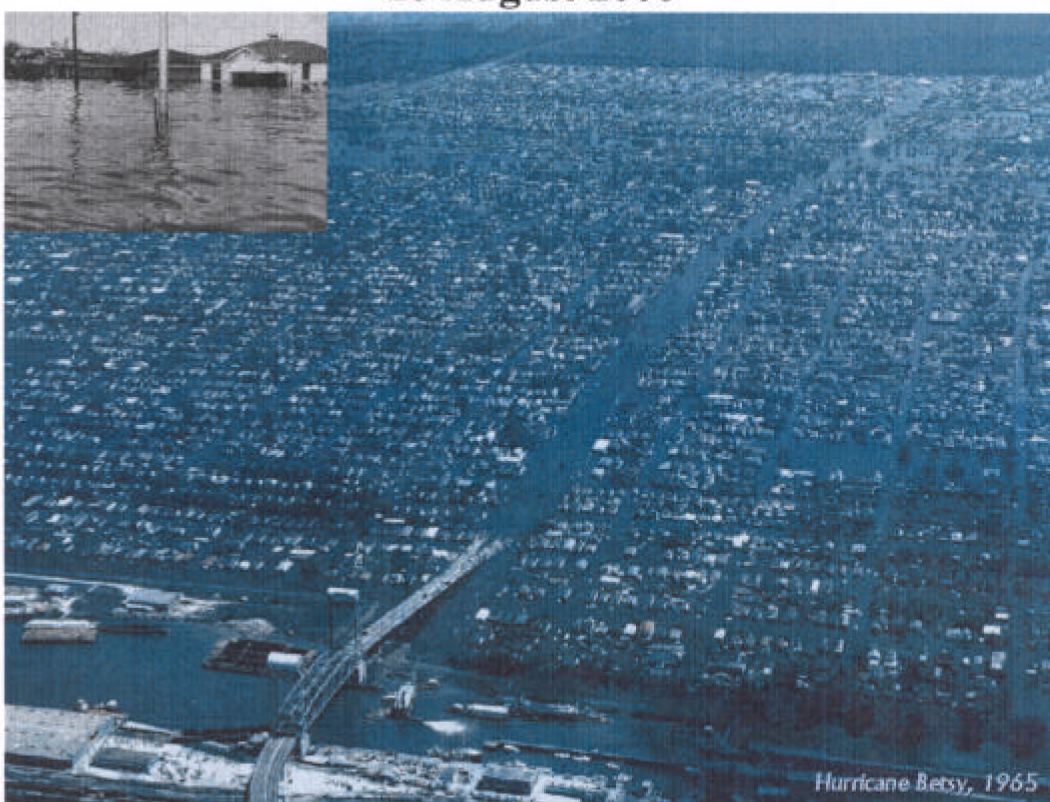
UN-WATERING PLAN

GREATER METROPOLITAN AREA

NEW ORLEANS, LOUISIANA

Prepared by
U.S. Army Engineer District
New Orleans
18 August 2000



REVISIONS

DATE	DESCRIPTIONS
17 February 2001	
7 September 2002	Added Revisions Page (this page)

CONCEPTUAL PLAN

FOR

UNWATERING NEW ORLEANS METRO AREA

GENERAL

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GENERAL

The New Orleans metropolitan area is protected against tidal and hurricane storm surges by a system of levees, floodwalls, and control structures. The hurricane protection system is not designed for the largest storms and as a result, the metropolitan area is vulnerable to flooding from hurricane storm surges. This report was developed using the founded knowledge of the U.S. Army Corps of Engineers (COE), New Orleans district personnel. The operation and maintenance of the protection system is a cooperative effort of the Federal government (COE) and the local Sponsors (levee districts). It is assumed that any emergency response will be fully coordinated with the appropriate levee districts, parish drainage departments and local and state officials.

INTRODUCTION

1) **Purpose** - The purpose of this report is to develop and present a conceptual plan for the unwatering of New Orleans metropolitan areas that may suffer catastrophic flooding from a hurricane event. The premise is that a category 4 or 5 hurricane may produce storm surge water levels of sufficient height to overtop the existing protection system. When the storm surge recedes, floodwater may be trapped inside the protection system. The conceptual plan will serve as the basis of action for a FEMA mission to unwater flooded areas.

2) **Authority -** The Mississippi Valley Division office directed the further development of a conceptual plan on July 21, 2000.

3) **Scope** - This conceptual plan is limited in scope to the Greater New Orleans metropolitan area and to emergency operations to facilitate the unwatering of flooded areas.

4) **Setting** - The overall metropolitan area included in this plan is shown on plate 1. The total area is about 322 square miles including Bayou Sauvage wildlife refuge (Area E-4B) and the sump area in St. Bernard Parish (Area E-5B). The inhabited area is about 256 square miles with a population of about 1,022,000 and encompasses parts of 5 parishes (counties).

    a) **Geography** - The metropolitan area is bounded on the north by Lake Pontchartrain, on the east by Lake Borgne and to the south and west by coastal marshes and lakes. The entire land area is very flat with natural ground elevations within the metropolitan area ranging from +12 NGVD to -9 NGVD. The highest elevations, and virtually all elevations above sea level, are located on the alluvial banks adjacent to the Mississippi River. The natural drainage pattern is away from the Mississippi River. The majority of the area is below sea level due to drainage, subsidence and compaction of the soils. The Mississippi River flows through the area and divides it into two parts. Several man-made navigation channels (the Gulf Intracoastal Waterway (GIWW), the Mississippi River-Gulf Outlet (MR-

GO), the Inner-Harbor Navigation Canal (IHNC), the Harvey Canal, and the Algiers Canal further divide the area.

b) Transportation

1) Highways - Major access roads into the metro area are:

From the West - Interstate 10, U.S. 61, U.S. 90, LA 18
From the North - Lake Pontchartrain Causeway
From the East - Interstate 10, U.S. 11, U.S. 90

2) Railroads - Railroads into the metro area are :

From the West - Burlington - Northern Santa Fe
Texas and Pacific
Illinois Central
Kansas City Southern

From the East - Norfolk Southern
CSX Transportation

4) Airports - New Orleans International (Moisant) - Area E-2
New Orleans Lakefront - Area E-4A
U.S. Naval Air Station (Alvin Callender Field) - Area W-4A

3) Navigation Access

From the West -	Mississippi River
From the North -	Lake Pontchartrain
-	Inner-Harbor Navigation Canal
From the East -	Gulf Intracoastal Waterway (GIWW)*
-	Lake Borgne
-	Mississippi River - Gulf Outlet (MR-GO)
From the South -	Mississippi River
-	Harvey Canal * (part of GIWW)
-	Algiers Canal * (part of GIWW)
-	GIWW

* Includes a lock at junction with Mississippi River.

5) Other - Access may also be possible from the west using the service roads (unpaved, single-lane) on the tops of the protection levees, particularly those atop the Mississippi River levees. It should be noted that most of the levees were not designed to receive loads from the reverse side, i.e. during flooding they will be loaded from the landside. These levees may have very low safety factors as a result of this reverse head and may be very dangerous to travel with heavy equipment. No analysis have been performed on the levee system to determine the possibility of failure therefore precautions must be taken to protect those using the levees for ingress and egress.

c) Flood Protection - The entire area included in this conceptual study is protected to some extent by Federal flood protection projects, as follows:

1) Mississippi River Levees - The existing project was authorized in 1928 and is essentially complete. It provides levees and floodwalls along both banks of the Mississippi River through the metro area to protect against flooding from the river, including any increases in river stages induced by hurricane winds or tidal surges. See project map 3 - 9 and project description in Appendix A.

2) Lake Pontchartrain and Vicinity Hurricane Protection - The existing project was authorized in 1965 and is about 75 percent complete. It provides levees and floodwalls around the outer edges of populated/developed areas on the east bank of the Mississippi River, i.e. between these areas and lakes Pontchartrain and Borgne, to protect these areas from flooding due to hurricane surges. See project map 2 - 35 and project description in Appendix A.

3) Westbank of New Orleans and Vicinity Hurricane Protection - The project was first authorized in 1986. Expansion and extension was authorized in 1996. It provides levees and floodwalls around the outer edges of populated/developed areas on the west bank of the Mississippi River, i.e. between these areas and the adjacent coastal lakes and marshes, to protect the areas from flooding due to hurricane surges. See project maps 2 - 41 and 2 - 43 and project descriptions in Appendix A.

4) Level of Protection - The two hurricane protection projects described above are not designed to protect against the maximum possible storm. The projects are generally designed to protect against a moderate category 3 storm. In addition, segments of the protection system, mainly on the west bank are currently under design/construction and thus incomplete, offering a reduced level of protection.

d) Navigation - The metro area is served by several Federal navigation projects. Deep draft access is provided by the Mississippi River (45 foot draft) and by the Mississippi River - Gulf Outlet (36 foot draft). Additional shallow draft access is provided by the Gulf Intracoastal Waterway (12 foot draft) and by the Inner-Harbor Navigation Canal (12 foot draft). The Algiers and Harvey Canals are branches of the GIWW. Navigation locks are located at the junctions of the GIWW with the Mississippi River. See project maps and project descriptions of the navigation projects in Appendix A.

e) **Drainage -** For drainage purposes, the entire metro area can be divided into thirteen separate "ringed levee" or looped levee drainage systems. There are 7 areas on the east bank of the Mississippi River and 6 areas on the west bank. The areas are listed in the table below. With the exception of areas E-4B and E-5B drainage through or over the levees is by pumping stations. Areas E-4B and E-5B are drained by gated gravity drainage structures. Interior drainage to the pumping stations is provided by a interconnected system of open and closed covered canals. Drainage to the canals for the most part is provided by a system of secondary and tertiary subsurface drainage culverts. The extremely low topography, often below sea level, together with the construction of the flood control and navigation projects and the political boundaries with internal local levees have resulted in this series of loops or bowls of low lying ground encircled by levees and floodwalls. Each of these areas is served by its own drainage collection and pumping system(s) and will be considered as an independent area for this conceptual study. The thirteen areas have been identified as shown on plate 1.

