

Levees, Oysters, and Dirt: How Breaching the Mississippi River May Save Louisiana's Coast

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Introduction

The Mississippi River has been a friend and a foe to New Orleans throughout the city's history.¹ A few months after its founding in 1718, the city was struck with its first flood.² Refusing to leave their homes, the citizens of New Orleans constructed rudimentary structures to curb the river.³ After each disaster, the fixtures became more and more restrictive, culminating in massive levees after the destructive flood of 1927.⁴ However, the levees posed a catch-22: the same floods that devastated the city also nourished the surrounding wetlands, which, in turn, afforded the city protection from floods and hurricanes.

For millennia, the Mississippi River has periodically overflowed its banks, each time depositing tons of sediment across its flood plain.⁵ This cycle created Louisiana's coast and prevented the Gulf of Mexico ("the Gulf") from intruding inland.⁶ The construction of levees upset this delicate balance: the Gulf continued to erode the coast, but the land-building sediment that offset erosion suddenly vanished.⁷ As a result, coastal lands began receding.⁸ Although other factors contribute to coastal land loss, levees along the Mississippi River have accelerated

¹ See Oliver A. Houck, *Land Loss in Coastal Louisiana: Causes, Consequences, and Remedies*, 58 TUL. L. REV. 3, 18 (1983).

² *Id.* Though rudimentary attempts at controlling the river were attempted from the City's founding, the first levees were built after the Great Flood of 1927. *Id.*

³ See *id.*

⁴ *Id.* at 8–9. By 1828, levees extended from north of Baton Rouge to south of New Orleans. *Id.* at 18. After floods in 1912 and 1913 destroyed several miles of levees, the Army Corps of Engineers rebuilt a "larger and more extensive system." *Id.* at 19. The flood control act of 1928, 33 U.S.C. § 702 (2012), set out a plan, still in effect today, that calls for levees now twice the size of those in 1927. Houck, *supra* note 1, at 19.

⁵ See *id.* at 8.

⁶ *Id.* at 9. In the last nine thousand years, the Mississippi River has changed course five times, each time creating a deltaic lobe extending into the Gulf of Mexico; however, whenever the Mississippi changed course, the abandoned delta began to erode. *Id.*

⁷ See *Partners in Restoration: Twentieth Anniversary Portfolio*, COASTAL WETLANDS PLANNING, PROT. AND REST. ACT, 36 (2011), http://www.lacoast.gov/products/Portfolio_of_Success_Final_web.pdf.

⁸ See *id.*

erosion significantly.⁹ Louisianans began noticing that coastal wetlands were disappearing in the 1930s.¹⁰ Since then, Louisiana has lost nearly enough land to fill the state of Delaware.¹¹

Without intervention, the State may lose 1,750 square miles of land over the next fifty years.¹²

The destruction of Louisiana's wetlands is in itself a calamity that, if unabated, will wash away an entire ecosystem.¹³ Coastal wetlands also provide a buffer from hurricane storm surges, absorbing water to ease the effects of floods.¹⁴ The economic consequences of removing this buffer reverberate beyond the State. Coastal wetlands shield the oil and gas industry's substantial infrastructure in South Louisiana,¹⁵ as well as five of the top fourteen ports in the United States.¹⁶ Otherwise these structures would be exposed to the detrimental consequences of flooding, erosion, and the subsequent interruption of service these disasters may cause.¹⁷

⁹ See Office of the Governor – Coastal Activities, *What's Causing the Crisis?*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=118> (last visited Oct. 14, 2012). Along with levees and natural erosion, logging, oil and gas canal dredging, invasive species, hurricanes, saltwater intrusion, subsidence, and sea level rise are among other factors contributing to coastal land loss. See *id.*

¹⁰ See Houck, *supra* note 1, at 10.

¹¹ Joel K. Bourne, Jr., *Gone With the Water*, NAT'L GEO. MAGAZINE (Oct. 2004), <http://ngm.nationalgeographic.com/2004/10/louisiana-wetlands/bourne-text>.

¹² Coastal Protection & Restoration Authority, *Future Without Action*, LOUISIANA'S 2012 COASTAL MASTER PLAN, <http://www.coastalmasterplan.louisiana.gov/whats-at-stake/future-without-action/> (last visited Oct. 14, 2012).

¹³ See Office of the Governor – Coastal Activities, *Habitat*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=121> (last visited Oct. 29, 2012). "Some 60 species of reptiles and amphibians, along with over 250 species of birds, including the American Bald Eagle, Ivory-billed Woodpecker and the Peregrine Flacon [sic] can be found in these productive regions." *Id.* The wetlands are also home to many groups of people, including the insular Cajuns, who derive their culture and livelihood from the bayous, and are responsible for Louisiana staples like Mardi Gras, jambalaya, and zydeco music. See Diane Courselle, *We (Used to?) Make A Good Gumbo-the BP Deepwater Horizon Disaster and the Heightened Threats to the Unique Cultural Communities of the Louisiana Gulf Coast*, 24 TUL. ENVTL. L.J. 19, 31-32 (2010); Office of the Governor – Coastal Activities, *Culture*, COASTAL.LOUISIANA.GOV., <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=116> (last visited Oct. 29, 2012).

