Bring New Orleans Back
Infrastructure Committee
Levees and Flood Protection Sub-Committee

John E. Koerner III, Chairman
January 18, 2006

Executive Committee
Bruce Thompson
Billy Marchal
Ralph Lehmann

For More Information or
Additional Copies Contact:
John E. Koerner, III
(504) 524-9600
koerner@koernercap.com

Bring New Orleans Back
Infrastructure Committee
Levees and Flood Protection Sub-Committee
John E. Koerner III, Chairman
January 18, 2006

Vision Statement

Our vision is to ensure that our citizens, their families and property, are secure from intrusion by and damage from water, whether river, rain or sea.

Flood Control is not simply accomplished by raising levees, but requires a coordinated system of levees, pumps, locks, dams, weirs, flood gates, dredging, siphons and other forms of coastal restoration.

The charge to the sub-committee is to examine, probe, learn and recommend a course of action, which would give our citizens comfort that our flood control system for Orleans Parish will provide, by its design and construction, a clear margin of safety when confronted with rising water.

Inherent in deliberations is the recognition that repairs, improvements and new works need to be both feasible and affordable, not merely a wish list.

Some of the recommendations are for the near term, i.e. implementation before the next hurricane season and some, like coastal restoration, have a multigenerational timeline.

People Who Contributed

First, we need to recognize the many people whose input, expertise and ideas are incorporated into this report. Some of their ideas are included, even plagiarized without credit. There is not always agreement on the recommendation.

Many Have Contributed To This Report

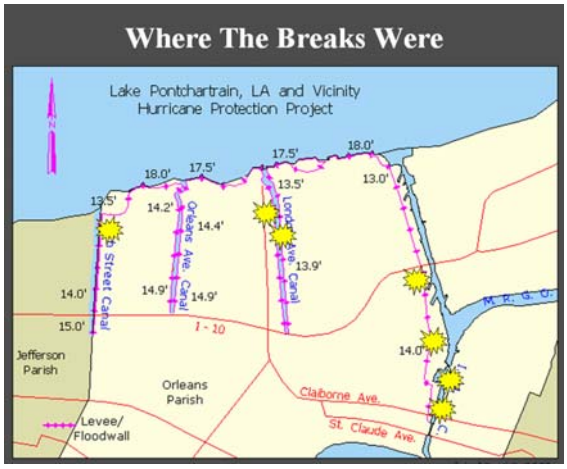
Bruce Thompson	TECO
Billy Marchal	Engineer
Boysie Bollinger	Bollinger Shipyards / Dock Board
Jim Bean	Bean Dredging
Mark Schxnider	LSU Agricultural Center
John Kallenborn	Chase Bank / Dock Board
John Barry	Author
Charles Nelson	Waldemar S. Nelson and Company
Jimmy Kostmayer	Kostmayer Contruction
Robert Boh	Boh Bros. Construction
Marsha St. Martin	Sewerage & Water Board of New Orleans
Toby Roesler	Levee Guard
Allan Colley	Dupuy Storage
Rene Cross	Louisiana Recovery Authority
David Voelker	Louisiana Recovery Authority
Joe Sullivan	Sewerage & Water Board of New Orleans
Tim Axtman	U.S. Corps of Engineers
Cynthia Fromhertz	FEMA
Erik L. Johnsen	International Shipholding
Walter Baumy	U.S. Corps of Engineers
Randy Evans	Levee Guard
Ralph Lehmann	Koerner Capital
Jason Lehmann	UNO
Jay Lapeyre	Laitrim / Business Council
King Milling	American's Wetlands
Frank Nicolates	NY Associates
Bill Monteleone	La Branch Wetlands
John Lopez	Lake Pontchartrain
Greg Miller	U.S. Corps of Engineers
Joseph Becker	Sewerage & Water Board of New Orleans
Walter Baudier	Desin Engineering, Inc.
Maj. Hugh Darville	U.S. Corps of Engineers
Col. Lewis Setliff	U.S. Corps of Engineers
	Times Picayune
	National Geographics

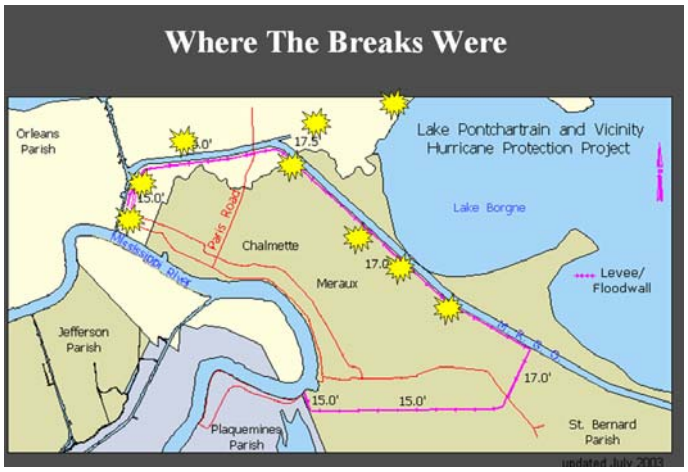
Many Others Contributed to This Work in Addition to Those Listed

This report is centered on the protection of Orleans Parish, but obviously rising water does not respect political boundaries. Our recommendations need to tie-in to the flood protection system of the adjacent parishes. We are all in this together.

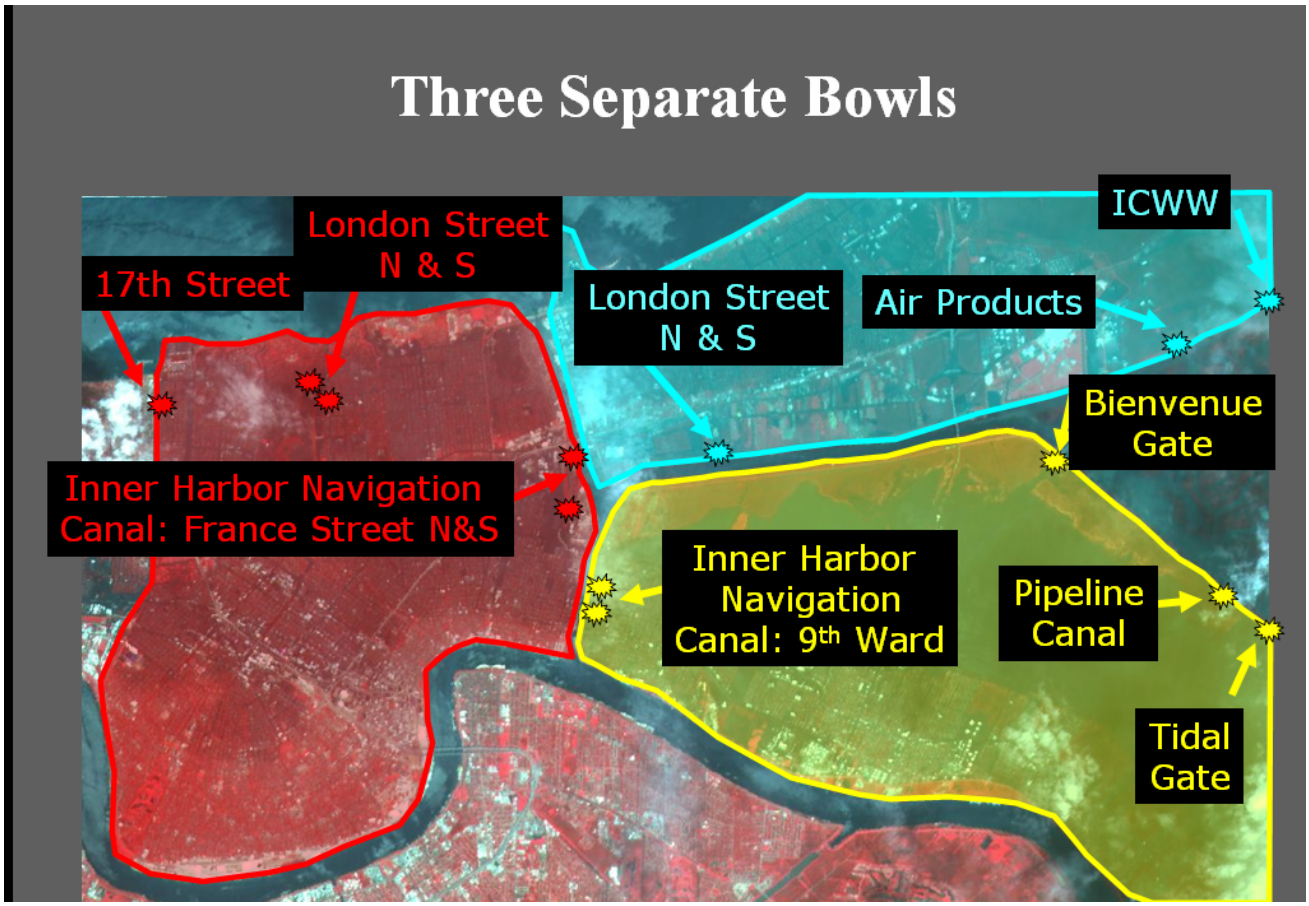
What Happened?