Lake Pontchartrain & Vicinity - East Bank (7 Areas)

Map Area	Name	Parish	Area Sq. Mile	Population
E-1*	St. Charles Parish	St. Charles	17.2	22,000
E-2	Jefferson Parish-East Bank	Jefferson	47.9	261,000
E-3	New Orleans Metro (East Bank)	Orleans	39.4	328,000
E-4A	New Orleans East (Citrus)	Orleans	32.3	89,500
E-4B	New Orleans East (Bayou Sauvage)	Orleans	22.2	0
E-5A	St. Bernard Parish – developed	St. Bernard/ Orleans	31.4	**88,400
E-5B	St. Bernard Parish – sump	St. Bernard	43.8	0
		Totals	234.2	766,900

* Not included in this study because closure of the levee system is under construction and currently incomplete.

** Includes a portion of Orleans Parish east of the IHNC

Westbank & Vicinity (6 Areas)				
Map Area	**Name**	**Parish**	**Area Sq. Mile**	**Population**
W-1	Cataouatche	Jefferson	22.6	23,800
W-2	Westwego to Harvey Canal	Jefferson	21.4	66,700
W-3A	Harvey Canal to Algiers Canal	Jefferson/ Plaquemines	18.8	77,000 (Includes W3b)
W-3B	Harvey Canal to Algiers Canal	Orleans	6.3	57,000
W-4A	Algiers Canal to Hero Canal	Plaquemines	14.1	8,600
W-4B	Algiers Canal to Hero Canal	Orleans	4.7	300
			87.9	233,400

STORM SCENARIO

5) **Preparation** - As a hurricane approaches the metropolitan area, final preparations are made.

   a) **Levees** - The local levee districts are responsible to close all openings in the protection system. This includes physical closure of all vehicular gates, railroad gates, control structures, navigation structures and sandbagging of low spots on the levees, openings at bridges and gaps in floodwalls. They will insure the readiness/availability of all their manpower and equipment.

   b) **Drainage** - The local drainage departments will pump down their drainage systems to their lowest levels to provide maximum storage for heavy rainfall. They will ensure the readiness/availability of all their manpower and equipment. The continued operation at full capacity of all pumping stations is critical during hurricane events.

   c) **Emergency Operations** - Federal, State and local agencies will activate emergency operation centers to deal individually and collectively with events prior to, during and after the hurricane.

6) Flooding Scenarios

a) Each of the thirteen separate protected loops or "bowls" within the metro area are susceptible to flooding from a category 3 or stronger hurricane. A category 5 hurricane could produce a storm surge of up to 25 feet NGVD in the metro area, which would overtop any of the protection systems. The extent of flooding in any particular area will depend upon the rainfall associated with the storm coupled with the degree to which the levee and floodwalls may be overtopped. Overtopping will depend upon the intensity of the storm, the track that the center or "eye" of the storm follows and the speed at which it travels along the track.

b) Minor to moderate flooding of the lowest lying areas may occur from rainfall alone, without any overtopping of the protection system. This type of flooding, although it may affect a large area and do great damage will likely not damage the pumping stations and can thus be quickly removed by the pumps after the storm passes.

c) When the storm surge height reaches a critical level, waves will begin to overtop the protecting levees and floodwalls. At this point flooding of the protected interior areas (from overtopping) will begin to occur and the amount of flooding will increase exponentially as the surge height continues to increase. At the point where the surge height reaches or exceeds the top of the levees and floodwalls the protected areas will be completely inundated. This will cause catastrophic damages including likely damage and shutdown of all pumping stations.

d) Even though an area is completely inundated and flooded during a hurricane event, if the levees or floodwalls are breached by the storm, the area will drain naturally and will remain only partially flooded after the event.

7) Aftermath

The condition of the thirteen separable areas after a hurricane passes may range anywhere from no flooding to complete inundation (ponded water to the top of the levee and floodwall protection system). Four potential flooding cases will be considered, as follows:

Case	**Extent of Flooding**	**Probable Cause**
A	None	None
B	Minor to moderate	Rainfall/minor overtopping
C	Moderate to severe	Rainfall/significant overtopping of levees and floodwalls
D	Catastrophic (top of protection system or higher)	Inundation

	ANTICIPATED DAMAGES		ANTICIPATED EMERG. RESPONSES		
CASE	**LEVEES / FLOODWALLS**	**PUMPING STATIONS**	**LEVEES / FLOODWALLS**	**PUMPING STATIONS**	**OTHER**
A	None	Minor *	None	Minor repairs	None
B	Potential erosion	Minor *	Repair erosion	Repairs	None
C	Probable erosion, potential breaching	Potential major	Potential levee breaching, levee repairs	Potential major repairs	Potentially required
D	Erosion, probable breaching	Probable major	Levee breaching, levee repairs	Major repairs	Required
* Damages due to wind and rainfall, not flooding					

a) Cases A & B – With the possible exception of potential severe rainfall flooding, the likelihood of severe flooding or damages with Cases A and B is small as compared to Cases C and D. Therefore the need for emergency response by FEMA and support by the Memphis District ERRO is unlikely. There may be some minor damages to the levee and floodwall system due to wave action and minor overtopping but repairs will be within the capability of the local levee districts and the New Orleans District. There may also be minor damages to pumping stations due to wind, debris, rainfall and other non-flooding causes. Repairs will be within the capability of the local drainage district, local governments and public utilities.

b) Case C - There is moderate to severe flooding due to significant overtopping of the protection system. Levees will be eroded, perhaps severely. In this case, some or all of the pumping stations may be partially or completely flooded resulting in major damages and an inability to operate without major repairs. Emergency responses will include assisting the levee district in breaching levees, as deemed appropriate, to relieve trapped floodwaters, in levee repairs, assisting the drainage departments in pumping station repairs and providing emergency supplemental pumping capacity.

c) Case D - There is catastrophic flooding due to complete overtopping of the levees and floodwalls and inundation of the protected area. There will be extensive and severe erosion of levees and perhaps complete breaches. Due to the high water levels, all of the pumping stations will probably be flooded with major damages. The emergency responses will be similar in nature to Case C but the level of effort may be much higher. The levee districts and drainage departments may be dysfunctional to some degree.

UNWATERING PLANS

8) General

a) Phases

The initial phase of the emergency response will consists of actions to drain impounded water down to the water levels in the adjacent unprotected areas. This will be done either by pumping, by gravity drainage or a combination of the two. Also included in this phase are initiating emergency repairs of equipment, e.g. pumping stations, that will be necessary to proceed into and implement the final phase, which will consist of continuing and completing emergency repairs and conducting pumping operations to remove the remainder of the floodwaters.

b) Emergency Responses

Emergency responses to drain impounded areas will consist of one or more of the following actions:

		Phase	
	Action*	**Initial**	**Final**
(1)	Open all closed floodgates, drainage structures and control structures, but carefully observe head differentials to avoid scouring downstream of gates so as to endanger the structure.	x	
(2)	Operate all pump stations that are capable.	x	x
(3)	If pumps are not operable, use as siphons	x	
(4)	Enlarge/deepen existing levee breaches and/or create new breaches.	x	
(5)	Repair levee erosion and intentional breaches. Note Emergency response will include possible degrading of adjacent levees as a source of fill material	x	x
(6)	Repair and restoration of pumping stations	x	x
(7)	Utilize emergency temporary pumps, generators, etc. Note- Because of immediate repairs of levee breaches once gravity drainage is accomplished the immense capacity of the existing pump stations, any temporary emergency pumps are expected to have a miniscule effect in comparison and are not a long term solution	x	x
(8)	Debris removal necessary for drainage operations	x	x

*Each of these actions is discussed, in general terms, in the following section.

c) Discussion

1) Structures - All the various structures (floodgates, drainage structures and control structures) that pass through the levees and floodwalls will be closed as the storm approaches. If the storm floods these areas, the opening of the structures may provide (if the sill elevation is low enough) for gravity drainage of the flooded areas.

   The majority of the structures are access floodgates that provide for either vehicular, pedestrian or railroad access.

   There are four main types of access floodgates as follows:

   Standard swing gates, which have hinges on one side and latches on the other side.

   Miter swing gates, which have two leaves, hinges on each side and latches in the middle.

   Bottom roller gates, which have rollers on the bottom and latches on both sides.

   Overhead roller gates, which have rollers on an overhead trolley and latches on both sides.

   These gates are designed for water loading from the outside but are not designed for water loading from the inside, i.e., reverse heads. The weak points of these floodgates, when subjected to reverse water loading, is the hinges and latches. Any of these gates are susceptible to failure at these points if water is impounded behind them. If the gates do not fail, the reopening of them while the reverse head is applied will be very dangerous due to the tremendous pressure and stress on the latches and hinges. The quickest and safest way to open a gate in this condition will be to use small shaped explosive charges to break open the latches.