¹⁴ See *Partners in Restoration*, *supra* note 7 at 36; Matt Irwin, *Category 3 Wake-Up Call: Recognizing the Importance of Mississippi Delta Restoration*, 8 SUSTAINABLE DEV. L. & POL'Y 59, 59 (2007). "Hurricane Andrew demonstrates that a kilometer of coastal wetland decreases storm surge by 5 cm." *Id.*

¹⁵ See Office of the Governor – Coastal Activities, *Oil & Gas*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=114> (last visited Oct. 29, 2012). Wetland loss could cost the industry millions of dollars (the cost to replace a mile of pipeline is approximately one million dollars). *Id.* Considering "[t]his infrastructure produces or transports nearly one-third of the nation's oil and gas supply, and is tied to 50% of the nation's refining capacity," the nation-wide effects could be drastic. *Id.*

¹⁶ Office of the Governor – Coastal Activities, *Navigation*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=115> (last visited Oct. 29, 2012). The top ranked Port of South Louisiana with carries approximately 225,000,000 tons of cargo per year. *Id.*

¹⁷ *Id.*

Louisiana is also the top producer of seafood in the contiguous United States, generating over three billion dollars in revenue annually.¹⁸ As the wetlands disappear, so too will the fish and shellfish that inhabit them, inevitably decreasing production, and severely impairing the industry.¹⁹ The consequences of losing Louisiana’s coastal wetlands reach far beyond the State and affect much more than the millions of residents that call Louisiana’s coast home.²⁰

Efforts to Restore the Coast

A. Legislative Action

In 1987, the State and federal government, under the auspices of the Environmental Protection Agency (“EPA”), gathered a committee to study the causes and consequences of coastal land loss, and possible solutions to the problem.²¹ The committee’s call for action compelled the Louisiana legislature to enact the Louisiana Coastal Wetlands Conservation, Restoration, and Management Act in 1989 (“1989 Act”).²² A year later, Congress enacted the Coastal Wetlands Planning, Protection, and Restoration Act of 1990 (“CWPPRA”),²³ a nationwide effort primarily focused on restoring Louisiana’s coast.²⁴ The goals of the 1989 Act and CWPPRA were brought together in 1993 under Louisiana’s first substantive plan to tackle

¹⁸ Office of the Governor – Coastal Activities, *Coastal Crisis—Land Loss*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&nid=152&pnid=0&pid=112&catid=0&elid=0> (last visited Oct. 14, 2012). “Louisiana is second only to Alaska in terms of both tonnage and dockside revenues from commercial fishing.” Office of the Governor – Coastal Activities, *Fisheries*, COASTAL.LOUISIANA.GOV, <http://coastal.louisiana.gov/index.cfm?md=pagebuilder&tmp=home&pid=113> (last visited Oct. 29, 2012).

¹⁹ *Fisheries*, *supra* note 18.

²⁰ *See Coastal Crisis—Land Loss*, *supra* note 18.

²¹ *See* LOUISIANA WETLAND PROTECTION PANEL, *SAVING LOUISIANA’S COASTAL WETLANDS: THE NEED FOR A LONG-TERM PLAN OF ACTION* (April 1987), *available at* <http://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1000K4Y.PDF>. A quantitative analysis leading up to this effort began in the 1970’s. Houck, *supra* note 1, at 10.

²² *See* Louisiana Coastal Protection, Conservation, Restoration, and Management Act of 1989, LA. REV. STAT. ANN. §§49:213.1-214.42 (2011) (repealed in part 2009); Marc C. Hebert, *Coastal Restoration Under CWPPRA And Property Rights Issues*, 57 LA. L. REV. 1165, 1171 (1997).

²³ 16 U.S.C. §§ 3951-56 (2006); Hebert, *supra* note 22, at 1171.

²⁴ *See* Hebert, *supra* note 22, at 1171. Forty percent of nation’s wetlands are in Louisiana. *Id.* Eighty percent of total land loss and ninety percent of coastal wetlands loss occurs in Louisiana. *Id.*

coastal restoration.²⁵ Although CWPPRA has had some success, it was widely recognized that on its own it did not provide enough funding for long-term solutions.²⁶ Its successor, the Coast 2050 Plan,²⁷ created in 1998, emphasized the need for a cohesive plan to unify and supplement the piecemeal projects set forward in CWPPRA.²⁸ Although lauded throughout the state as an improvement over CWPPRA alone, the project's cost—fourteen billion dollars over thirty years—made implementation impossible.²⁹

Hurricanes Katrina and Rita in 2005, inundating New Orleans, causing thousands of deaths³⁰ and billions of dollars in damage,³¹ illustrated the need to protect the coastal wetlands. Compared to the nearly two hundred billion dollars in damages from Katrina, the fourteen billion dollar price tag for implementing Coast 2050 would have been a relatively small amount.³²

²⁵ See LOUISIANA COASTAL WETLANDS REST. PLAN 1 (1993), *available at* <http://lacoast.gov/reports/cwcrp/1993/1993lcwrp-2intro-solutions.pdf> [hereinafter 1993 Plan].