When Hurricane Katrina (Katrina) hit the New Orleans area the levees that are supposed to protect the city either were (1) overtopped, (2) overtopped and scoured to a breach or (3) breached due to a failure of design or construction.

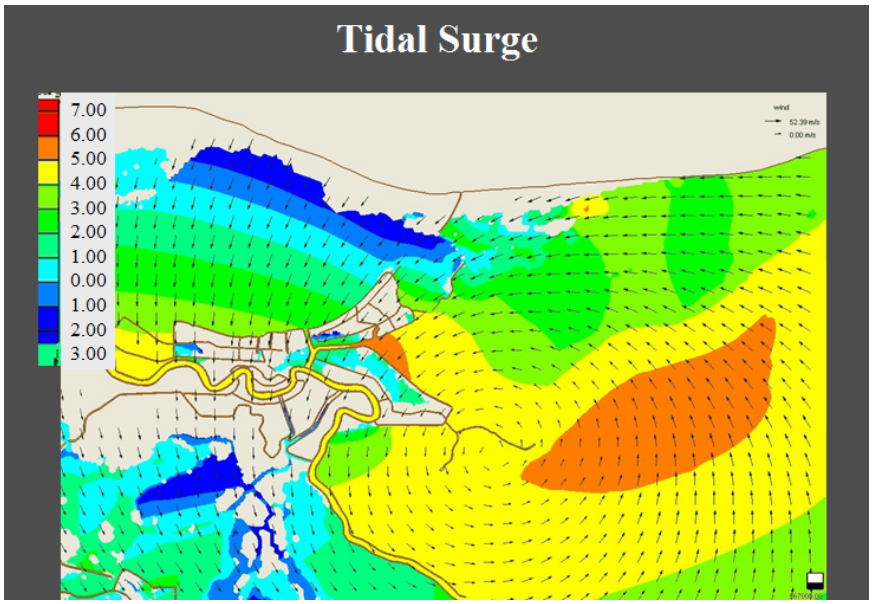




These levee failures occurred throughout the city and caused flooding in three distinct catchments.

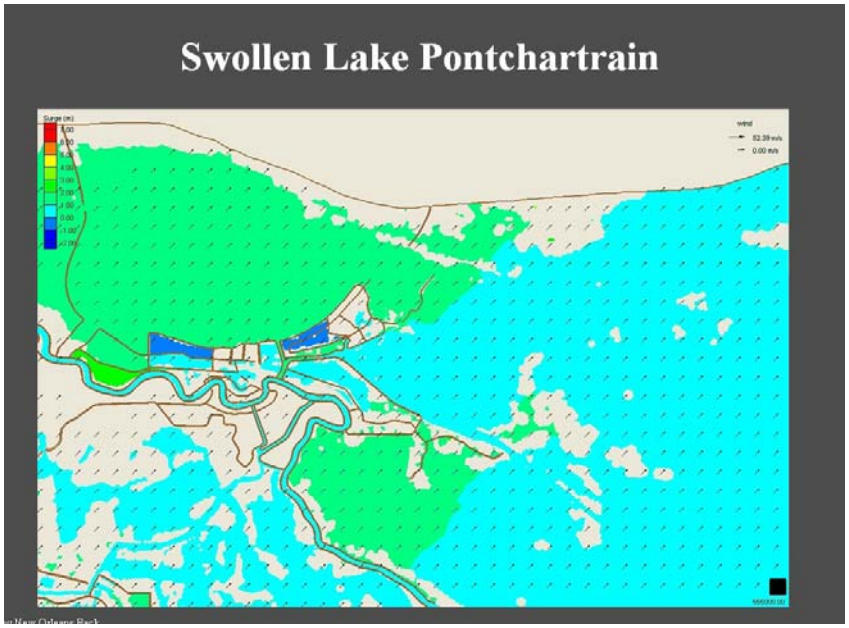


The only body of water that is common to the three catchments is the Inner Harbor Navigation Canal (Industrial Canal.) The initial flooding, which occurred while the eye of Katrina was southeast of the city, was funneled into the city from Lake Borgne. The wind driven water was amplified by two converging levee systems, one to the north following the Intracoastal Waterway right of way in Orleans Parish and the other to the south built atop the spoil bank alongside the Mississippi River Gulf Outlet (MRGO.)



The funnel effect resulted in a storm surge, which was most pronounced near the Paris Road, I-510, Bridge. The amplified surge took a direct route westward through the 36-foot deep Intracoastal Waterway to the Industrial Canal and into the surrounding neighborhoods.

This driven water was incredibly destructive, but shortly after the eye of Katrina passed east of the city, Lake Borgne returned to relatively normal levels.



Then Lake Pontchartrain (Lake), swollen by strong easterly winds, and later pushed and tilted by northerly winds, stacked water even higher against its south shore as the storm passed.

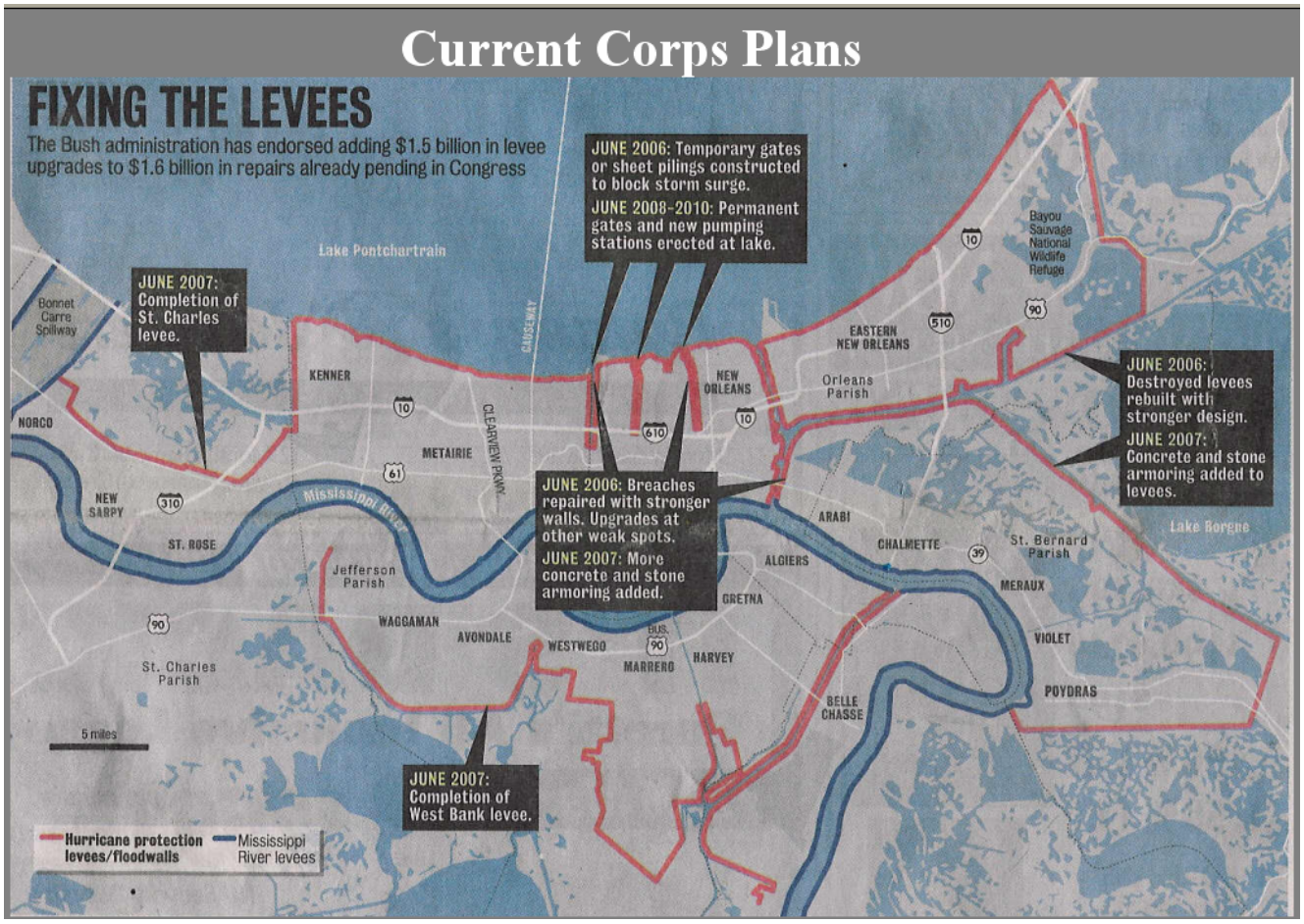
The lake water gained access to all of the city from interior levee breaches and poured flood water into

all three catchment areas for the next 40-48 hours.