   The flow of the impounded water through a re-opened floodgate may result in significant damage to adjacent structures and erosional damage in the vicinity.

   There are not many drainage structures or navigable floodgates in the metro area. The drainage structure are not expected to present any re-opening problems, but the navigable floodgates are expected to present some serious problems. These will be discussed in the appropriate area.

2) Pumping Stations - The continued operation of all pumping stations before, during, and after a hurricane is essential to prevent, control and eliminate flooding in the protected areas.

   The pumping stations are large and complex installations with a number of mechanical and electrical systems and subsystems which must act together with each other in order for the entire station to operate. Typically, the following systems are present:

   - Pumps and intake/discharge piping
   - Primary power supply
   - Secondary/backup power supply
   - Fuel storage and transfer
   - Vacuum priming
   - Control systems and panels
   - Air/water cooling
   - Transformers

   Damage to any of the critical systems or subsystems from wind, rain, debris or flooding can result in a shut-down of the pump station. Emergency response action will be directed toward:

   - Repair of the damages and restoration of operation.
   - Use of the intake piping, pumps and discharge piping as siphons until the pumps can be repaired.
   - Installation of temporary pumping equipment.

   The following table is a generalized presentation of potential damages, preventive measures and emergency repairs.

Pump Station		
Potential Damages	**Preventive Measures**	**Emergency Repairs**
1. Unreinforced Windows	Place shutters outside windows.	New shutters.
2. Unbraced Rollup Doors	Place supported braces on doors.	New doors.
3. Flooded Air Intakes for Engines	Elevate air intakes.	Drain fluids from engine & replace. Flush out air vents. Portable water tanks.
1. Flooded Fuel Transfer Pumps	Elevate pumps.	Portable pumps.
2. Flooded Diesel Engines	Waterproof all electrical connections & elevate all possible water entry openings.	Disassemble, drain, clean & replace fluids.
3. Flooded Electric Motors	None.	Disassemble, flush with clean water, use blowers & heaters to dry. Portable water tanks.
4. Flooded Vacuum Pumps	Elevate pumps.	Diesel-flush & replace fluids. Electric-portable pumps. Portable water tanks.
5. Flooded Control Panels	Elevate panels.	Disassemble, flush with clean water, use blowers & heaters to dry. Portable water tanks.
6. Flooded Generators	None.	Diesel part-treat as diesel engine. Portable water tanks. Generator part-treat as electric motor.
10. Loss of Commercial Power	None.	Backup generators.
7. Loss of Water Service	None.	Portable pumps for use with canal water for cooling.
12. Submerged Pump Bearings/Seals	Waterproof bearings.	Clean & repack bearings.
13. Submerged Fuel Tanks & Air Intake Vents	Elevate vents above flood level & anchor. Seal all other openings.	Drain water from tank. Fuel may be useable or bring in diesel fuel in tanks.
14. Air Compressors	Elevate compressors.	Portable air compressors.

3) Levees and Floodwalls - The levees and floodwalls are designed to be stable against the maximum water levels, i.e., water to the top of the levee or floodwall, applied from the flood side of the protection. In most cases the project design case is with no load from the land side other than static forces, resulting in the design safety factor being violated by reverse head conditions. Many of the levees and flood walls may be severely damaged to the unanticipated loads from water applied from the land side, i.e., reverse heads. However, emergency response may be required either to intentionally breach levees to release impounded floodwater or to repair levees or floodwalls that have been damaged by erosion or by breaching.

   Intentionally breaching of levees or sheet pile floodwall sections can result in unpredictable damages and may be difficult to repair. Intentional breaching will only be done if other methods of drainage (floodgates, culverts, pumps, operating or in siphon mode) are not sufficiently effective.

   The location at which to intentionally breach levees, has been carefully studied considering:

   (a) Geologic Conditions - Areas with soil conditions of a clay levee overlying 20 feet of insitu clay soil are considered most likely to react predictably when a breach is developed. The most desirable locations will have 20 feet or more of clay below the base of the levee, which will likely resist undesirable deepening and widening of the breach. Areas have been delineated on the site maps for those zones where clay layers of 20 feet or more are at the base of the levee. Areas where sand deposits lie within 20 feet of the ground surface will likely produce more of an uncontrolled crevasse condition, which will be difficult to repair. Many areas of sand in the near surface beneath the levees and floodwalls exist in the New Orleans Lake front and New Orleans East areas.

   (b) Existing Construction - The levees are generally constructed of hauled clay material. Some of the recent levee construction utilizes a geotextile fabric with seams sewn perpendicular to the levee centerline. Some of the older levees are reported have steel sheet piling embedded in the levee. Such locations will be avoided if possible. However the geotextile may be removed very easily and replaced during closure/repair operations. Should embedded sheet-pile sections be found in a selected site they can be driven down, extracted, or otherwise removed from service.

   (c) Access - In many cases the most likely access to areas requiring breaching will be by water via barge and tug. All of the 13 separate areas are approachable by navigable waterways that under normal circumstances would provide ready access. However, access by water will require care due to the likelihood of debris. The tug may push the rake of the barge as close as is possible to the levee allowing the degrading equipment to offload into shallow water at the levee toe.

(d) Repair/restoration - Repair of the levee breach or breaches will be required once gravity flow drainage has been accomplished and the inside stage is equalized with the outside stage. Repair of breaches necessarily includes consideration of the location of any nearby soil stockpile areas, borrow areas and the ability to partially degrade adjacent levees to obtain materials for repair. The most probable expedient source will be from adjacent levee berms or levee crown, since the next critical step in restoring the area will require tha the lowest areas be pumped drained. The sites selected for potential breaching should be adjacent to public lands or underdeveloped lands if it is at all possible to facilitate future repair by the use of public lands for staging the repair construction. The source of fill for future restoration of the levees which have been breached could come from public lands, and/ or the Bonnet Carre Spillway or could be pumped sand with a clay cutoff. Rock toe dikes and sandbag landside dikes may be an option with soil contained between these two facilities.

The methods of forming a breach in the flood protection will vary at each site however the use of explosives could prove difficult especially if the levee's clays become saturated by standing water. Saturated and/or unsaturated clays are not easy to move with explosives. The use of long boom grade-alls or draglines is recommended in this case.

The levee berm intersection at the shoreline of Lake Pontchartrain in many cases is armored with rip-rap to prevent erosion of the shoreline by waves. If the initial breach and resulting flow of water does not erode this material, it may necessary to remove this material to facilitate drainage and water level equalization. If partial levee breaches have been created by the hurricane during the event, and the area remains partially flooded, then these existing breaches may be intentionally widened or deepened to further drain the area.

Breaching steel sheet pile floodwalls may also be an option in some areas to provide drainage. The breach may be accomplished either by pulling the sheets out or by driving them deeper. However, for the most part, sheet pile floodwalls have been capped with concrete and removal of the caps under flood conditions would be difficult if not impossible. Sections of floodwall where breaching is feasible will be studied. In most cases this will be very dangerous as the floodwalls were not designed for reverse head loadings and may be at very low safety factors. The added stress of applying the breaching effort may cause failure of the floodwall resulting in injury to those working to perform the breach.

4) Debris Removal - In the event of complete inundation, there will be tremendous amounts of debris created by the combination of hurricane winds, inundation and waves. The presence of large amounts of debris will be a major obstacle to unwatering operations.

   Once pumping stations have been made operable, debris removal in the vicinity of the intakes for pumping stations will be necessary to allow the pumps to operate. Removal of small debris will be accomplished by the motorized mechanical rakes on the trash racks supplemented as needed by a dragline with clamshell bucket. If flooded, the electric motors on the rakes must be replaced or reconditioned. Generator will supply emergency power. Disposal of the debris removed from the intakes will be by use of front-end loaders and dump trucks. The debris will be moved away from the pump station and dumped as close nearby as possible either on the landside or floodside levee berms and slopes.

   As the water level is lowered to the point that emergency vehicles can travel on highways and streets, debris removal will be expanded to the clearing of drainage canals, bridges and culverts. Removal will be accomplished by draglines with clamshells buckets, gradealls, front-end loaders, dump trucks and other appropriate equipment. Disposal of the debris removed will be by disposal in landfill or by burning. Temporary stockpile areas may be used.

   The After Action Report for Hurricane Betsy (Appendix E, Pg. 17-26 and 42-48) contains a discussion on debris removal problems and operations after that storm.

5) Emergency pumps – The pumps and motors/engines at the many pumping stations are so large and specialized that the pumping stations do not have spares and they are not available "off-the-shelf". In most cases, it will be necessary to repair/rehabilitate the existing equipment and get it back in operating condition.

   If the pumps in an area have been flooded and are unable to operate, then emergency pumping capability will be required to unwater the area. This equipment will be hydraulic dredges, pump barges, temporary pump platforms with off-the-shelf pumps and motor installed or similar. Appendix E, After Action Report for Hurricane Betsy, pages 32-35, discusses emergency pumps used after that storm.

d) Coordination Requirements – Emergency response actions for unwatering flooded areas must be coordinated as appropriate, with:

- Emergency Operations center (EOC), New Orleans District

- The cooperating agencies/offices identified in the Emergency Operation Plan (EOP)) of the New Orleans District

- Parish governments, drainage districts and emergency operations centers

- Municipal governments

- Public utilities

Current information for coordination purposes will be available from:

- Emergency Operations Center (EOC), New Orleans District

- Louisiana Office of Emergency Preparedness

- Parish Emergency Operations Centers

e) Specific assessments of each of the 13 separate protection loops follows. All emergency response actions that are taken must be fully coordinated with all affected local, parish, state and Federal agencies.

