water through the guide levee is only a very modest change to the overall hydrodynamics of the Spillway and so would not hinder the use of the Spillway for flood protection.

Preliminary design of the Bonnet Carré Spillway Wetland Restoration Project includes a structure along the guide levees and local adjustment to the guide levee. The estimated cost for construction is \$25 million for each side of the Spillway including structure, levee modification and related construction costs. Post-Katrina Congressional legislation requires that the Corps analyze and act on opportunities, such as this, under the combined efforts of flood protection and coastal restoration authorized in the LACPR, LCA and WRDA 2007.

## Background

The Bonnet Carré Spillway is authorized under the 1928 Mississippi River and Tributaries Act (MR&T) as part of a comprehensive plan for flood control in the Lower Mississippi Valley.<sup>2</sup> It is managed and operated by the US Army Corps of Engineers (USACE) in the New Orleans District. However, the final decision to open the structure rests with the President of the Mississippi River Commission in Vicksburg, MS. It has been opened nine times and, with river levees, it has successfully prevented flooding from the Mississippi River in the region.

The Bonnet Carré Spillway is located along the Mississippi River just 6 miles upriver of the greater New Orleans area and within the burgeoning “River Parishes” region. The Spillway was constructed by the US Army Corps of Engineers between 1929-1936, in response to the disastrous 1927 flood of the Mississippi River. In spite of the prior failure to control the river and the age of the structure, since construction the Spillway has been a marked engineering success for flood protection from river flooding. The Spillway is opened to lower river flood stage on the Mississippi to reduce the risk of flooding to communities downriver, such as New Orleans. Due to the historic technological advances and age of the Spillway, it is eligible for listing on the National Register of Historic Places.



*The Bonnet Carré Spillway is adjacent to wetlands in need of sediment, freshwater and nutrients. These wetlands protect existing or proposed hurricane protection levees. Modification to the Spillway guide levees with the Bonnet Carré Spillway Wetland Restoration Project could allow the Spillway to still function and restore wetlands.*

The Bonnet Carré Spillway is composed of a structure along the river and guide levees extending from the Mississippi River to Lake Pontchartrain. The structure allows control of river flow into

the Spillway from the river. The guide levees were designed to deliver flow through the Spillway to Lake Pontchartrain and prevent backwater flooding of adjacent communities. With the Spillway open, river water levels are lowered by allowing as much as 20% (250,000 cfs) of the river flow (1,250,000 cfs) to flow directly into Lake Pontchartrain and ultimately to the Gulf of Mexico. Water levels in the Mississippi River are lowered by a few feet and thus can greatly lower the risk of overtopping of river levees or levee failure downstream of Bonnet Carré. Water velocity in the river is also lowered reducing navigational hazards to large vessels on the Mississippi River.

Over the past 76 years, the Spillway's authorization, structure and operation has been static while the local and regional landscape has undergone major economic transformations, now requiring improved hurricane flood protection with levees and wetland restoration. The Mississippi River and the adjacent transportation system of highways, interstate and railroads are now a major industrial-transportation corridor between New Orleans and Baton Rouge. Population has increased 100% from 1980 to 2000 in east St. Charles Parish where the Spillway is located.<sup>3</sup> Along with this economic growth came the need for flood protection from hurricane storm surge emanating from Lake Pontchartrain. Consequently, the Lake Pontchartrain and Vicinities project was authorized by Congress. In the 1990s, a hurricane protection levee was constructed in St. Charles Parish, east of the Spillway.<sup>4</sup> A similar levee is planned west of the Spillway in St. John the Baptist Parish under the same authority.

Since construction of the St. Charles levee and the authorization for the levee to the west in St. John Parish, the need for the portions for the Spillway's guide levees to protect the same communities has diminished. Over the same period, significant wetland loss has occurred in the swamp and marsh area (LaBranche wetlands) fronting the St. Charles Parish Hurricane protection levee, making the need for restoration of these wetlands of greater importance. Hurricane Katrina and the ongoing re-building of the region's hurricane protection system has clarified the need for better flood protection with traditional levees but also reinforce the need for coastal restoration - suggesting re-consideration of use of the Bonnet Carré beyond its original purpose of flood control.