²⁶ *About CWPPRA*, COASTAL WETLANDS PLANNING, PROT. AND REST. ACT, <http://lacoast.gov/new/About/Default.aspx> (last visited Oct. 14, 2012). One major limitation of the Coastal Wetlands Protection, Preservation and Restoration Act is its relatively small amount of funding. *Id.* CWPPRA has provided about fifty million a year for small scale, short-term projects. John Tibbetts, *Louisiana's Wetlands: A Lesson in Nature Appreciation*, ENVTL. HEALTH PERSPECTIVES (Jan. 2006), <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1332684/>. By comparison, the Caernarvon diversion alone cost approximately twenty-six million dollars. *Caernarvon Freshwater Diversion Project*, U.S. ARMY CORPS OF ENGINEERS (Mar. 11, 1998), <http://www.mvn.usace.army.mil/prj/caernarvon/caernarvon.htm>.

²⁷ LOUISIANA COASTAL WETLANDS CONSERVATION AND RESTORATION TASK FORCE, AND THE WETLANDS CONSERVATION AND RESTORATION AUTHORITY, COAST 2050: TOWARD A SUSTAINABLE COASTAL LOUISIANA, COAST 2050 65 (1998), *available at* <http://www.coast2050.gov/products/docs/orig/2050report.pdf> [hereinafter Coast 2050].

²⁸ See Gina Schilmoeller, *Invoking the Fifth Amendment to Preserve and Restore the Nation's Wetlands in Coastal Louisiana*, 19 TUL. ENVTL. L.J. 317, 327 (2006) (“[I]t is now clear that the fragmented projects enacted under piecemeal legislation do not result in successful wetland restoration.”). The 2012 CMP also notes that multiple small diversions are not effective. *Louisiana's Comprehensive Master Plan for a Sustainable Coast*, COASTAL PROT. AND REST. AUTH. 104 (2012), <http://www.lacpra.org/assets/docs/2012%20Master%20Plan/Final%20Plan/2012%20Coastal%20Master%20Plan.pdf> [hereinafter 2012 CMP].

²⁹ See Tibbetts, *supra* note 26.

³⁰ Richard D. Knabb et al., *Tropical Cyclone Report Hurricane Katrina*, NAT'L HURRICANE CENTER 11 (Dec. 20, 2005), http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf.

³¹ Mark L. Burton et al., *Hurricane Katrina: Preliminary Estimates of Commercial and Public Sector Damages*, CTR. FOR BUS. AND ECON. RESEARCH, MARSHALL UNIVERSITY 1 (Sept. 2005) <http://www.marshall.edu/cber/research/katrina/Katrina-Estimates.pdf>.

³² See *id.*

Katrina was the impetus for the 2007 Coastal Master Plan (“2007 CMP”),³³ which once again set the foundation for a more cohesive approach to coastal restoration. Immediately following the storm, Louisiana senators proposed the Hurricane Katrina Disaster Relief and Economic Recovery Act³⁴ which would have provided \$250 billion for reconstruction and \$40 billion for restoration projects.³⁵ The controversial proposal never passed,³⁶ however, and the state lost a funding opportunity for the 2007 CMP. Updated five years later to the 2012 Coastal Master Plan (2012 CMP), the plan was unanimously approved by the Louisiana legislature in May 2012.³⁷ With a price tag of fifty billion dollars over fifty years, the new plan may face the same significant funding hurdles that caused previous plans to falter.³⁸

B. Mississippi River Diversions

Beyond significant legislative and funding efforts, reversing coastal erosion will require the incorporation of multiple restoration schemes into one comprehensive regime, as both CMPs advocate.³⁹ One such scheme entails diverting the Mississippi River into neighboring wetlands. This strategy has drawn particular interest because of its magnitude—it constitutes 65% of

³³ COASTAL PROT. AND REST. AUTH., INTEGRATED ECOSYSTEM RESTORATION AND HURRICANE PROTECTION: LOUISIANA’S COMPREHENSIVE MASTER PLAN FOR A SUSTAINABLE COAST (April 30, 2007), available at [http://www.lacpra.org/assets/docs/Comprehensive%20Master%20Plan%20\(Main%20Report\)%20-%201.%20Executive%20Summa.pdf](http://www.lacpra.org/assets/docs/Comprehensive%20Master%20Plan%20(Main%20Report)%20-%201.%20Executive%20Summa.pdf).

³⁴ Hurricane Katrina Reconstruction Act, S. 1765, 109th Cong. (2005).

³⁵ Tibbetts, *supra* note 25.