9. East Bank Area

A. Area E-1 – Saint Charles Parish, East Bank

1) Description

a) General - The area is shown on plate 1. The area is located in St. Charles Parish, has a land area of 17.2 square miles and a population of 22,000 people. Area E-1 is essentially a low density residential community with a small business district along U.S. Highway 61. It is generally bounded by St. John the Baptist Parish on the west, Lakes Pontchartrain on the north, Jefferson Parish on the east and the Mississippi River on the south.. Topography is flat with ground elevations ranging from +12 feet NGVD on the alluvial ridges along the Mississippi River to –2 feet NGVD near the locally maintained levee south of Lake Pontchartrain. Approximately 25 percent of the developed area is below sea level.

b) Levees and floodwalls - Because the Federal Project is under construction, but not complete, no additional data has been prepared for St. Charles Parish for this document.

B. Area E-2 – JEFFERSON PARISH EAST BANK

1) Description

a) General - The area is shown on plates 1 and E-2. The area is located in Jefferson Parish, has a land area of 47.9 square miles and a population of 261,000 people protected from hurricane storm surge by levees and floodwalls. Area E-2 is essentially a high-density residential community with a small business district with high rise buildings along Causeway Boulevard from Veterans Highway to the lake. In addition, there is an industrial area near the Huey Long Bridge and the Mississippi River and a few buildings of 5 to 10 stories height scattered throughout the area. St. Charles Parish generally bounds it on the west, Lake Pontchartrain on the north, Orleans Parish on the east and the Mississippi River on the south.. Topography is flat with ground elevations ranging from +12 on the alluvial ridges along the Mississippi River to -8 in the interior of the area. Approximately 70 percent of the area is below sea level.

b) Levees and floodwalls - The area is protected by 28.9 miles of levees and floodwalls as indicated in Table E-2-1 below. Of this protection, 0.42 miles (segments 1, 2, and 3) were locally constructed. The segments described begin at Mississippi River and the St. Charles Parish line and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevation for the entire area is +5.0 feet NGVD located in segment 1. A storm surge height that exceeds this height at this location will begin to flood Area E-2. However because the height varies along the levee reach and the length is short, flooding will not be extremely rapid and stages will have to persist for a long time to flood the entire area. Segment 3, (U.S. Highway 61, Airline Drive) also has a controlling elevation of +5.0 feet NGVD, but is short and can be sandbagged to a higher elevation, probably +10 feet NGVD.

Table E-2-1
Area E-2: Jefferson Parish East Bank
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	MRL to Railroad	Natural Contour	0.20	5.0 - 7.5	5.0	
2	Floodwall	Steel I-Wall	0.20	10.0	10.0	
3	Airline Hwy	Concrete 4 Lane	0.02	5.0	5.0	sandbagged
4	Jeff/St. Charles line	Clay Levee	1.00	14.0	14.0	
5	Jeff/St. Charles line	Floodwall	3.30	13.5	13.5	
6	Lakefront	Floodwall	0.50	17.0	17.0	
7	Reach-1	Levee/Floodwall	2.00	16.5	15.0	clay
8	Pump Sta # 4	T-Wall	0.40		17.0	

9	Reach-2	Levee	1.50	16.5	15.0	geotextile
10	Pump Sta # 3	T-Wall	0.10		12.0	
11	Reach-3	Levee	2.30	16.5	14.5	geotextile
12	Pump Sta # 2	T-Wall	0.20		12.5	
13	Reach-4	Levee	1.50	16.5	15.5	geotextile
14	Reach-5	Levee/Sheetpile	2.00	14.5	14.5	geotextile
15	17th St. Canal West	Floodwall	2.30	14.0 - 15.0	14.0	
16	MRL	Levee	11.4	17.0 – 22.0	17.0	clay
	Total Length		28.9	Miles		

Segment 1 thru 5 extends from the main line Mississippi River levee (MRL) to the lakefront.

Segment 1 Extends from MRL through the railroad tracks. There are no levees or dikes in this area.

Segment 2 Is a short steel sheet pile segment between the railroad and Airline Drive (Hwy 61).

Segment 3 Is Airline Drive. The roadway is sandbagged as storms approach.

Segment 4 Is an earthen levee extending from Airline Dr. to an ungated railroad crossing which is sandbagged as storms approach. The levee continues on behind the Moisant Airport and ties into a concrete floodwall at the North side of the airport runway.

Segment 5 Is a concrete T-Wall atop a low levee that extends to the lakefront.

Segment 6 thru 14 Consists of all clay levees, geotextile reinforced (at El. +4 & +5) clay levees, concrete floodwalls, 3 vehicular floodgates, steel sheet pile floodwalls, and 4 major pumping stations with discharge lines being passed through concrete T-Walls that parallel the lake front.

Segment 15 Is the return protection between the lake and MRL. It consists of a concrete floodwall on top of an all clay levee. It parallels the 17th Street Canal that separates Jefferson Parish and Orleans Parish. It ties into Pumping Station No. 6, which forms part of the Orleans East Bank cell. The Hoey's Basin (drained by Pumping Station No. 6) local levee and ridge ties back to the MRL.

Segment 16 Is the East Jefferson Levee District Mississippi River levee. This segment closes the South side of the cell. The levee is an all clay levee with an asphalt bike path on the 10' wide crown. It extends from the Orleans Parish line to the St. Charles Parish line. Pertinent details are tabulated in Table E-2-1.

c) Gravity drainage Structures – There are a total of 13 structures. There are a total of 9 floodgates in the protection system that provide for pedestrian, roadway and railroad access. These floodgates are not expected to be effective for drainage as the sill elevations are all higher than the expected elevation of the impounded waters (+5.0 feet NGVD). Pertinent details on the floodgates are tabulated in Table E-2-2 below. Two additional floodgates are proposed for construction at Bonnabel Boulevard and Orpheum Avenue. There are 2 gravity drainage culverts that drain Hoey's Basin (a small segment of Area E-2) into the 17th Street Canal in Orleans Parish. These culverts are: a 10 ft. by 30 ft. box near Hwy 61equipped with sluice gates; and a 60 inch circular pipe near the confluence of the 17th Street and Palmetto Canals. Sluice gates on the box culvert were installed in the early 1960's but have never been operated.

Table E-2 – 2
Area E-2: Jefferson Parish East Bank
Gravity Drainage Structures

LOCATION	GATE #	TYPE	OPENING (feet)	ELEVATION	GATE TYPE
Return levee @ Veterans	1	Swing	6 x 9	sill 5.1	Pedestrian
Return levee @ Esplanade	2	Swing	7.5 x 9	sill 6.1	Pedestrian
Return levee @ corner	3	Swing	20 x 5	sill 12.0	Road
Williams Blvd.	4	Bottom roller	60 x 4.5	sill 10.0	Road
Pump Sta. #4	5	Swing	22 x 7	sill 10.0	Road
Bonnabel (proposed)	6	Swing			Road
Hoey Canal @ 17th St Canal	NA	NA	5.0 diam.	Invert	culvert
Hoey Canal @ 17th St Canal	NA	Sluice	30 x 10	Invert	culvert
Orpheum Ave. (proposed)	7	Swing	24 x 4.5	sill 9.0	Road
North side of Veterans bridge	8	Swing	5 x 7	sill 7.5	Pedestrian
South side of Veterans bridge	9	Swing	5 x 6.5	sill 8.0	Pedestrian
I – 10	10	Dbl. swing	10.5 x 3	sill 11.5	Road
Pump Sta. #6	11	Swing			RR

d) Pumping stations - There are 7 pumping stations that drain the protected area. Six of these are operated by Jefferson Parish Drainage Department and one, P.S. N#6, by the New Orleans Sewerage and Water Board. The locations of the pumping stations are shown on plate E-2 and pertinent details are tabulated in Table E-2-3 below. In addition, several smaller pumps assist gravity drainage within the protected area, but none of these gets water past the protection levees. Note: Additional detailed information in the pumping stations, if available, is contained in Appendix B and the New Orleans District Emergency Data Container ("Black Box").