First there was the quick surge of driven water from the east, then the slower rising flood from the North. These events were interrelated, yet separate.

FIXIN'

At this writing, the U.S. Army Corps of Engineers (Corps), through its Guardian Task Force, has undertaken to repair and restore the levee footprint around Greater New Orleans to the pre-Katrina authorization level with the goal of June 1, 2006 completion. In the Corps' words, the near term approach is to " optimize performance of the existing system within the current authorization." We participate in a progress update each Thursday morning.



Levee, pump and floodwall work around Orleans parish is broken into three distinct project groups, Orleans East Bank, New Orleans East, and Inner Harbor Navigation Canal, each headed by its own

manager. There are 28 distinct jobs proposed and 16 have already been awarded. The balance will be awarded soon.

Potential bottlenecks in equipment and materials have been identified and solutions are being implemented. Contractors who have fallen behind in the schedule have been given additional resources to catch up.

There is an interesting difference of opinion between the Corps and local contractors about which type of floodwall is appropriate. The Corps seems to prefer the inverted "T' for floodwall, while local contractors think that parallel rows of sheet pile 15 feet apart, filled with rock and capped with concrete is more advisable. It would be informative to have a "bake off."

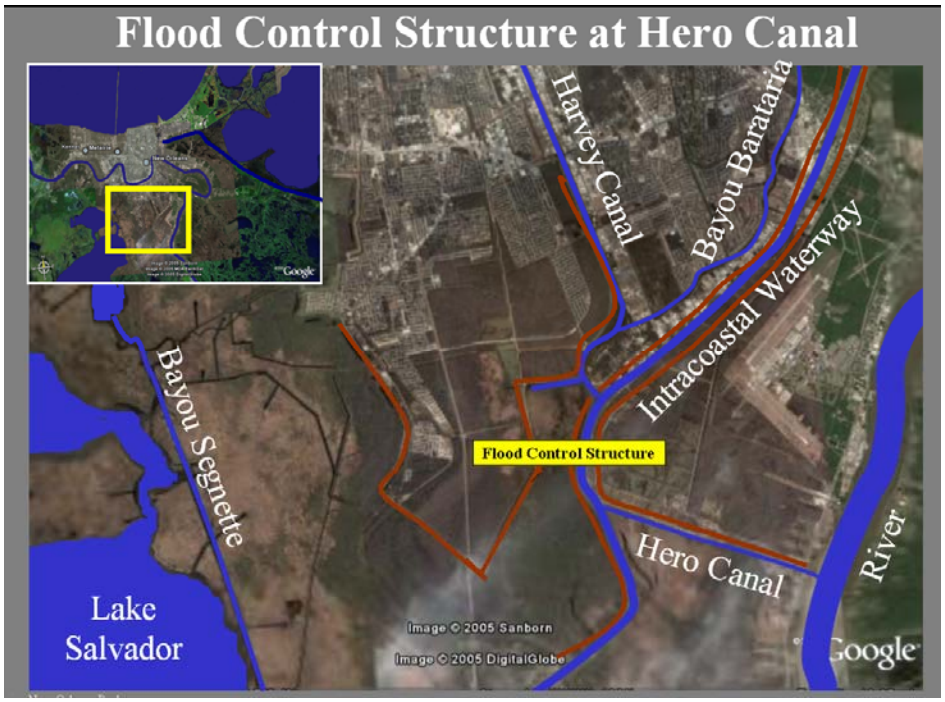
There is cautious optimism that our flood protection system will be in place by June1, 2006 and be as strong as previously promised.

The Corps plans additional work, which has not yet been funded, to continue after June1, 2006. They propose constructing pumping stations at the outlets of the London Avenue, Orleans Avenue, and 17th Street Canals; armoring levees to prevent failure in the event of overtopping; "jump starting" coastal restoration and other works, all of which will have a total cost in excess of $1.5 billion.

Algiers

Algiers is the only part of Orleans Parish on the West Bank of the Mississippi River (River). It is relatively high ground and is insulated from rising seawater by Plaquemine and Jefferson Parishes. The levee system protecting Algiers on the River we assume to be adequate, but the levees separating the swamps and marshes from the West Bank need to be raised. The land loss in the Barataria Basin over the last fifty years has been worse than any other region in the state. The starvation of the marshes and swamps by the river levee that interrupts the natural flow of spring floods combined with salt water intrusion from the Barataria Seaway and oil field canals has resulted in massive marsh loss and salt poisoning of the trees which help hold together the natural high ridges.

The sea moves closer to Algiers everyday, but the flood protection systems necessary to protect the West Bank are all interrelated with surrounding parishes and in fact are virtually all located in neighboring parishes.



The single work that would have the most impact for Algiers, as well as the communities of Belle Chase, Gretna and Harvey, would be to put a flood control structure, possibly including pumping capacity, in the Baritaria Seaway/Intracoastal Waterway at the Hero Canal. This would block storm waters and boat traffic when closed, but the duration of closure should be limited. The control structure would be linked by a strengthened Hero Canal levee to the River levee, three miles east and to the west the Crown Point Levee would be connected by a levee of less that one mile. All these levees need to be completed to a height of at least twelve feet. This single structure would protect an area which now requires maintenance of almost 30 miles of smaller levees.

East Bank of Orleans

The East Bank of New Orleans suffered severe flooding and loss of life. It is here where the community is most sensitive and anxious for solutions.

Flood protection systems are built in layers which surround us. At the center of that protection is an individual, like you or me.

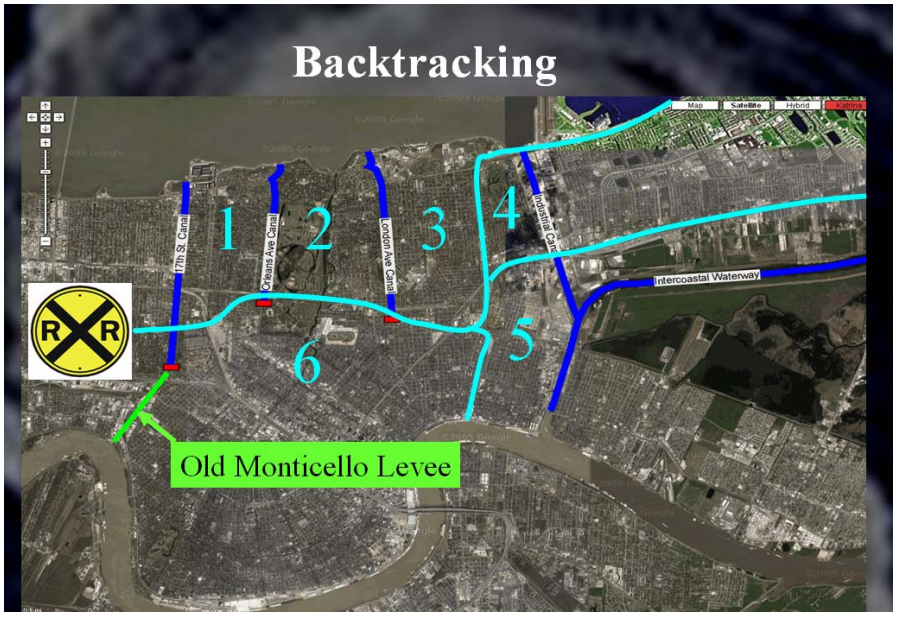
The best flood protection is common sense and self-actuation. That is what makes us move our cars to higher ground and stock up on batteries for flashlights and portable radios. If we live in areas of lower elevation we chose raised houses and we keep our business records safe, but the best defense against flood is to evacuate. Virtually everyone who stayed for Katrina wishes that they had evacuated. Personal initiative is the best insurance against floods. God helps those who help themselves.

But government, adding layers of protection, also has an obligation: to give an early warning of impending danger, to have a plan, to maintain clear evacuation routes and to declare the evacuation. The evacuation plan must provide for the infirm and those without personal transportation.

The government must also provide infrastructure, such as police and fire protection, pumps operators, and of course levees, to protect people and property that might be left behind.

Backtracking

Let us start in the middle of the East Bank and look at another layer of protection. The various railroad tracks throughout the city are elevated on raised roadbeds. These roadbeds could act as secondary levees to prevent floodwater from spreading across town, but we have undermined this deterrent by using underpasses for our roads to cross the rail right of way. We need to change this condition by replacing underpasses with overpasses or by installing floodgates at each underpass to close the throughway. It is also possible to raise the roadbed near the underpass in a hump equal to the height of the railroad and boarder the road with a floodwall back to the railroad tracks. Each of these fixes can be used where appropriate to give integrity to the railway as a secondary flood protection. Costs for these retrofits depend on which is chosen.



The rail right of way is also undercut by large pipes used for storm drainage. These pipes would backflow in flood conditions, but the New Orleans Sewerage & Water Board feels that these pipes can be gated closed for a cost of approximately 10 million dollars.