³⁶ See Oliver Houck, *Can We Save New Orleans?*, 19 TUL. ENVTL. L.J. 1, 6 (2006). “But there were billions of dollars in there for timber companies, energy companies, highways to everywhere, and a cornucopia of canals It was a Christmas list, much of which had absolutely nothing to do with flood control or attending to the victims of the storms.”; Anne Applebaum, *Corruption as Usual*, WASHINGTON POST (Sept. 28, 2005), <http://www.washingtonpost.com/wp-dyn/content/article/2005/09/27/AR2005092701435.html>.

³⁷ Emily Guidry Schatzel, *Conservation Groups Commend Louisiana Legislature for Approving State’s 2012 Coastal Master Plan*, NAT’L WILDLIFE FED’N (May 22, 2012), <http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Wildlife/2012/05-22-12-Conservation-Groups-Commend-Louisiana-Legislature-for-Approving-2012-Coastal-Master-Plan.aspx>.

³⁸ See Bob Marshall, *Approval of 2012 Master Plan for the Coast is Worth Celebrating*, THE TIMES-PICAYUNE (May 27, 2012), http://www.nola.com/outdoors/index.ssf/2012/05/approval_of_2012_master_plan_f.html.

³⁹ See LOUISIANA WETLAND PROTECTION PANEL, *supra* note 21.

coastal restoration efforts allowed by the CWPPRA—and its cost—it is among the most expensive projects.⁴⁰ Controlled diversions have long been touted as an effective land-building alternative to the natural delta-formation of the Mississippi's floods.⁴¹

Two diversion stories are particularly informative. The first is the Caernarvon diversion, a man-made structure in Breton Sound Basin.⁴² The second is the Atchafalaya River, a natural Mississippi River distributary, which currently captures 30% of the Mississippi River's water flow.⁴³ Though not part of any legislative restoration scheme, these structures reveal some of the unintended consequences of diversions, as well as the most effective ways to use them to replenish coastal wetlands. Lessons from the Caernarvon diversion and the Atchafalaya River will aid legislators and scientists in forming an effective plan to rescue Louisiana's coast.

1. Caernarvon: A Man-made Diversion

The Caernarvon diversion was created primarily for economic purposes.⁴⁴ Increased salinity in Breton Sound Basin, an unintended consequence of Mississippi River levees, was severely hindering oyster production in the area.⁴⁵ Although the increased salinity expanded oyster habitats further inland, allowing harvesters to seek leases in areas previously too fresh to sustain oysters,⁴⁶ salinity increased to harmful levels in the traditional oyster grounds further out

⁴⁰ See Amanda Mascarelli, *Wetlands Not Aided by Mississippi Diversions*, NATURE (Aug. 5, 2011), <http://www.nature.com/news/2011/110805/full/news.2011.462.html>; *Caernarvon Freshwater Diversion Project*, *supra* note 26. Construction of the Caernarvon diversion project cost \$26.1 million; the federal government covered 75% of the cost, and the state of Louisiana covered 25%. *Id.*

⁴¹ See *Partners in Restoration*, *supra* note 7; LOUISIANA WETLAND PROTECTION PANEL, *supra* note 21.

⁴² See M.S. Kearney et al., *Freshwater River Diversions for Marsh Restoration in Louisiana: Twenty-six Years of Changing Vegetative Cover and Marsh Area*, 38 GEOPHYS. RESEARCH LETTERS 1 (Aug. 26, 2011); Robert L. Rogers, III, *Turning River Water into Gold: Why Oyster Harvesters Should Not Be Permitted to Cash in on Changes in Salinity Caused by the Caernarvon Water Diversion Project*, 22 VA. ENVTL. L.J. 53, 56 (2003).

⁴³ 1993 PLAN, *supra* note 25, at 1.

⁴⁴ See *Caernarvon Freshwater Diversion Project*, *supra* note 26. Caernarvon was authorized by section 204 of the Flood Control Act of 1965. *Id.*; Rogers, *supra* note 42, at 55.

⁴⁵ Rogers, *supra* note 42, at 55.

⁴⁶ See *Avenal v. State (Avenal II)*, 886 So. 2d 1085, 1089 (La. 2004).

in the basin.⁴⁷ This detrimental effect drove a 1959 memo from U.S. Department of Interior to the Army Corps of Engineers (“the Corps”) suggesting a fresh water diversion to reduce salinity throughout the basin and aid the oyster industry.⁴⁸ In 1986, Congress approved funds for its construction.⁴⁹

Construction of the Caernarvon diversion began in 1988 and was completed in 1991, one year after CWPPRA.⁵⁰ Although the Caernarvon diversion seemed to have accomplished its intended purpose,⁵¹ it also created new problems for the oyster industry. Oyster beds require a delicate balance of salt and fresh water. Increasing the supply of freshwater via the diversion revitalized the oyster beds further out in the Breton Sound, where the water had become too salty to sustain oysters.⁵² It harmed the oyster beds closest to the diversion, however, where water was becoming too fresh.⁵³ Oyster harvesters who had leased marshlands in the area closest to the diversion sued both the federal government⁵⁴ and the state of Louisiana.⁵⁵

In their lawsuits, the oyster harvesters argued that the Caernarvon diversion drastically decreased the salinity of the water so they could no longer successfully harvest oysters in their leased areas.⁵⁶ They further claimed that reducing the salinity of the water violated their rights under the Louisiana Constitution because the government had taken their property without

⁴⁷ Rogers, *supra* note 42, at 56.