Table E-2-3 Area E-2: Jefferson Parish - East Bank Pumping Station Summary										
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) NGVD	Pump		Pump Type	Driver Type	Freq. (Hz)
						Flow (cfs)*	No. Pump			
JP-4	PS 4 –Duncan #	Spanish Fort	30.03850	-90.2451	-5.3 -0.5 3.6	4800	6	V/H	D/E	60
JP-3	PS 3 – Elmwood #	Spanish Fort	30.03213	-90.2191	6	3400	8	H	D	
JP-2	PS 2 – Suburban #	Spanish Fort	30.02017	-90.1802	7	3040	6	V/H	D/E	60
JP-1	PS 1 – Bonnabel #	Spanish Fort	30.01855	-90.1453	0.1 3.6 7.1	3750	5	V/H	D/E	60
JP-5	PS 5 – Parish Line #	Bonnet Carre	30.01140	-90.2789	10.6	900	3	V	E	60
CS-PS	Canal Street	New Orleans	29.99092	-90.1250	3	176	4	V	E	60
OP-6	PS 6 #	New Orleans	29.98693	-90.1240	3.6	9480	15	V/H/C	E	25

* -- Total station capacity
V – Vertical pump
H – Horizontal pump
C – Centrifugal pump
D -- Diesel engine
E -- Electrical engine
-- Additional information in Appendix B

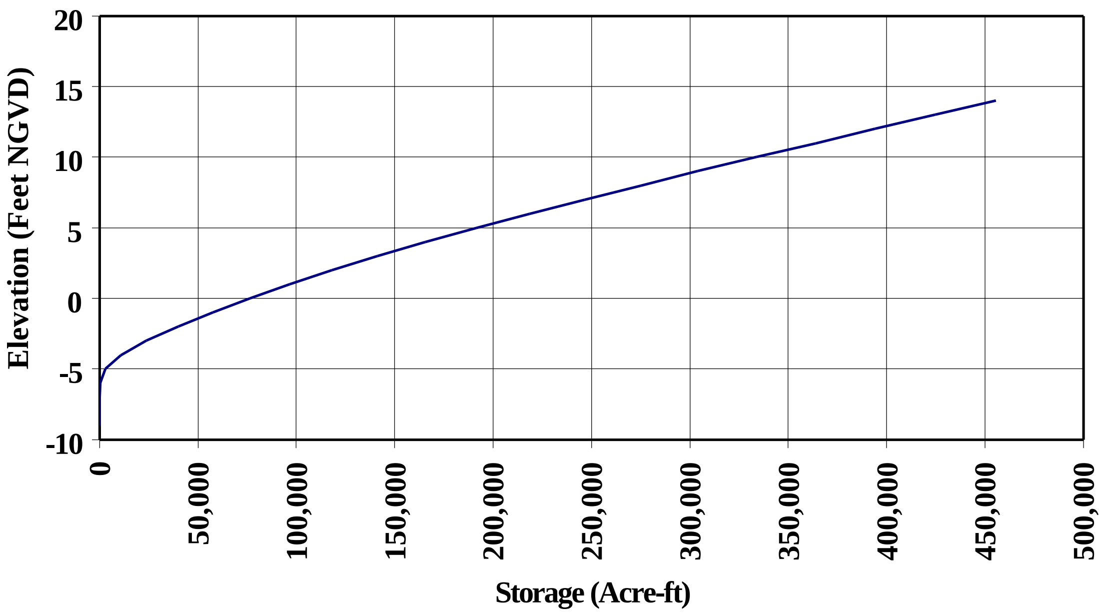
2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is 5 feet NGVD. The lowest ground elevation in the interior is about – 8 feet NGVD. The ponding of storm surge may range anywhere between these two extremes. Stage - storage relationship is shown in Figure E-2-1 below. In the event of catastrophic flooding the area may experience storm surge water elevations in excess of 20 feet NGVD. Within a few hours after storm passage water levels in the levee areas would recede to the elevation of the top of the levees, about + 14 feet NGVD, unless failure of a levee or floodwall occurred. Following this, the water elevations will recede more slowly by gravity drainage through levee segments 1, 2, and 3. Within a few days if unattended, water levels would recede to elevation +5, the lowest elevation along the line of protection at the natural contours near the Mississippi River. If levees and floodwalls remained intact, water depths in low area could be as deep as 13 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet NGVD. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the Lake drain their surcharge of flood water. A stage-storage curve for Area E-2 is shown in Figure E-2-1. A detailed discussion of drainage after inundation is contained in Appendix C. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

3) Emergency Response Plan

a) <u>Levees and floodwalls</u> - The most likely location for damage is at the controlling locations (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Failure may occur from reverse heads. Erosion around floodwalls may occur. Intentional levee breaches will be constructed within the reaches shown in levee segments in the lakeshore levee.

Figure E-2-1
Area E-2 - Jefferson Parish East Bank



The breaches may be built to a combined width of 600 feet at an elevation of + 2 feet NGVD by means of mechanical equipment. Access to the area will be via levee berm on the flood side of the levees wherever practicable, by barge, or by helicopter airlift as the situation demands. In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take one or more days depending upon the width of the breach. See Appendix C. This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet. On the east bank of Jefferson Parish the land generally slopes from the river toward Lake Pontchartrain. With the exception of Hoey's Basin, most floodwater in the parish can drain by gravity through the existing drainage culverts and canals toward the pumping stations located along the lakefront. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as I-10, US 61and it's parallel railroad bed, US 90, and Causeway, and the filled area encompassing the N.O. International Airport can create such obstructions to flow.

(1) Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections. The levee breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation +7 feet NGVD.

(2) Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) <u>Vehicular and Railroad Access</u> - There are five vehicular floodgates in this area. From a drainage standpoint the sill elevation is too high to be very effective. Reopening with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Access will be by road, (from the outside), boat or helicopter. Sandbags used to close off Airline Highway (U./S. 61) and the ICRR at the Jefferson Parish – St. Charles Parish Line may be removed to facilitate drainage of Area E2. Emergency interim repairs with crushed stone and gravel will be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) <u>Drainage Structures</u> - There are 2 drainage structures in area E-2 in Hoey's Basin. Reopening is not expected to present any problems other than access. Access may be by boat, truck or helicopter. Hoey's Basin is a separate drainage area surrounded by alluvial ridges; the area normally drains into the 17th Street Canal. The Mississippi River alluvial ridge surrounds Hoey's Basin to the south and Metairie ridge to the north and west. It drains toward the east via several culverts into the 17th Street Canal. From the canal this drainage is discharged into Lake Pontchartrain by Orleans Pumping Station No 6. In the event of loss of Pumping Station No.6 this area will remain flooded to a height equal to the lowest elevation of the surrounding ridges, about +3, or drain by gravity into some of the lower areas of portions of New Orleans to which it is connected by the 17th Street and Palmetto Canals. To drain this area more, all or part of Pumping Stations No. 6 will have will have to be restored into operation, or a breach will have to be made in the 17th Street Canal along the line of protection at Orleans Parish Pumping Station No. 6.

d) Navigation Structures - There are no navigation structures in area E-2.

e) Pumping Stations- There are seven pumping stations in the area. Six of the seven stations were visited. Of these, the most susceptible to damage from interior flooding is Pump Station #4, which can only withstand flooding to elevation -0.3 feet NGVD. Pump Station #5 is the least susceptible to damage and can withstand flooding to elevation 12.0 feet NGVD.

C. Area E-3 – New Orleans Metro (East Bank)

1) Description

a) General - The area is shown on plate 1 and on plate E-3. The area is located in Orleans Parish and is generally bounded by the Jefferson-Orleans parish line on the west, Lake Pontchartrain on the north, the Inner Harbor Navigation Canal on the east and the Mississippi River on the south. Topography is flat with ground elevations ranging from +12 feet NGVD on the alluvial ridges along the Mississippi River to –8 feet NGVD in the interior of the area. Approximately 50 percent of the area is below sea level. The surface area is 39.4 square miles and the population is approximately 328,000. This is the most highly developed and populated area in the metro area. It is the heart of the city, containing the central business district, many high-rise buildings, the Louisiana Superdome and the historic French Quarter. Along the Mississippi River is a highly developed industrial and port area.

b) Levees and floodwalls - The area is protected by 34.9 miles of levees and floodwalls as shown on plate E-3 and as indicated in tabulation E-3-1 below. The segments described begin at Pump Station #6 on the western side and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevations for the entire area are located in segment 2 (+13.5 feet NGVD) and segment 9 (+13.0 feet NGVD) A storm surge height that exceeds these elevations at these locations will inundate this area.

Table E-3-1
Area E-3: New Orleans Metro (East Bank)
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	17th St. Canal East	Floodwall	2.30	14.0 - 15.0	14.0	
2	Orleans Lakefront	Floodwall/levee	1.60	13.5 - 18.0	13.5	
3	Orleans Canal West	Floodwall	2.30	13.5 - 14.5	14.2	
4	Orleans Canal East	Floodwall	2.40	13.5 - 14.5	14.4	
5	Orleans Lakefront	Levee	1.50	17.5	17.5	clay
6	London Ave Canal West	Floodwall	2.50	14.0	14.0	
7	London Ave Canal East	Floodwall	3.00	14.0	14.0	
8	Orleans Lakefront	Levee/I-wall	2.30	17.5 - 18.0	17.5	
9	IHNC - West Levee	Floodwall/levee	5.60	13.0 - 14.0	13.0	
10	Main Line Mississippi	Floodwall/levee	11.4	22.5 - 25.0	22.5	
	Total Length		34.9	Miles		

Segment 1 through 9 begin from the Orleans Pumping Station No. 6, follow the 17th Street Canal, lakefront, Orleans Avenue Canal, London Avenue Canal, and Inter Harbor Navigation Canal, and end at the IHNC Lock.

Segment 1 This return, protection levee separates the Jefferson Parish East Bank cell from the Orleans East Bank cell. It parallels the 17 th St. Canal, between Pumping Station No. 6 and the lakefront. Hoey's Basin, a local levee and ridge, is drained by Pumping Station No. 6 and ties this segment back into the Main Line Mississippi River project. Included in this segment is a railroad gate, waterproofed bridges, and bridges sandbagged during storms.

Segment 2 This segment runs parallel to the lakefront and consists of earthen levees, floodwall, concrete T-Walls, and numerous vehicular traffic gates.

Segment 3 Extending from the lakefront to Pumping Station No. 7, while running parallel to the Orleans Avenue Canal, is a floodwall atop a low, earthen levee. Also included in this segment are waterproof bridges.

Segment 4 This segment runs parallel to the Orleans Avenue Canal from Pumping Station No. 7 to the lakefront. Included in this segment are waterproof bridges.