The railroad tracks can be raised, if overhead clearances allow, an additional two feet for a cost of one million dollars per mile and flood walls can be added alongside the railway to give a level barrier where necessary.

This secondary flood protection is termed containment and is used extensively by the Dutch. The improved railroad "levee" could be joined with the outfall canal levees and other internal floodwalls to create containment areas, which isolate floodwaters and prevent them from migrating unimpeded all over the city.

In addition, the old protection levee along Monticello Street at the Orleans/Jefferson Parish line could be renewed by either closing or raising the streets, which now penetrate it. This program would involve raising River Road and Jefferson Highway, placing a floodgate at the Public Belt Railroad, and raising Airline Highway, as well as dealing with other neglect and abuse of an originally solid flood protection system, which extended from Pumping Station #6 to the River.

Combined, these secondary systems would help isolate future possible floods east of the Industrial Canal into six separate containment areas.

In New Orleans East, the Maxent levee along Paris Road, starts at Little Woods and meanders until it intersects with the floodwall at the Intracoastal Canal. This levee, which is owned by the U. S. Wildlife and Fisheries, needs to be strengthened and raised, and combined with the railroad right of way which runs near Highway 90, could provide a number of containment areas in new Orleans East.

Secure the Perimeter

.

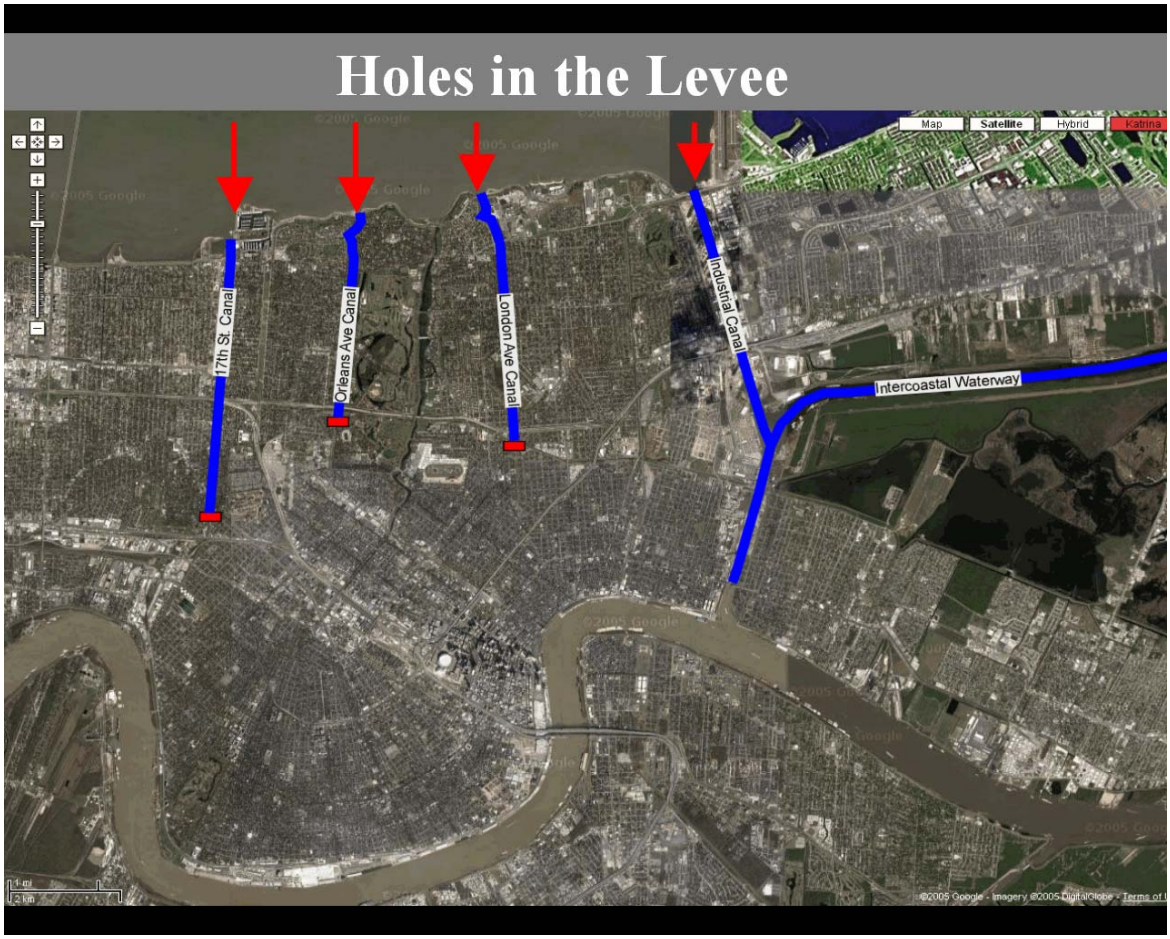
Our perimeter levees at this time are our most important line of defense against floodwaters.

The Southern border of the East Bank is the Mississippi River levee and for this discussion we assume it to be adequate.

To the west lies Jefferson Parish. Their levee and pump system along Lake Pontchartrain held up well in hurricane Katrina. The floodwall at the Jefferson/St. Charles Parish line is being inspected, because of its similarity to the failed floodwalls in Orleans Parish. Renewal of the aforementioned systems at the Orleans/Jefferson Parish line can add some comfort. For purposes of this discussion we will assume that we are protected from the West.

Looking North

Now we look to the North toward Lake Pontchartrain. The protection levee along the South shore of the Lake, our city's North side has four big holes in it, not counting Bayou St. John. Three holes are at the mouths of the outfall drainage canals: 17th Street, Orleans and London Avenue. The fourth opening is the north end of the Industrial Canal.



All these canals are open, without restriction, to the Lake and carry sea level water into the interior of the city; well behind our robust levee at the Lake.

We need to do something about that!

Ready Jetty

The three drainage canals open, unprotected into the Lake. Any mechanism placed near the mouth of these canals, be it sheet pile dam, flood gate or pump needs protection from 24 miles of open water and the waves that can develop in that fetch.

Jefferson Parish has wisely installed jetties across the mouths of its canals thus protecting the pumping stations from a direct hit.

Orleans Parish should do the same, immediately.

The Corps theorizes that the canal walls may have failed because waves driven into the canals by the north wind in Katrina slopped side to side throughout the canals thus causing increased stress and flexing of the canal walls.

Jetties at each canal would stop these waves and keep them from entering the canal or damaging any mechanical structure placed near the mouth. The jetties will be needed when the new pumping stations are built at the lake, so the sooner they are built, the better.

We recommend immediate construction of jetties at the mouth of each canal. Cost for both the jetties recently built in Jefferson Parish, $11 million or $5 ½ million apiece.

No other flood protection system is built like ours. Everywhere else pumps are put at the mouth of drainage canals and integrated into and made part of the perimeter or outer levee system. We need to move the pumps or construct new pumping capacity at the Lake end of these canals, thus cutting off the free flow of water from the Lake to the interior of our neighborhoods. The cost to move or build anew for three pumping stations has been estimated to be in excess of $450 million, and take up to five years.

During the interim we remain exposed.

A dam of sheet piles has been used to hold back the Lake since Katrina, and some have suggested flood gates be used to close the mouth of these canals. But each of these has a drawback. Sheet piles are temporary and must be installed well before a hurricane arrives. Floodgates will probably take almost as long as new pumps to be installed and would be discarded when pumps are installed.

Even worse, dams and floodgates stop the city's pumps from emptying rain or floodwater into the Lake.