⁴⁸ *Id.* at 57.

⁴⁹ *Avenal II*, 886 So. 2d at 1090 (La. 2004).

⁵⁰ *Id.* at 1091.

⁵¹ *See id.* at 1112. “Oyster productivity from the public seed grounds increased by 300 percent, a fact acknowledged by plaintiffs in brief.” *Id.*

⁵² *Id.* at 1091.

⁵³ Rogers, *supra* note 42, at 60.

⁵⁴ *Avenal v. United States*, 33 Fed. Cl. 778 (Fed. Cl. 1995), *aff'd*, 100 F.3d 933 (Fed. Cir. 1996). “[P]laintiffs . . . filed suit in the United States Court of Federal Claims against the United States, more particularly the Corps, which designed, financed, and built Caernarvon, alleging the same takings theories [as in their case against the State], but under the Fifth Amendment to the United States Constitution.” *Avenal II*, 886 So. 2d at 1092 (La. 2004).

⁵⁵ *Avenal v. State (Avenal I)*, 858 So. 2d 697, 700 (La. App. 4 Cir. 2003), *rev'd*, 886 So. 2d 1085 (La. 2004).

⁵⁶ *Avenal II*, 886 So. 2d at 1092 (La. 2004).

compensating them.⁵⁷ Although the oyster harvesters were unsuccessful in their federal claim,⁵⁸ they were awarded nearly two billion dollars for their state claim.⁵⁹ However, the Louisiana Supreme Court reversed, noting that the state interest in thwarting coastal erosion allowed the alleged “taking” of the lessee’s property for the public good.⁶⁰ The court further reasoned that because the vast majority of the leases contained “hold harmless” clauses, most lessees did not have valid takings claims.⁶¹

Despite the controversies, Caernarvon was generally considered a success, serving as a prototype for the various State plans.⁶² Beginning as a venture to save oysters, the Caernarvon diversion soon turned into a beacon of hope for the vanishing Louisiana coast. The 1987 EPA report, which led to the 1990 CWPPRA, stated that any long-term solution required the use of fresh-water diversions.⁶³ The 1993 plan, created in response to CWPPRA,⁶⁴ acknowledged the need for freshwater diversions to sustain crucial plant life and decrease salinity,⁶⁵ and for sediment diversions that would mimic the Mississippi’s natural delta building.⁶⁶ The Coast 2050

⁵⁷ *Id.*; “Property shall not be taken or damaged by the state or its political subdivisions except for public purposes and with just compensation paid to the owner or into court for his benefit.” LA. CONST. art. I, § 4.

⁵⁸ *Avenal v. United States*, 100 F.3d 933, 936 (Fed. Cir. 1996) (“The court holds that the state acquired no property interest in the salinity level of the waters above plaintiffs’ leased grounds. Plaintiffs therefore also hold no compensable expectancy in the salinity.”).

⁵⁹ *Rogers*, *supra* note 42, at 62; *Avenal I*, 858 So. 2d 697 at 700 (La. App. 4 Cir 2003) (affirming trial court judgment in favor of oyster harvesters holding that increased salinity of water constituted “taking” of leased property).

⁶⁰ *Avenal II*, 886 So. 2d at 1102 (La. 2004) (“The State simply cannot allow coastal erosion to continue; the redistribution of existing productive oyster beds to other areas must be tolerated under the public trust doctrine in furtherance of this goal.”). *See* LA. CIV. CODE ANN. art. 450 (2011) (“Public things that belong to the state are such as running waters, the waters and bottoms of natural navigable water bodies, the territorial sea, and the seashore.”); LA. CONST. art. I, § 4.

⁶¹ *Avenal II*, 886 So. 2d at 1103 (La. 2004). For the remaining leases, the court reasoned that the state did not “take” the oyster harvester’s property, but “damaged” it under Article I, § 4 of the Louisiana Constitution. *Id.* *See* LA. CONST. art. I, § 4. However, these lessees could not recover either because the statute of limitations had run on their claims. *Avenal II*, 886 So. 2d at 1109 (La. 2004).

⁶² *See* *Rogers*, *supra* note 42, at 58.

⁶³ LOUISIANA WETLAND PROTECTION PANEL, *supra* note 20.

⁶⁴ 1993 PLAN, *supra* note 25, at 1.

⁶⁵ *Id.* at 32. Plants strengthen soil, and keep it from collapsing. *Id.*

⁶⁶ *See id.* at 46.

plan⁶⁷ also acknowledged the benefits of diversions and encouraged enriching the Caernarvon with sediment to boost its land-building capabilities.⁶⁸ The 2007 CMP cites the need for freshwater diversions, like the Caernarvon diversion, to sustain land.⁶⁹ More recently, however, studies of the diversion indicate that it may be causing more harm than good.