Segment 5 This is an all earthen levee parallel to the lakefront running from the Orleans Avenue Canal to the London Avenue Canal. This levee also ties into the a 30 foot, navigable floodgate located several thousand feet above the mouth of Bayou St. John.

Segment 6 This is a segment consisting of a levee topped with floodwall running along London Avenue Canal from the lakefront back to Pumping Station No. 3. It contains several waterproof bridges, bridges sandbagged during storms, and a railroad gate.

Segment 7 Running from Pumping Station No. 3 parallel to the London Avenue Canal, past Pumping Station No. 4 to the lakefront, is a floodwall atop a levee. Included in this section are numerous waterproof bridges, bridges sandbagged during storms, and a railroad gate.

Segment 8 This segment is made of levees and I-Walls running parallel to the lakefront from the London Avenue Canal to the Inner Harbor Navigation Canal.

Segment 9 Along the west Inner Harbor Navigation Canal runs concrete I-Walls atop low, clay levees and concrete T-Walls broken by numerous vehicular and railroad gates.

Segment 10 The Orleans East Bank cell located in the Orleans East Levee District is closed on the south side by this segment consisting of the Main Line Mississippi River levees and floodwalls extending from the Jefferson Parish line to the Inner Harbor Navigation Lock. The protection consists of clay levees, floodwalls atop levees, T-Walls, and numerous vehicular and railroad gates.

c) Gravity drainage structures - There are a total of 55 structures in the protection system. Of these 52 access floodgates provide for vehicular, railroad or pedestrian access. There is one floodgate that provides for navigation access and there are two gated drainage structures. In the event that floodwater is impounded in the protected area, opening these structures may provide gravity drainage through the openings. Pertinent details are tabulated in Table E-3-2 below.

Table E-3-2
Area E-3: New Orleans Metro - East Bank
Gravity Drainage Structures

LOCATION	GATE #	TYPE	OPENING (W x H)	ELEVATION (ft NGVD)	GATE TYPE
17th Street Canal, Orleans side:					
North side of Veterans bridge	12	Swing	5' x 8'	sill 6.5	Pedestrian
South side of Veterans bridge	13	Swing	5' x 7'	sill 7.5	Pedestrian
Pump Sta. #6	14	Swing	22' x 4.59'	sill 9.98	RR
Orleans Parish West, Orleans Marina area:					
Lake Ave.	1	Swing	12' x 7.5'	sill 3.0	Road
Lake Ave.	2	Swing	24' x 6.5'	sill 4.0	Road
Lake Ave.	3	Swing	24' x 6.5'	sill 4.0	Road
Lakeshore Drive	4	Bottom roller	60' x 6.75	sill 6.75	Road
Pontchartrain Drive	5	Swing	30' x 4.5'	sill 9.0	Road
Topaz St.	6	Miter	38' x 9.75'	sill 7.75	Road
Lakefront:					
Marconi Dr.	7	Miter	38' x 5.2'	sill 12.3	Road
Bayou St. John	SG1	Sector gate	30' x 24.5'	Inv. -8.0	Navigation
Bayou St. John	SG2	Sluice gates	2 @ 3' dia. & 1 @ 2' dia.	Inv. -3.0	Drainage
Elysian Fields Ave.	7a	Swing	30' x 6.25'	sill 13.0	Road
Elysian Fields Ave.	7b	Swing	30' x 7.5'	sill 13.0	Road
Elysian Fields Ave.	7c	Swing	30' x 6.25'	sill 13.0	Road

Leroy Johnson near Seabrook bridge	8	Miter	34' x 5.9'	sill 11.6	Road
Entrance to Reserve base off of Leroy Johnson	9	Swing	22' x 5.75'	sill 11.75	Road
France Rd. near Hayne Blvd.	10	Swing	30 x 4.5	sill 9.5	Road
RR near Seabrook bridge	11	Swing	33 x 7.35	sill 7.65	RR
Boat launch road	12	Swing	28 x 5.25	sill 9.75	Road
London Ave. Outfall Canal:					
Leon C. Simon (east side)	42	Swing	5 x 7.9	sill 6.5	Pedestrian
Pump Sta. #3 (east side)	43	Swing	34.3 x 2.87	sill 11.13	RR
Pump Sta. #3 (west side)	44	Swing	34.3 x 2.72	sill 11.28	RR
Orleans Parish West, IHNC West Levee:					
Near IHNC lock	13	Overhead roller	20 x 12	sill 2	Road
Near N. Robertson	14	Overhead roller	20 x 10.75	sill 3.25	Road
Under Claiborne bridge	15	Swing	17 x 8.9	sill 5.1	RR
South end Galvez St. wharf	16	Overhead roller	20 x 8.9	sill 5.1	Road
South end Galvez St. wharf	17	Swing	17 x 12	sill 2.0	RR
Near Galves St.	18	Overhead roller	30 x 12.4	sill 1.6	Road
Loading dock J&L Steel	19	Hinged flap gate	78 x 5.7	sill 8.83	Dock
Lonestar Cement	20	Overhead roller	18 x 9.7	sill 4.3	RR
Lonestar Cement	21	Overhead roller	15 x 6.75	sill 7.25	Road
Lonestar Cement	22	Overhead roller	20 x 6	sill 8.0	RR
Lonestar Cement	23	Overhead roller	20 x 6.25	sill 7.75	Road
N. Dorgenois St.	24	Overhead roller	20 x 7	sill 7.0	Road
Florida Ave wharf	25	Swing	17 x 9.8	sill 4.2	RR
Florida Ave wharf	26	Overhead roller	20 x 6.8	sill 7.25	Road
Florida Ave wharf	27	Overhead roller	20 x 11.25	sill 2.75	Road
North of Fla. Ave near bridge	28	Bottom roller	45 x 2.6	sill 11.41	Road
North of Fla. Ave	29	Bottom roller	45 x 3	sill 11.0	Road
North of Fla. Ave near France	30	Swing	17 x 9.65	sill 4.35	RR
Benefit St.	30a	Overhead roller	39 x 9.43	sill 5.0	Road
Benefit St.	30b	Overhead roller	39 x 9.43	sill 5.0	Road

France Rd. near Almonaster	31	Overhead roller	17 x 10.4	sill 3.6	RR
Between Almonaster & Old Gentilly	32	Overhead roller	32.5 x 8.5	sill 5.5	RR
Old Gentilly Rd.	33	Overhead roller	30 x 8.75	sill 5.25	Road
Between Hwy. 90 & I-10	34	Swing	22.5 x 43	sill 9.7	RR
Between Hwy. 90 & I-10	35	Swing	22 x 3	sill 11.0	Road
Between Hwy. 90 & I-10	36	Swing	22 x 3	sill 11.0	Road
Between Hwy. 90 & I-10	37	Swing	22 x 3	sill 11.0	Road
France Rd. north of Hwy 90	38	Overhead roller	17 x 6.65	sill 7.35	RR
France Rd. north of Hwy 90	39	Overhead roller	20 x 6.55	sill 7.45	Road
Florida Ave. Complex (west):					
Florida Ave	40	Overhead roller	40 x 12.4	sill 1.6	Road
Florida Ave. Drainage Canal	sg3	Sluice gates	2 @ 12.5 x 13	Inv. -26.68	Drainage
RR just north of Florida Ave.	41	Swing	31.5 x 6.4	sill 7.6	RR

(1) There is one navigation access structure located in Bayou St. John, near it's junction with Lake Pontchartrain (Lakefront Area). The structure is 30 feet wide with a sill elevation of –8 feet NGVD and is closed with 2 electrically operated sector gates. Additional details on this structure are contained in the New Orleans Emergency Data Container.

(2) There are also two drainage structures. One structure is immediately adjacent to the Bayou St. John sector gate structures (see above). It has 2 – 36 inch diameter culverts and 1 – 24 inch diameter culvert, all with a sill elevation of –3 feet NGVD and manually operated gates. The other drainage structure is near P.S. #19 (levee segment 9) and has 2 – 12.5'x13' box culverts with a sill elevation of –26.7 feet NGVD. Additional details on the drainage structures is in the New Orleans District Emergency Data Container.

d) Pumping stations - There are 10 pumping stations that drain the protected area. The location of the pumping stations are shown on plate E-3 and pertinent details are tabulated in Table E-3-3 below. The pumps are operated by the New Orleans Sewerage and Water Board. Six of the pumps on the perimeter evacuate the water over or through the protection system. The remaining four in the interior assist gravity drainage to reach the perimeter stations. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box").