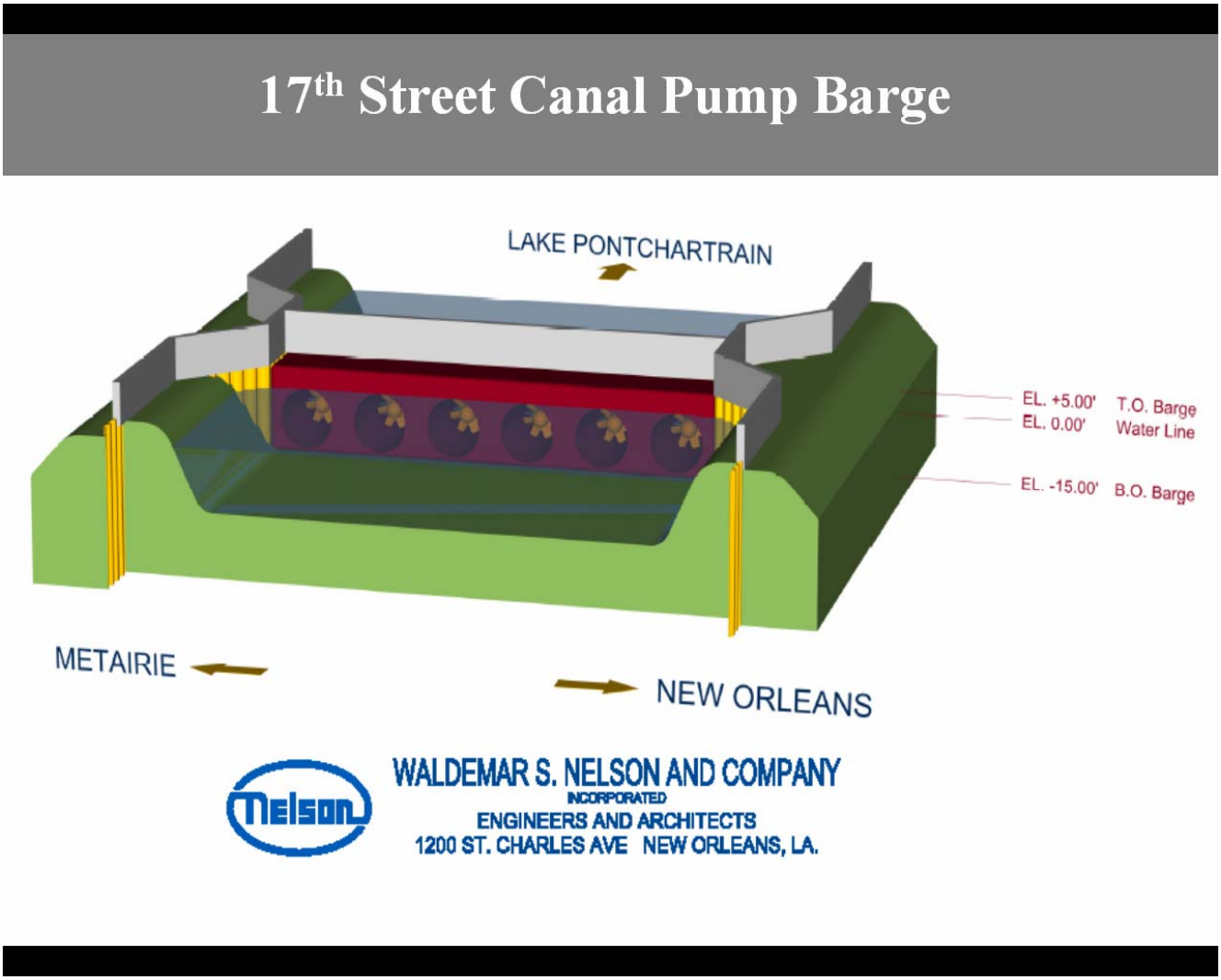
This is particularly critical in the 17th Street Canal which is the discharge for the new pump system designed to keep the Mounes underpass on I-10 clear and dry as an evacuation route. Closing the mouth of the 17th Street Canal forces pumps to stop and allows rain water to collect in low lying areas, including the underpass.

Bucking the Tide at Bucktown

Charles Nelson, of Waldemer S. Nelson and Co. suggests an alternative to dams and gates.

He has a design for a barge, which would be submerged near the mouth of the canal, integrated with the 18 foot high protection levee. A set of dolphins or a frame would be pre installed around the sides and bottom of the canal and the barge would be attached, tongue and grove like, to the frame and submerged there. But inside the barge, powered by 12 megawatts of generated electricity would be 6 powerful bow

thruster pumps, which would accelerate the flow of rainwater to the lake. Of course the original inland pumps and the barge pumps need to be coordinated with each other by redundant speed controls.



This barge /thruster pump combination would present an 18-foot high dam to lake floodwaters, while simultaneously allowing the city pumps to drain rainwater. If this design proves feasible it requires permitting by the U.S. Corps of Engineers, the New Orleans Sewerage & Water Board and the Orleans Levee Board, before it can be installed.

At this time, if funding is available, it appears that this solution could be in place by June 1, 2006 at a cost of $10-20 million. We recommend strong consideration and independent evaluation of this creative solution.

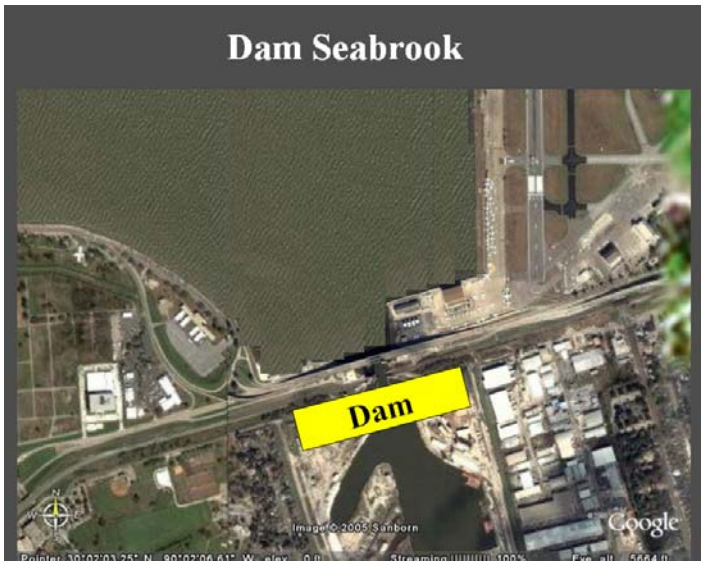
This barge /thruster pump solution could also be used in the Orleans and London Avenue Canals. Although low bridges in the mouths of these canals may dictate on-site modular construction, the capacity requirements are less, so the project is more manageable. There is even the possibility that this

could be a permanent solution and the barges would remain fixed on location at a considerable cost saving to building three new pumping stations. Cost estimate for all three canals is $25-50 million, with a hurry up installation time of six months.

DAM IT

We have been talking about drainage canals, but have said nothing of the 4th gap in the Lake Pontchartrain Protection Levee, the Industrial Canal.

We recommend that strong consideration be given to damming the 300 foot wide north end of the Industrial Canal at the Seabrook Bridge and integrating the dam with the levee system, thus closing a major throughway for flood water into the city. A floodgate or lock could be installed later. In fact, the Corps since 1965 has been authorized to build a flood control structure at this spot.



The north end of the Industrial Canal has long since lost its commercial usefulness, particularly with the cessation of shell dredging. Little commerce flows around the Lake, and there is an alternative route using the Intracoastal Waterway and Chef Menteur Pass (The Chef).

In addition to commercial barge traffic, others effected by this closure would be speckle trout fisherman, shrimpers and recreational boaters. All have alternative choices.

There are boat yards and other businesses on the canal that would be hurt financially and those businesses need to be compensated.

Who would favor closing the Industrial Canal?

Environmentalists would be favorably disposed because it would return the Lake to its original salinity and natural state that existed prior to the opening of the Mississippi River Gulf Outlet (MRGO) in the

mid ‘60s. The daily tide which scours the marsh from the ever widening banks of the MRGO would be greatly reduced, almost eliminated.

The locks on the south end of the Industrial Canal could even be reauthorized to function as fresh water diversion structures, when not locking vessels through, thus nourishing the Lake Borgne estuary.

The neighborhoods that border the canal would be much more secure knowing that they would be protected from flood waters from an overflowing Lake Pontchartrain.

Again we suggest damming the north end of the Industrial Canal. Early estimates from contractors are 6 months to construct at a cost of $10-15 million.

By implementing these proposed solutions using jetties, specialized barge/thruster pumps, a dam, and in a few years, new pumping stations, we can close the weak points in our defenses against an angry Lake. We would present a continuous barrier on our northern front that would stretch from Highway 11 on the east to the St. Charles Parish line on the west.

To the East

To the East is Chef Menteur Pass, Rigolets Pass, Lake Borgne and MRGO. All need to be dealt with in any flood control plan.

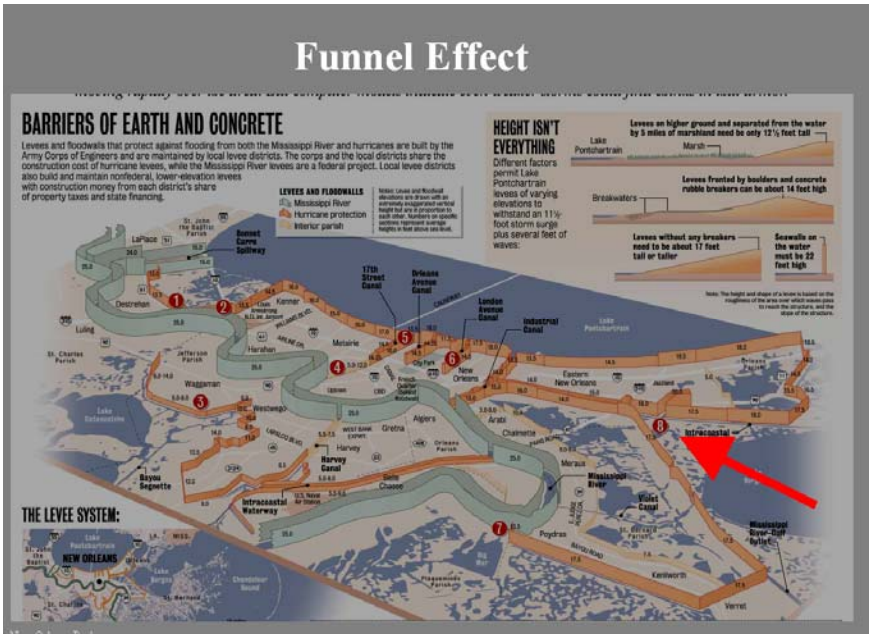
Seeking Closure

MRGO is generally thought to contribute greatly to the storm surge effect by channeling water into both Orleans and St. Bernard. It is also maligned by environmentalist for destroying marshland, nature’s barrier to storm surge. It also provides a navigable waterway for boats of all types, including ocean-going ships that need access to various docks on the Industrial Canal.