A 2011 study, conducted by the Department of Geography at the University of Maryland, and the Department of Oceanography and Coastal Sciences at Louisiana State University, revealed that the Caernarvon diversion was weakening, and not sustaining, coastal wetlands.⁷⁰ As a freshwater diversion (as opposed to a sediment diversion), the Caernarvon's main purpose was not to create land, but to reduce the salinity of the water; depositing land-creating sediment was only a favorable side effect.⁷¹ The decreased salinity also helped foster plant life,⁷² and the plants' root systems, in turn, prevented further land loss.⁷³ The Caernarvon diversion also deposited agricultural runoff throughout the area which, some have argued, served as fertilizer for marsh plants.⁷⁴ However, Hurricane Katrina in 2005 damaged the areas where plants seemed to be flourishing most.⁷⁵

Interestingly, Katrina appeared to wash away the plants closest to the fresh water source, not those most susceptible to the hurricane's storm surge.⁷⁶ The Caernarvon diversion's excess nutrient loads explain this odd result. Although the area closest to the diversion appeared to be

⁶⁷ Coast 2050, *supra* note 27, at 65.

⁶⁸ *Id.* at 95.

⁶⁹ *Id.* The 2007 CMP also calls for the use of sediment diversions as a land-building method. *Id.*

⁷⁰ See Kearney, *supra* note 42, at 1.

⁷¹ See 1993 PLAN, *supra* note 25, at 49.

⁷² See *Caernarvon Freshwater Diversion Project*, *supra* note 26. "Monitoring data show that freshwater marsh plants increased over 7 times while brackish marsh plants increased by almost half since operation of the structure began, and the amount of salt marsh vegetation has decreased by more than half." *Id.*

⁷³ See Rogers, *supra* note 42, at 57. When nutrient-rich sediments are taken away, the plants that hold surrounding soils in place disappear, the soil turns "mushy," and the land "turns to open water." *Id.*

⁷⁴ See Bourne, Jr., *supra* note 11.

⁷⁵ Kearney, *supra* note 42, at 1.

⁷⁶ *Id.* at 5. Increased nutrients and over-flooding weakened marsh plants and caused their collapse. *Id.* Plants further out in the Basin were less susceptible to these nutrient loads. *Id.*

flourishing, plant life consisted mostly of floating vegetation and not the deep-rooted plant systems required to hold land together.⁷⁷ More egregiously, the excess nitrogen in diversion nutrients had weakened current root systems causing existing land to break apart and wash away with the hurricane.⁷⁸ For these reasons, the 2011 study concludes that there is not enough scientific evidence to prove that diversions help mitigate land loss and foster land creation.⁷⁹

2. *The Atchafalaya River: A Natural Diversion*

Despite studies to the contrary, some scientists still believe that diversions are the key to mitigating coastal land loss.⁸⁰ Proponents point to the Atchafalaya River Basin and the Wax Lake Delta as regions where the coast is not only resisting erosion but is creating land in the Gulf.⁸¹ The Atchafalaya River breaks off from the Mississippi at the Old River Control Structure and captures 30% of the Mississippi's water flow.⁸² Many argue that if left to run its course, the Atchafalaya would capture all of the Mississippi's water flow.⁸³ The Atchafalaya essentially functions as a Mississippi river diversion,⁸⁴ carrying significant sediment loads to Atchafalaya Bay.⁸⁵ The Wax Lake Delta began forming when, in 1942, the Army Corps of Engineers created an outlet for the Atchafalaya to divert water away from Morgan City, Louisiana.⁸⁶ Twenty-five square miles of new land have appeared since the outlet's creation.⁸⁷ Although this effect was

⁷⁷ *Id.* at 2.

⁷⁸ *Id.* at 6.

⁷⁹ Kearney, *supra* note 42, at 1.

⁸⁰ See Mascarelli, *supra* note 40.

⁸¹ Scott M. Madere, *Wonders of the Wax Lake Delta*, COALITION TO RESTORE COASTAL LOUISIANA (Oct. 17, 2011, 2:52 PM), <http://www.crcl.org/blog-menu-item/post/joomla-quiz-deluxe-new-features-are-added.html>.

⁸² 1993 PLAN, *supra* note 25, at 26.

⁸³ Bourne, Jr., *supra* note 11.

⁸⁴ *See id.*

⁸⁵ *Id.*

⁸⁶ Madere, *supra* note 81.