Table E-3-3 Area E-3: New Orleans Metro - East Bank Pumping Station Summary										
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab Elev (Est ft) NGVD	Pump Flow (CFS)	No. Pump	Pump Type	Driver Type	Freq. Hertz
OP-12	PS 12	Spanish Fort	30.02096	-90.1139	3.6	1000	1	H	E	25
OP-4	PS 4	Spanish Fort	30.01611	-90.0676	2.4	3680	6	V/H	E	25/60
OP-7	PS 7 #	New Orleans	29.99424	-90.1010	3.8	2690	5	V/H	E	25/60
OP-3	PS 3 #	New Orleans	29.98836	-90.0680	4.1	4140	7	H/C	E	25/60
OP-6	PS 6 #	New Orleans	29.98693	-90.1240	3.6	9480	15	V/H/C	E	25
OP-5	PS 5	New Orleans	29.98011	-90.0191	3.6	2260	7	H/C	E	25
OP-19	PS 19 #	New Orleans	NA	NA	12.6	3770	5	V/H	E	60
Mont	Monticello	New Orleans	NA	NA	NA	99	3	V	E	60
OP-2	PS 2	New Orleans	29.96854	-90.0839	3.6	3190	7	V/H/C	E	25
OP-1	PS 1	New Orleans	29.95417	-90.0986	3.6	4640	10	V/H	E	25/60

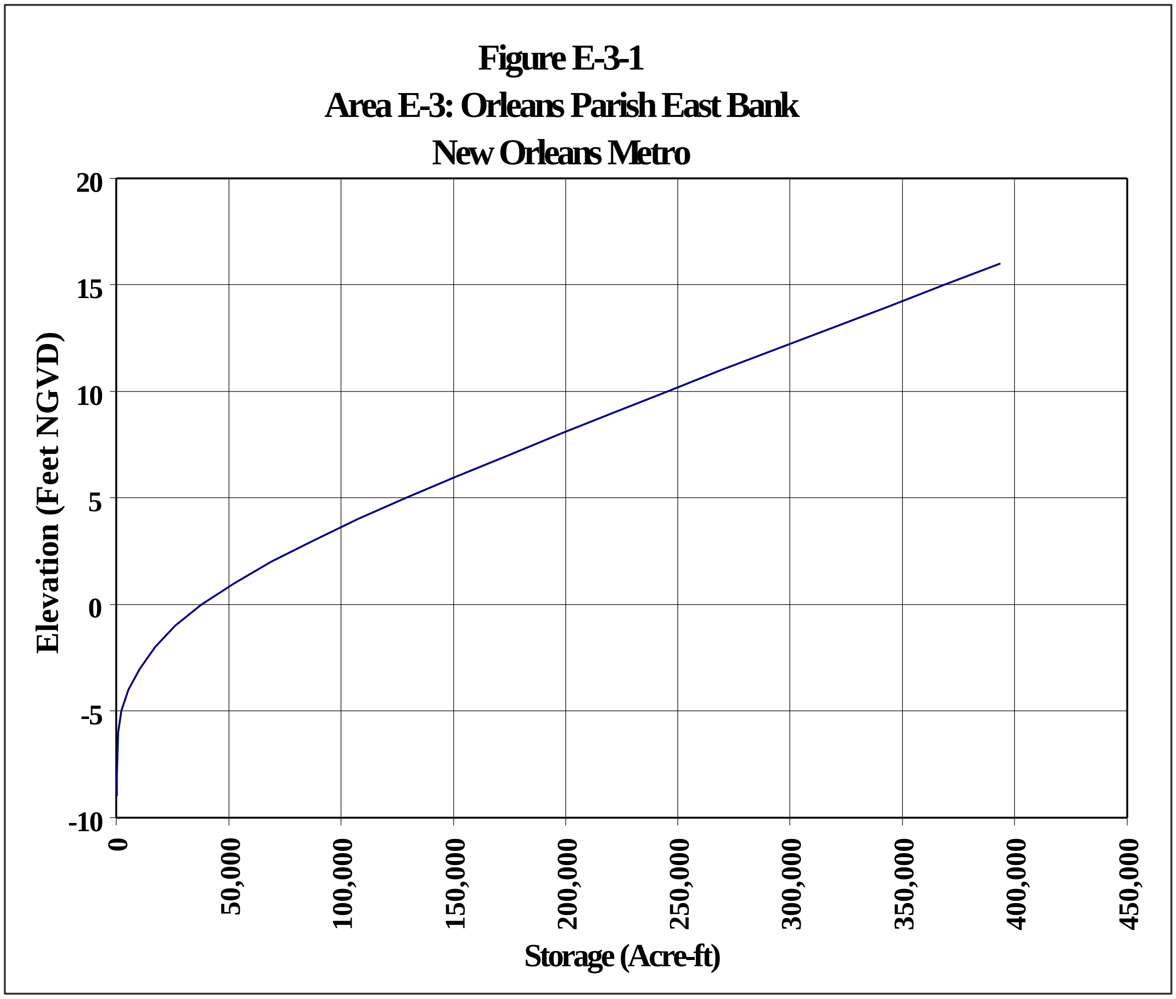
-- Additional information in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +13.0 to 13.5 feet NGVD. The lowest ground elevation in the interior is about –8 feet NGVD. Hurricane storm surges may exceed +20 feet NGVD in this area. Residual flooding elevation may range anywhere between these two extremes. Stage - storage relationship is shown in Figure E-3-1 below. A detailed discussion of drainage after inundation is contained in Appendix C.

3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur with reverse heads. Intentional levee breaches may be constructed within the reaches shown on plate E-3 in levee segment(s) 2 and 9. The breaches may be constructed to a combined width of 500 feet and a depth of cut elevation of +2 feet NGVD by means of



dragline or backhoe. Access to the area will be via levees, by water from Lake Pontchartrain or IHNC or by helicopter. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags or by use of temporary steel sheet piling. The levees breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation +7 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

a) <u>Vehicular and Railroad Access</u> - There are 52 vehicular and RR floodgates in this area. The most effective locations, from a drainage standpoint are in levee segments 2 and 9. Reopening with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Many of the gates in this area, particularly the overhead roller type, will likely fail if they are subjected to any appreciable reverse head. Access

b) will be by road, (from the outside), boat or helicopter. Emergency interim repairs with crushed stone and gravel will be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) Drainage Structures - There are 2 drainage structures in this area. Reopening is not expected to present any problems other than access. Access may be by boat, truck or helicopter.

d) Navigation Structures - There is 1 navigation structure in the area. (Bayou St. John) This structure is wide enough and deep enough to provide significant gravity drainage. However, the control house for the gate operating machinery will begin to flood at an interior water elevation of +4.5 feet NGVD and the operating machinery will begin to flood at +11.7 feet NGVD. If this area is inundated, the structure will require repair/rehabilitation before it can be reopened. Also, reopening the structure may result in high velocities through the structure and may cause severe scour near the structure.

e) Pumping Stations - There are 10 pumping stations in the area. The most susceptible to damage from interior flooding is Pump Station # 19, which can only withstand flooding to elevation 6.6 feet NGVD. Pump Station # 7 is the least susceptible to damage and can withstand flooding to about elevation 11.6 feet NGVD.

D. Area E-4A – Orleans Parish East Bank – New Orleans East - Citrus

1) Description

a) General - The area is shown on plate 1 and plate E-4A. The area is located in Orleans Parish east of the Inner Harbor Navigation Canal (IHNC), between the Mississippi River Gulf Outlet (MRGO) and Lake Pontchartrain. It has a land area of 32.3 square miles and a population of 89,500 people protected from hurricane storm surge by levees and floodwalls. Area E-4A is essentially a high-density residential community with an industrial area along the IHNC and the MRGO and a few buildings of 3 or more stories in height scattered throughout the area. It is generally bounded by the IHNC on the west, Lake Pontchartrain on the north, Bayou Sauvage Wildlife Area on the east and the MRGO on the south. Topography is flat with ground elevations ranging from +5 feet NGVD along Gentilly Road (US 90) to -7 feet NGVD in some of the residential areas. Approximately 75 percent of the area is below sea level.

b) Levees and floodwalls - The area is protected by 31.0 miles of levees and floodwalls as indicated in Table E-4A-1 below. The segments described begin at MRGO and the IHNC and proceed clockwise around the area, along the lakefront to Paris Road. From there local levees proceed south to Interstate 10 then East to the Maxent Canal and south to the MRGO, where Federal levees resume westward along the MRGO to the IHNC. The controlling (lowest) elevation for each segment is shown in Table E-4A-1. The lowest exterior levee elevations for Area E-4A are located in segments 1,2,3, and 5 (13.0 – 13.5 feet NGVD). A storm surge height which overtops Area E-4B to the east and floods that area higher than +5 feet NGVD will also inundate this area. The lowest protection offered by exterior levees in Area E-4A is along the MRGO/GIWW.

Table E-4A-1 Area E-4A: New Orleans East (Citrus) Levees And Floodwalls						
Seg-ment Num-ber	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	IHNC-East	Embed Sheet Pile/Floodwall	2.75	13.0-14.0	13	
2	NO Lakefront	Floodwall	1.20	13.5	13.5	
3	Citrus Lakefront	Levee/Floodwall	1.03	14.5	13.5	
4	Citrus Lakefront	Levee	3.80	14.0	14	Clay
5	Lincoln Beach	Embed Sheetpile	0.31	13.5	13.5	
6	Citrus Lakefront	Levee	0.51	14.0	14	Clay
7	Local Interior Levee	Levee	8.20	3.0	3	Clay
8	NO East Back Levee	Levee	2.00	17.5	17.5	Clay
9	Michoud Canal	Levee/Floodwall	2.03	20.0	20	Clay
10	Michoud Canal	Levee/Floodwall	1.75	18.0	18	Clay
11	Citrus Back Levee	Levee/Floodwall	7.45	14.0-18.0	14	Clay
	Total Length		31.0	Miles		

Segment 1 Extends from the GIWW to the New Orleans Lakefront and runs parallel to the Inner Harbor Navigation Canal (IHNC). This segment has levee with embedded sheetpile in the area close to the GIWW and floodwall as the protection nears the lakefront.

Segment 2 Extends from the IHNC past New Orleans Lakefront Airport.