How do we accommodate all these needs?

MRGO, since Katrina, has silted up near Breton Island to a depth of 22 feet, far short of its authorized depth of 36 feet. The U.S. congress has not funded the Corps to dredge the waterway in 2006, so that the future status of MRGO is uncertain. The perverse outcome of this situation is that most of maritime commerce is denied, yet the silting is so far out as to provide no public safety benefit. Everyone loses.

The maritime interests have said that the long promised large lock in the Industrial Canal at the river would obviate the need for MRGO and it could be closed when the lock is ready. The new lock would also ease a long time bottleneck for barge traffic in the Intracoastal Waterway. But the lock may take 7 to 10 years to complete. Additionally, immediate closure of MRGO would cause 350 million dollars in relocation expenses and a loss of up to 9,000 jobs. We need to keep our options open.



These maritime needs must be balanced with public safety. And the public has expressed its desire to have the waterway continue to service the commercial needs of oystermen, shrimpers, offshore oil service boats and recreational boats.

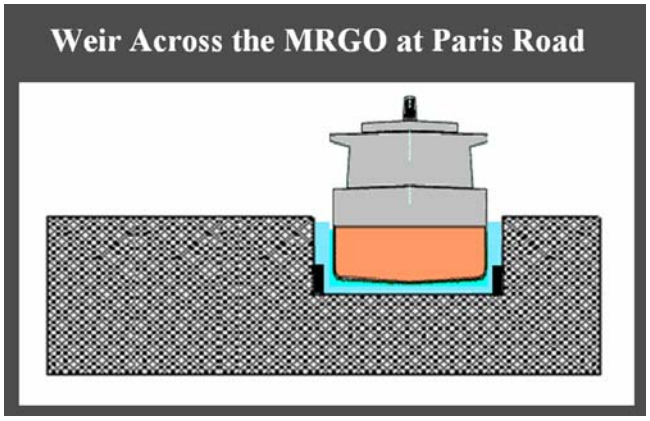
We propose a weir or flood control structure be placed across the merged channel of MRGO and the Intracoastal Waterway near Paris Road. This is where the funnel is most narrow and the effect most pronounced. This structure should be located here, whether MRGO is operational or not.

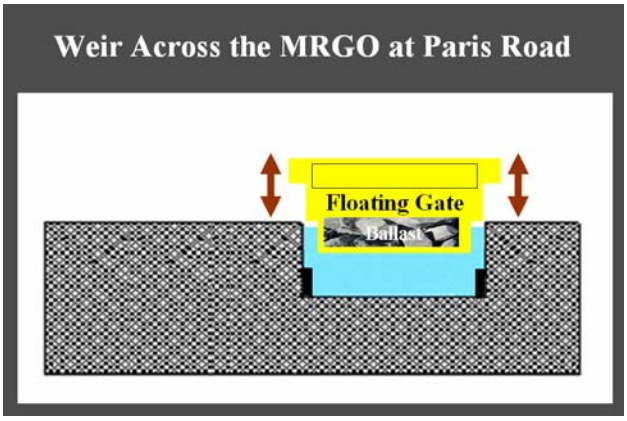
A weir is like a dam, but with a horizontal gap in its upper part, which allows water or boats to pass through to a certain depth. At threatening times a floodgate would close the gap. In this case we propose a gap 175 feet wide, which would accommodate a ship's draft of 28 feet.

Because the funnel effect causes an amplification of the storm surge from the east, the top of the weir should be at least 25 feet above sea level. The weir should be integrated into the nearby floodwalls and those floodwalls need to be both strengthened and heightened outward from the weir for some distance. Protection at this focal point must be higher than the balance of the levees. Equal height will prove inadequate.

In case of an impending storm, the waterway would be closed, at that location, to all traffic from MRGO and the Intracoastal Waterway. A floating flood gate, a barge, specially designed to fit in the 175 x 28 foot gap, using a "tongue and grove" like mounting, would be maneuvered into the gap, submerged by its own self-contained pumps and secured to the weir. The weir, so closed, would function as a dam. Upon the all clear, the gate could reverse its pumps, raise itself and be moved to its standby mooring, reopening MRGO and the Intracoastal Waterway for all traffic.

The weir could be constructed quickly by using parallel rows of deep sheet pile, 50 feet apart, a series of coffer dams, filled in the middle with rocks and capped with concrete. The floating gate, could be made in our local shipyards, eschewing the normal gears and hydraulics, using known technology and it could be made fast. Cost of the weir and gate has been estimated to be $50-80 million.





The weir would be incorporated into our primary levee systems and, combined with the dam on the north end of the Industrial Canal would isolate the Industrial Canal system from floodwaters and prevent flooding of the adjacent neighborhoods.

Further down the MRGO, near Hopedale, is the LaLoutre Ridge, which is a natural ridge that was bisected by MRGO. This ridge was once a deterrent to floodwaters, but now it has been degraded by

not only MRGO, but also by a series of smaller canals and cut-throughs. This natural defense needs to be renewed and replanted with trees, so that it can do its part in flood protection.

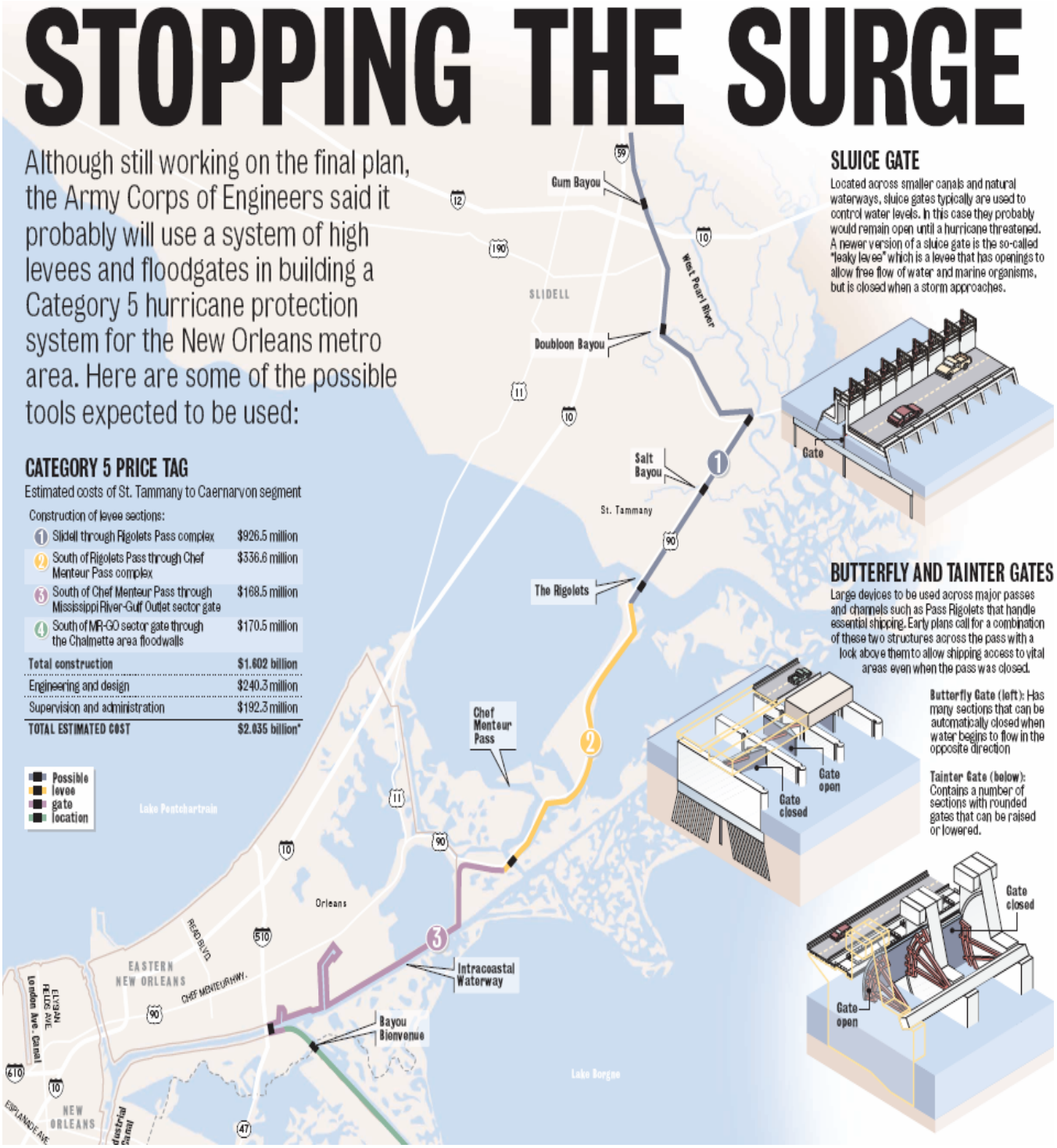
We recommend that a second weir be placed at the LaLoutre Ridge. The primary purpose of this weir would be to inhibit floodwater from channeling up the MRGO. It would be only four feet above sea level at its top to match the surrounding topography. This weir would have the same large opening, 175 feet wide by 28 feet deep and would be closed for storms by a floating gate, but it would also have a smaller opening, which would remain open at all times, to accommodate local boats with a draft up to 12 feet.