### **Hurricane Katrina**

During Hurricane Katrina, surge water levels in Lake Pontchartrain near the Bonnet Carré Spillway were 10 to 12 feet. The St. Charles Parish flood protection levee was slightly overtopped locally and resulted in minor flooding. Post-Katrina evaluations by the Corps show that the St. Charles levee was not meeting pre-Katrina authorized standards. New analysis of surge indicates that pre-Katrina standards need to be improved even further. The local Pontchartrain Levee District considers the wetlands separating the St. Charles levee and Lake Pontchartrain to have been vitally important in reducing the flooding from Hurricane Katrina, and is convinced that restoration of the LaBranche wetlands are necessary to enhance flood protection in St. Charles Parish.

Post-Hurricane Katrina, the concept of integrating flood protection and coastal restoration in coastal Louisiana is firmly embraced by the State of Louisiana in their State Master Plan<sup>5</sup> and in the congressionally mandated LACPR study undertaken by the US Army Corps of Engineers.<sup>6</sup> Since Hurricane Katrina, the state and Corps have incorporated the Multiple Lines of Defense Strategy as a multi-faceted and integrated approach to flood protection in south Louisiana.<sup>8</sup>



*The Corps, the State of Louisiana, and the Pontchartrain Levee District have adopted a Multiple Lines of Defense Strategy, as proposed by the Lake Pontchartrain Basin Foundation, to use coastal buffers to complement hurricane flood protection*

In 2008, the Pontchartrain Levee District passed a resolution embracing this strategy.<sup>7</sup> This strategy applies levees, home elevation, coastal restoration, evacuation routes, etc., as a multi-layered approach to flood protection that develops depth and redundancy to achieve a sustainable economy and wetland habitats in coastal Louisiana. A primary tool of the strategy is to have robust wetland restoration near communities, just as exists in the wetlands adjacent to the Bonnet Carré Spillway.

### **The New Opportunity**

There is very broad scientific and institutional recognition that wetland restoration in coastal Louisiana must include re-establishment of Mississippi River water flow into the adjacent wetlands.<sup>9</sup> A continuing contribution to the problem of wetland loss and degradation is the loss of historic river discharge into wetlands during river floods. The nearby Maurepas Swamp has been well documented as largely a dying (relic) baldcypress swamp due to the lack of freshwater and water circulation that is primarily due to severing of the Mississippi River water from wetlands by the river levees.<sup>10</sup> The Diversion into Maurepas Swamp Project is a diversion project is being designed by EPA upriver from the Bonnet Carré Spillway<sup>11</sup> and will likely cost \$80 million for the 1000 cfs discharge. Since this project addresses other wetlands, it is needed, but is burdened by the design complexity of moving river water through a developed corridor along the Mississippi River, i.e. there is no local Spillway.

The Bonnet Carré Spillway offers a wonderful opportunity to take advantage of an existing Spillway to deliver river water to wetlands in severe need of freshwater. The LaBranche wetlands have many dying baldcypress trees and a large stand of trees were destroyed a few years before Hurricane Katrina by high salinity. There is no question that a direct flow of Mississippi River water into wetlands adjacent to the Bonnet Carré Spillway will vastly improve the ecology of the wetlands. Diverting water the LaBranche and Frenier wetlands are recommended in the EPA approved Comprehensive Habitat Management Plan by the Lake Pontchartrain Basin Foundation.<sup>12</sup> As water flows through the wetlands, sediments will be captured and nutrients utilized by the wetland plants. The project will also improve water quality in Lake Pontchartrain by reducing nutrient loading and the potential for harmful algal blooms. The resulting, more robust wetlands should improve flood protection for St. Charles and St. John Parishes.