⁸⁷ *Id.*

unintended, it provides firm evidence that diversions can work, and provide scientists ample opportunity to study a successful diversion.⁸⁸

3. Future of Diversions: The 2012 Coastal Master Plan

The writers of the 2012 CMP acknowledge that breaching the Mississippi, in combination with other methods,⁸⁹ is crucial to curbing land loss.⁹⁰ But the plan heeds the lessons of the Caernarvon diversion and the Atchafalaya River, concluding that diversions are far more effective when they focus on diverting sediment rather than just freshwater.⁹¹ Although the Caernarvon diversion is not part of the 2012 CMP, the State hopes to take over its operation and maximize its land building potential.⁹² The Lake Pontchartrain Basin Foundation (LPBF), as of March 2012, has been conducting turbidity tests at Caernarvon to determine the most effective way to maximize sediment diversion while minimizing the negative consequences of freshwater diversions.⁹³ Although the LPBF is a non-profit organization not directly tied to the State, these tests will provide crucial information for the eight projected diversions mentioned in the 2012 CMP.⁹⁴

⁸⁸ See *id.* Initial purpose of diversion was to prevent Atchafalaya River from flooding Morgan City. *Id.*

⁸⁹ 2012 CMP, *supra* note 28, at 55. Other promising projects include marsh creation and canal realignment; while it may take some time to see effects of sediment diversions, marsh creation will provide immediate results. *Id.*

⁹⁰ *Id.* at 148. “We found that sediment diversions and channel realignments have the greatest land building potential of all the individual restoration projects considered;” without diversions, land gain was significantly lower. *Id.*

⁹¹ See *id.* at 104. “One lesson learned from previous experience is that future diversions should focus on sediment capture and land building. As such, the 2012 Coastal Master Plan focused on sediment diversions and not on the use of freshwater diversions as a restoration tool.” *Id.*

⁹² *Id.* at 155. This was also suggested in Coast 2050. See Coast 2050, *supra* note 27, at 95.

⁹³ See Andy Baker, *Turbidity Monitoring at Caernarvon Diversion Provides Real-Time Data for Effective River Management*, RESTORE THE MISSISSIPPI RIVER DELTA (March 2, 2012), <http://www.mississippiriverdelta.org/blog/2012/03/02/turbidity-monitoring-at-caernarvon-diversion-provides-real-time-data-for-effective-river-management/>.

⁹⁴ See *id.* The LPBF is a non-profit organization focused on restoring and preserving the Lake Pontchartrain Basin area. *About Lake Pontchartrain Basin Foundation*, SAVE OUR LAKE, <http://saveourlake.org/about-us.php> (last visited Nov. 1, 2012).

The 2012 CMP acknowledges the limitations and possible unintended consequences of diversions. Navigation remains a big concern; therefore, the plan currently avoids diversions of a size that may negatively affect navigation.⁹⁵ Strategically placed diversions will move sediment away from navigation routes so that rather than impede navigation, however, they may help reduce the cost of dredging.⁹⁶ As the projects develop, the CMP task force will also seek to gain input from the community, particularly property owners.⁹⁷ Eighty-percent of the coastal wetlands are privately owned, and property owners hold riparian rights in Louisiana to reclaim lost lands.⁹⁸ However, it is difficult to balance a sustained effort to restore the coast with “undiminished autonomy over private land use.”⁹⁹ Several solutions have been proposed in the 2012 CMP to address this issue including acquisition of coastal lands before attempting to restore them,¹⁰⁰ granting eminent domain,¹⁰¹ and allowing property owners to retain mineral rights over reclaimed land.¹⁰²

In addition to property rights concerns, diversions also present environmental problems. Removing material from sediment rich to sediment deprived regions may have unintended ecological consequences for both areas.¹⁰³ The absorption of agricultural runoff, although cited as a proactive solution to preventing hypoxia in the Gulf, may negatively impact land-sustaining

⁹⁵ 2012 CMP, *supra* note 28, at 57. Developments in navigation and commerce led to the leveeing of the river beyond New Orleans, so that land-building sediments, which were now creating an impediment to ships at the mouth of the river, flowed past Louisiana and fell to the bottom of the Gulf of Mexico. Houck, *Land Loss in Coastal Louisiana*, *supra* note 1, at 20.

⁹⁶ *Id.* at 148.

⁹⁷ *Id.* at 166.

⁹⁸ Hebert, *supra* note 22, at 1181; LA. CONST. art. IX, § 3 (“The legislature shall neither alienate nor authorize the alienation of the bed of a navigable water body, except for purposes of reclamation by the riparian owner to recover land lost through erosion.”).

⁹⁹ John J. Costonis, *Two Years and Counting: Land Use and Louisiana's Post-Katrina Recovery*, 68 LA. L. REV. 349, 367 (2008).

¹⁰⁰ Schilmoeller, *supra* note 28, at 337.

¹⁰¹ Costonis, *supra* note 99, at 367.

¹⁰² Robert Viguerie, *Coastal Erosion: Crisis in Louisiana's Wetlands*, 51 LA. B.J. 85, 88 (2003).

¹⁰³ 2012 CMP, *supra* note 28, at 45. This is a particular concern for the Atchafalaya: “For example, . . . we [cannot] fully predict all ecological responses to actions such as sediment diversions.” *Id.*

vegetation, impeding rather than creating land.¹⁰⁴ Regardless of these concerns, the drafters of the 2012 CMP emphasize that doing nothing will have far more drastic consequences for Louisiana's coast and its property owners.¹⁰⁵ Doing something requires a substantial amount of funding, especially considering the \$50 billion price tag for the 2012 CMP. As the State's previous coastal restoration plans have shown, securing funding can be difficult. For instance, although Coast 2050 and the 2007 CMP were promising, both plans failed to secure the necessary funding. While the 2012 CMP now faces the same hurdle, settlement money from the Deepwater Horizon oil spill may enable its implementation.