Whenever MRGO is closed to oceangoing traffic, whether the Corps discontinues dredging it or whether some compromise is reached to keep it open until the big lock is completed, eventually it should be decommissioned. It should then be sized, including the weirs, to accommodate boats with a 12-foot draft and be filled to that size with dredged material pumped from the Mississippi River. This would help the natural storm buffer, the marsh, from further sliding into the deep channel.

Currently the confusion about the future of MRGO hinders planning, but certain flood control projects need to be implemented, regardless. These two weirs help answer the flood threat from both the funnel effect of converging levees and potential surge in MRGO.

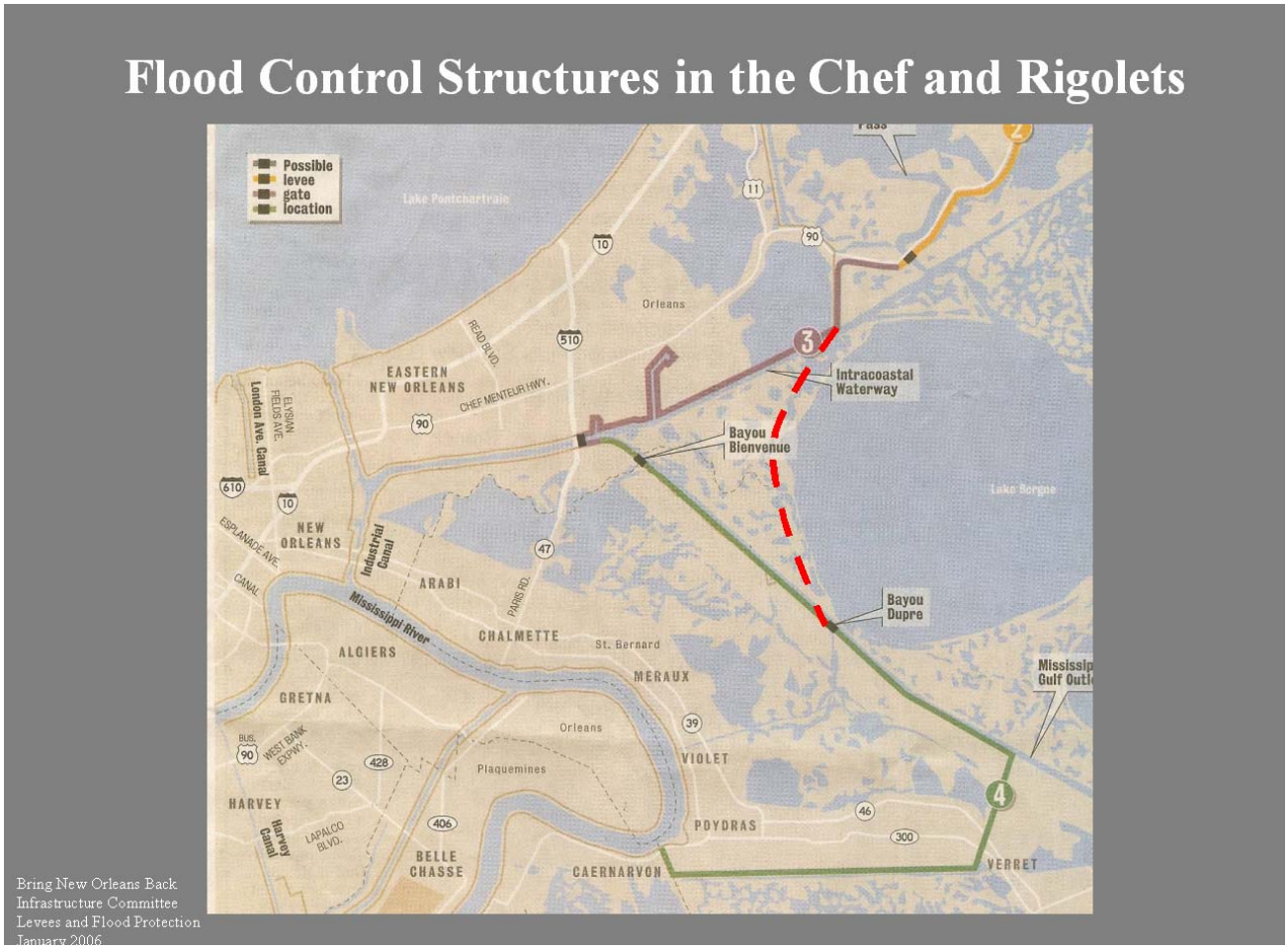
Big Barrier

In the ‘70s, a plan, called the Lake Pontchartrain Barrier Plan, was proposed to put flood control structures in the Chef and Rigolets allowing normal water flow at normal times and closure at threatening times. The proposed control structure also functioned as an automobile bridge. When closed, the flood gates would keep storm tides out of the Lake.



A levee connecting the high ground in St. Tammany Parish to the Rigolets and then following the highway right-of-way to the Chef, was to connect to a levee system continuing on, with a lock on the IntracoastalWaterway, to St. Bernard Parish.

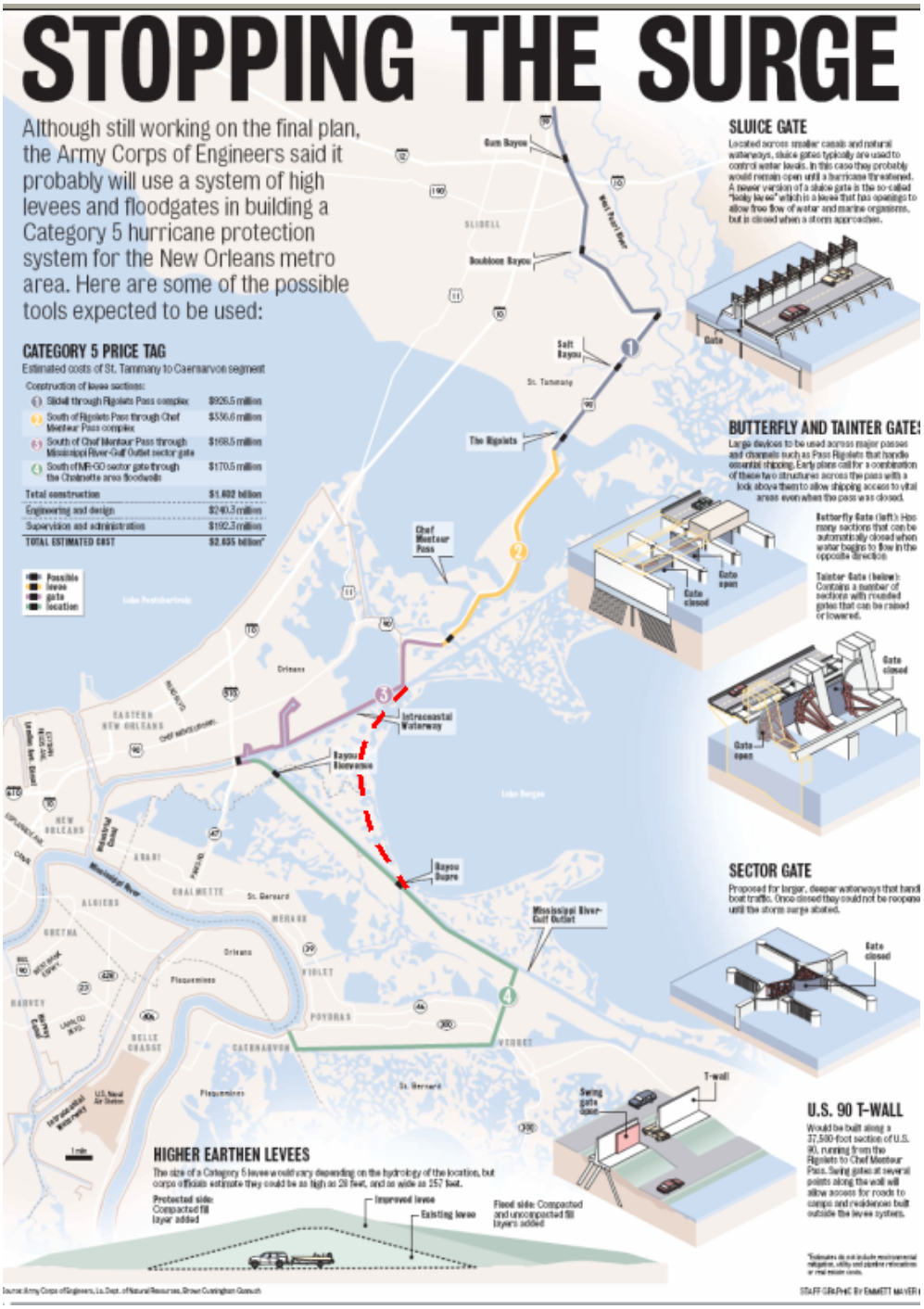
Environmental interests at the time discouraged the plan, but in light of the future threats of another Katrina, these plans need to be reconsidered.