On April 11, 2008, the Bonnet Carré Spillway was opened and satellite images of the discharge into Lake Pontchartrain clearly show the lost coastal restoration opportunity of this flood event. A massive sediment laden plume spread across Lake Pontchartrain widely dispersing a thin layer

of sediment on the lake bottom. Suspended sediment was monitored by the United States Geological Survey and the USACE for the last two openings in 1997 and 2008. Allison and Meselhe (2009) compiled the USGS/USACE suspended sediment load data, and found the 1997 data to constrain the maximum daily load that can be expected to pass through the structure in a large flood at 340,000 tons/day at 5,985 cms.<sup>13</sup> A fraction of this same sediment, if discharged directly into the adjacent wetlands, would have had a profound beneficial effect on the wetlands. The Bonnet Carré Spillway has a capacity to deliver water into the adjacent wetlands, but this requires modification to the existing guide levees. During a Bonnet Carré opening, river water is confined to the spillway by the guide levees. Only a modest modification to the guide levees would create sufficient capacity of discharge into the adjacent wetlands during such events. The amount of discharge needed is estimated to be 4000 cfs on either side of the Spillway and so is a small fraction (3%) of the water flowing through the Spillway. Hydrodynamic modeling needs are being investigated to refine the discharge requirement. Thus, the shunting of water through the guide levee is only a very modest change to the overall hydrodynamics of the Spillway.

<b>Mississippi R. Water Diversion</b>	<b>\$ Cost</b>	<b>Water Flow (cfs)**</b>	<b>Cost per 1000 cfs</b>
Davis Pond Diversion	\$120,000,000	10600	\$11,320,755
Diversion Maurepas Swamp*	\$80,000,000	1000	\$80,000,000
Bayou Lafourche Diversion*	\$180,000,000	1200	\$150,000,000
<b>Bonnet Carré Spillway (East)</b>	<b>\$25,000,000</b>	<b>4000</b>	<b>\$6,250,000</b>
<b>Bonnet Carré Spillway (West)</b>	<b>\$25,000,000</b>	<b>4000</b>	<b>\$6,250,000</b>

\* estimated cost

\*\*cubic feet per second

*Comparison of the cost effectiveness of the proposed Bonnet Carré wetland restoration project to nearby authorized diversion projects that are either constructed or currently being designed*

Preliminary design of a water control project along the guide levees could include a structure at the levee and extension of the guide levee into the wetlands. The structure could be within the existing footprint of the guide levee for approximately a 500-foot length. On the LaBranche wetlands (east side), the structure would be within a designated 800-foot wide corridor established for this purpose by the Louisiana Department of Environmental Quality. The location on the west guide levee also has viable options outside (lakeward) of the proposed hurricane protection levee in St. John Parish.

Several well-established structural designs have been preliminarily evaluated. The proposed design is a structure with vertical slotted concrete piers spaced approximately 50 feet in which gates are inserted by a mobile crane operating from an elevated roadway. The existing Morganza flood control structure and Bonnet Carré are similar to this design - incorporating a roadway and simple mechanical operation to minimize maintenance requirements. The estimated cost for this design by structural design engineers is \$25 million including structure, levee and all other construction costs, including an overall 75% contingency cost. The performance of this project could be dramatic; because it can deliver a large volume of water at a fraction of the cost compared to other typical diversion projects in coastal Louisiana (see table).

Although the Bonnet Carré Spillway Wetland Restoration Project would only operate during flood years when the Bonnet Carré Spillway is open, the project complements other diversion projects, such as the Diversion into Maurepas Swamp. The Spillway project introduces significant sediment into LaBranche wetlands, when it is available. Since the Diversion into

Maurepas Swamp works annually, it will moderate salinity in Lake Pontchartrain and, therefore reduce potential annual high salinity conditions in the LaBranche wetlands.

WRDA 2007 demands that the Corps analyze opportunities to integrate flood protection and coastal restoration in coastal Louisiana under the combined efforts of flood protection and coastal restoration authorized in the LACPR and LCA. The proposed Bonnet Carré Spillway Wetland Restoration Project offers an unusually effective project that is within the existing authority of the US Army Corps of Engineers.

## Citations

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