Deepwater Horizon and the Future of Coastal Restoration Projects

In 2010, five years after Hurricanes Katrina and Rita, the Deepwater Horizon rig in the Gulf of Mexico exploded, causing 200 million gallons of oil to seep into the Gulf with devastating consequences for ecosystems and industries.¹⁰⁶ The oil spill further weakened the fragile wetlands.¹⁰⁷ The Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economy of the Gulf Coast Act ("RESTORE Act") arose from the disaster.¹⁰⁸ Introduced in 2011, the RESTORE Act dedicates a portion of the settlement money from the

¹⁰⁴ *Id.* at 169; Kearney, *supra* note 42, at 5.

¹⁰⁵ 2012 CMP, *supra* note 28, at 45.

¹⁰⁶ CNN Wire Staff, *Feds Blame BP, Other Companies for 2010 Gulfspill*, CNN (Sept. 14, 2011), <http://www.cnn.com/2011/US/09/14/gulf.oil.spill/index.html>.

¹⁰⁷ Craig Guillot, *Hurricane Isaac Batters Louisiana Marshes, Uncovers Oil*, NAT'L WILDLIFE FED'N (Sept. 13, 2012), <http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Wildlife/2012/09-12-12-Hurricane-Isaac-Batters-Louisiana-Marshes-Uncovers-Oil.aspx>.

¹⁰⁸ Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economy of the Gulf Coast Act of 2011, S. 861, 112th Cong. (2011).

spill to restoration efforts.¹⁰⁹ Without this legislation, the “money could have been used for unrelated federal spending rather than for restoration.”¹¹⁰

The RESTORE Act was signed into law on July 6, 2012.¹¹¹ As of October 2012, negotiations on criminal and civil penalties between BP and the Justice department have come closer to an agreement.¹¹² The settlement is predicted to be between \$5.4 billion and \$21 billion.¹¹³ There is some controversy about how the liability will be assessed. If BP incurs fines through the Natural Resource Damage Assessment provision of the Oil Pollution Act (“OPA”),¹¹⁴ it will provide BP a tax break, and the money will have to be used for environmental remediation.¹¹⁵ Such a result would have a tremendously positive impact on coastal restoration efforts as it would provide much needed funding for the 2012 Master Plan.¹¹⁶ If fines do incur through the OPA, most of the funds would flow to Louisiana, since it sustained the most substantial environmental damage.¹¹⁷ Many nearby states oppose this route and would prefer the funds be dispersed through the Clean Water Act,¹¹⁸ which will allow for economic remediation, and benefit all the affected Gulf states.¹¹⁹

¹⁰⁹ *The RESTORE Act*, RESTORE THE MISSISSIPPI RIVER DELTA, <http://www.mississippiriverdelta.org/restore-the-delta/clean-water-act-penalties/restore-act/> (last visited Oct. 26, 2012).

¹¹⁰ *Id.*

¹¹¹ *Id.*

¹¹² *Id.* The RESTORE act was signed into law as part of the Moving Ahead for Progress in the 21st Century Act of 2012, Pub. L. No. 112-141, §§1601-08, 126 Stat. 405 (2012).

¹¹³ Daniel Gilbert, *BP Close to Spill Settlement*, WALL ST. JOURNAL (Oct. 10, 2012), <http://online.wsj.com/article/SB10000872396390444657804578048920996458306.html>, (“As of last month, the two sides were about \$6 billion apart on a final settlement figure, according to one person familiar with the negotiations.”).

¹¹⁴ Oil Pollution Act, 33 U.S.C. § 2706 (2012) (“Sums recovered under this Act . . . shall be retained . . . for use only to reimburse or pay costs . . . with respect to the damaged natural resources.”).

¹¹⁵ Gilbert, *supra* note 113.

¹¹⁶ 2012 *CMP*, *supra* note 28, at 173. Settlement money coming to Louisiana “will be used to build projects for the coast, using the master plan as guidance. The master plan will guide how funds from NRDA and other sources are used.” *Id.*

¹¹⁷ Gilbert, *supra* note 113.

¹¹⁸ Clean Water Act, 33 U.S.C. § 1321 (2012) (delineating oil and hazardous substance liability).

¹¹⁹ Gilbert, *supra* note 113.

Conclusion

After decades of research, planning, and many failed attempts, Louisiana appears to have developed a cohesive and scientifically sound plan to address coastal restoration. The future of the 2012 Coastal Master Plan is promising. This plan incorporates the successes and lessons learned from previous attempts, and it heeds the unintended consequences of the Caernarvon diversion and the Atchafalaya River outlet to the Wax Lake Delta. Furthermore, the expected settlement with BP may remove the funding limitations that hindered previous plans. Although uncertainties about the longer term impact of diversions linger, breaching the Mississippi's levees is a crucial part of the coastal restoration effort. One thing is certain, without action, Louisiana's fate is sealed.