The Corps, recognizing the devastating funnel effect that an east wind has on Lake Borgne, has suggested a modification to the aforementioned plan. A "leaky levee" which bridges the mouth of the funnel midway to its narrowest point would skirt Lake Borgne along its western shore. (An alternative plan would put the "leaky levee" in Lake Borgne rather than on shore) A "leaky levee" uses floodgates where appropriate to respect the flow of water at the levee junction with natural waterways, thus preserving the marsh behind the levee. The Intracoastal Waterway and MRGO would eventually require flood control structures, which could be added later rather than delay the levee construction.

Time to completion for this project in its entirety is in excess of five years, but the leaky levee portion should be a priority to thwart the funnel effect, protecting both East Orleans and St. Bernard Parish.

Total cost of the project is estimated to be in excess of two billion dollars, but this important work protects more than 1.4 million people who live in the seven parishes, which surround Lake Pontchartrain plus those in St. Bernard Parish.



This barrier would become South Louisiana's primary flood control structure east of the River, demoting our current primary and secondary systems, respectively, to secondary & tertiary systems, reducing their burden, yet giving our citizens triple protection.

Hand in Glove

Our committee has suggested a number of flood control solutions, some of which have not been proffered before. Our two guiding principles were feasibility and affordability. But we also recognize urgency.

Many of our proposals could be fast tracked. All of our fast tracked proposals, perhaps even including the barge/thruster pumps, are permanent solutions that do not interfere with any of the ongoing work that the Corps is doing on the levees. These recommendations are add-ons to the Corps' work and complement and augment their efforts.

To summarize, the fast track projects and their costs, not including the flood control in the Chef and Rigolets.

References

John A. Lopez, Ph.D., 2005. “The Multiple Lines of Defense Strategy to Sustain Louisiana’s Coast,” Lake Pontchartarin Basin Foundation

Severn T. Darned, General Counsel, “A Codification of Laws Relative to the Creation and Operation of the Board of Levee Commissioners of the Orleans Levee District.”

Design Engineering, Inc. 2006, “The Board of Commissioners of the Orleans Levee District.”

J.N. Tate, A.R. Carillo, R.C. Berger, B.J. Thibodeaux, 2002, “Salinity Changes in Pontchartrain Basin Estuary, Louisiana, Resulting From Mississippi River-Gulf Outlet Partial Closure Plans with Width Reduction,” US Army Corps of Engineers

2005, “New Orleans After the Storm: Lessons from the Past,” The Brookings Institution: Special Analysis in Metropolitan Policy

R. H. Caffey, B. Leblanc, 2002, “Closing the Mississippi River Gulf Outlet: Environmental and Economic Considerations,” Interpretive Topic Series on Coastal Wetland Restoration in Louisiana, Coastal Wetland Planning, Projection and Restoration Act.

Toby A. Roesler, 2005, “How to Protect New Orleans (West of the Industrial Canal) from Hurricane Strom Surge and Associated Flooding.”

Mark Schielfstein, Bob Marshall, John McQuaid, 2005, “Fixing the Levees,” The Times-Picayune, 12/16/05, Page 1.

John McQuaid, Mark Schielfstein, Bob Marshall, 2005, “100 Days After Katrina, the Evidence is Clear That the Great Flood Was a Man-Made Disater,” The Times-Picayune, 12/8/05, Page 1.

Mark Schielfstein, Bob Marshall, 2005, “Corps May Put Gates at Key Canals,” The Times-Picayune, 11/12/05, Page 1.

John McQuaid, 2005, “Beating Back the Sea: How the Dutch Fight to Save Their Low-Lying Land,” The Times-Picayune, 11/13/05, Page 1.

Eric A. Stene, 1996, “The Teton Basin Project,” Bureau of Reclamation History Program, Denver, Colorado Research on Historic Reclamation Projects.

“Economic Impact Assessment Louisiana Coastal Area Comprehensive Coast/Wide Ecosystem Restoration Study,” State of Louisiana, Department of Natural Resources.

2005, “Protecting New Orleans From Future Flooding,” White house Office of Communications, 12/15/05

1971, “Lake Pontchartrain, Louisiana and Vicinity, Lake Pontchartrain Barrier Plan, Rigolets Control Structure, Closure Dam and Adjoining Levees,” US Army Corps of Engineers, 1971

2004, “Louisiana Coastal Area, Louisiana, Ecosystem Restoration Study,” US Army Corps of Engineers, July 2004

Peter Nicholson, Ph.D., P.E., Associate Professor of Civil and Environmental Engineering and Graduate Engineers Chair, 2005, “Hurricane Katrina: Why Did the Levees Fail?,” Testimony on Behalf of the American Society of Civil Engineers before Committee on Homeland Security and Governmental Affairs, U.S. Senate, 11/2/2005

Rene Zijlstra, 2005, Consulting Engineer, Royal Haskoning, “Flood Management From a Dutch Perspective,” Louisiana Recovery & Rebuilding Conference, 11/11/05

2005, “Comprehensive Habitat Management Plan Lake Pontchartrain Basin,” Lake Ponchartrain Basin Foundation Draft Report, 11/7/05

Nicole T. Carter, Analyst in Environmental Policy, Resources, Science, and Industry Division, 2005, “New Orleans Levees and Floodwalls: Hurricane Damage Protection,” CRS Report for Congress, 09/06/05

2004, “Grand Isle Barrier Shoreline Stabilization Study No. 2512-04-05,” Coastal Restoration Division, Louisiana Department of Natural Resources, 01/07/04

2003, “Saving America’s Wetland, A National Treasure,” Governor’s Advisory Commission on Coastal Restoration and Conservation, March 2003

2004, “Saving America’s Wetland, 2004 Report on Progress Made and Future Challenges,” Governor’s Advisory Commission on Coastal Restoration and Conservation, March 2004

2005, “Saving America’s Wetland,” Governor’s Advisory Commission on Coastal Restoration and Conservation, May 2005

James R. Hanchey, Steven R. Abt, Gordon P. Boutwell, Jr., Charles C. Calhoun, Henry J. Hatch, Donald F. Hayes, Ehab A. Meselhe, Dominic Izzo, John F. Durrant, Gerald E. Galloway, Jr., Jerome Delli Priscoli, 2003, “Restoring Coastal Louisiana, Enhancing the Role of Engineering and Science in the Restoration Program,” American Society of Civil Engineers, Task Committee on America’s Wetland, 2003

Herbert R. Haar, Jr., Colonel, DM No. 1 – General, Seabrook Lock, February 6, 1969, The Flood Control Act (Public Law 89-298), “Lake Pontchartrain, Louisiana and Vicinity and Mississippi River-Gulf Outlet, Louisiana,” October 27, 1969, US Army, New Orleans District, Corps of Engineers,

Carl A Strock, Lt General, US Army, Chief of Engineers, “Report to the Secretary of the Army, Louisiana Coastal Area, Louisiana, Ecosystem Restoration,” January 31, 2005

Gerald M Duszynski, Louisiana Department of Natural Resources, Office of Coastal Restoration and Management, 2005, “Costal Restoration in Louisiana,” Remarks to Senate Committee Staff on Transportation, New Orleans, LA, January 5, 2005

2004, Physical Oceanographic Real Time System Ports For The State of Louisiana, National Oceanic and Atmospheric Administration, National Ocean Service, Center for Operational Oceanographic Products and Services

Louisiana Coastal Wetlands Conservation, Restoration and Management Act/ ACT 6 1986

CWPPRA (Coastal Wetlands Planning, Protection and Restoration Act) 1990

Coast 2050 Plan, " Coast 2050 – Toward a Sustainable Coastal Louisiana" 1998

Section 905(b) (WRDA 1986) Analysis Louisiana Coastal Area, Louisiana – Ecosystem Restoration - 1999