Segment 3 Extends from New Orleans Lakefront Airport to approximately 1/4 mile past the St. Charles pumping station. The flood protection includes the floodwalls that are below the newly constructed road crossings near the riverboat and Downman Road.

Segment 4 Extends from approximately 1/4 mile east of the St. Charles Pumping Station to the local interior levee.

Segment 5 Is a reach of embedded sheetpile in front of Lincoln Beach.

Segment 6 Extends from the floodwall at Lincoln Beach to the local interior levee.

Segment 7 Is the local interior levee that extends from the lakefront levee to the pumping station on the GIWW.

Segment 8 Extends from the pumping station on the GIWW and runs parallel to the GIWW to the Michoud Canal

Segments 9 & 10 Consist of a combination of levee with floodwalls and runs parallel to the Michoud Canal.

Segment 11 Extends from the Michoud Canal to the IHNC. It consists of earthen levees except for floodwalls near the three pumping stations which are located in this segment and several small reaches of levee with embedded sheetpile.

c) Gravity drainage structures - There are 21 floodgates in the protection system that provide for vehicular or railroad access. There are no culverts expressly for the purpose of gravity drainage. Pertinent details are tabulated in Table E-4A-2 below.

Table E-4A-2
Area E-4A: New Orleans East (Citrus)
Gravity Drainage Structures

LOCATION	GATE #	TYPE	OPENING\ (W x H Feet)	SILL ELEVATION (Feet NGVD)	GATE TYPE
***IHNC East Levee**:*					
Between Hayne Blvd and Dwyer Rd	47	Swing	17 x 10.7	3.3	RR
Between Hayne Blvd and Dwyer Rd	48	Overhead roller		6.6	Road
Dwyer and Jourdan Rd.	49	Overhead roller	17 x 7.45	6.3	RR
Dwyer Road Pump Station	50	Overhead roller	15 x 5	9.0	Road
Old Gentilly Rd.	51	Overhead roller	35 x 5.55	8.45	Road
RR near Old Gentilly	52	Overhead roller	37.25 x 5.3	8.7	RR
Near Almonaster	53	Overhead roller	20 x 5	9.0	Road
Plant Rd and Jourdan Rd.	54	Overhead roller	17 x 5.6	8.45	RR
Between Almonaster and MRGO	55	Overhead roller	20 x 5.5	8.5	Road
Between Almonaster and MRGO	56	Overhead roller	20 x 5.5	8.5	Road
Jourdan Rd Terminal	57	Swing	18 x 6.27	8.25	RR
New Orleans Airport and Lincoln Beach					
Hayne Blvd	58	Overhead roller	30 x 13	0.0	Road
Between Leroy Grumman & Hayne	59	Swing	33 x 2.53	10.47	RR
Leroy Grumman	60	Swing	32 x 6.5	6.5	Road
Crosses Road on Northside of Seabrook Bridge	61	Swing	26 x 8	5.0	Road
Downman and Lakeshore	62	Swing	22 x 6.17	4.33	Road
Casino Blvd.	63	Overhead roller			Road
Lincoln Beach	64		32 x 10.2	0.3	Road
Citrus Back along Intracoastal Waterway					
Dock Board wharf	65	Overhead roller	20 x 5.5	9.5	Road
Michoud steam electric station	66	Overhead roller	20 x 8.7	13.3	Road
Michoud steam electric station	67	Overhead roller	20 x 8.7	13.3	Road

d) Pumping stations - There are 8 pumping stations that drain the protected area. These are operated by Orleans Parish Sewerage and Water Board. The locations of the pumping stations are shown on plate E-4A and pertinent details are tabulated in Table E-4A-3 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and the New Orleans District Emergency Data Container ("Black Box").

Table E-4A-3
Area E-4A: New Orleans East (Citrus)
Pumping Station Summary

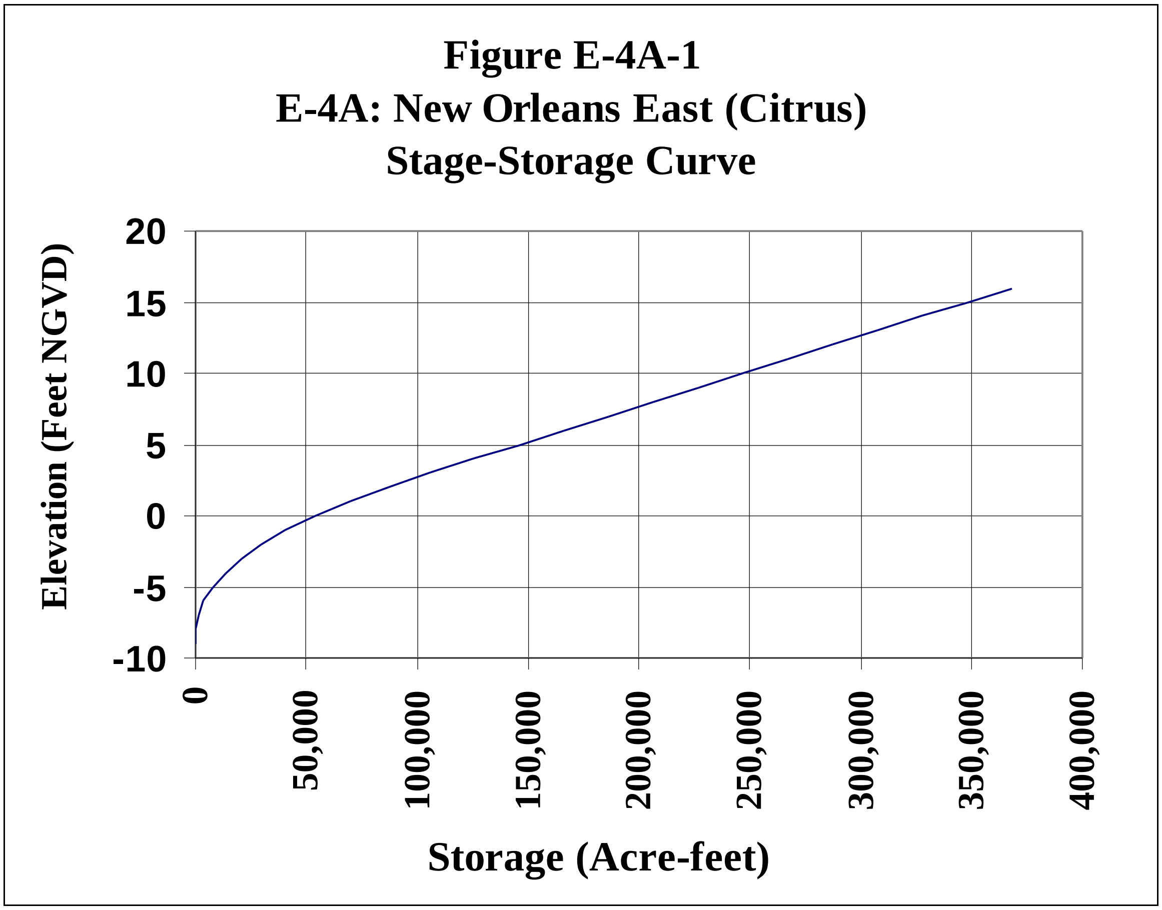
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) NGVD	Pump Flow (CFS) *	No. Pump	Pump Type	Driver Type	Freq Hertz
OP-14	PS 14 - Jahncke #	Chef Menteur	30.05860	-89.9667	16.1	1200	4	H	E	60
OP-10	PS 10 - Citrus	Chef Menteur	30.04680	-89.9886	NA	1000	4	V	E	60
OP-16	PS 16 - St. Charles #	Spanish Fort	30.03810	-90.0112	16.1	1000	4	H	E	60
DR	Dwyer Rd.	Spanish Fort	30.01616	-90.0252	0	120	2	V	E	60
OP-18	PS 18 - Maxent	Chef Menteur	NA	NA	NA	150	2	V	E	60
GS	Grant St.	Chef Menteur	NA	NA	NA	112	6	V	E	60
Elai	Elaine St.	New Orleans	NA	NA	NA	90	2	V	E	60
OP-20	PS 20 - Amid	New Orleans	NA	NA	NA	500	2	V	E	60

H- Horizontal E- Electrical
V- Vertical
- Additional information available in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is 13 feet NGVD. The lowest ground elevation in the interior is about – 7 feet NGVD. The ponding of storm surge may range anywhere between these two extremes. Stage - storage relationship is shown below in Figure E-4A-1. In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet NGVD. Within a few hours after storm passage water levels in the levee areas would recede to the elevation of the top of the levees, about +13 feet NGVD, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 20 feet after the storm. Within 72 hours after passage of the storm water levels in Lake

Pontchartrain would recede to a normal high level of +3 to +4 feet NGVD. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the lake drain their surcharge of flood water. A detailed discussion of drainage after inundation is contained in Appendix C. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling locations (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur due to reverse head. Intentional levee breaches may be constructed within the reaches shown on plate E-4A in levee segments 8 and 11. The breaches may be constructed to a combined width of about 500 feet to an elevation of + 2 feet NGVD by means of mechanical equipment. Access to the area will be via levee berm on the flood side of the levees wherever practicable, by barge, or by helicopter airlift as the situation demands. In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take about 5 days depending upon the width and depth of the breach. See Appendix C. This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach is kept open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet NGVD. Immediate interim repair of levee breaches and levee erosion may be by use of material obtained from degrading of adjacent levee sections, by sandbags, or by temporary sheet piling. The levees breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation +7 feet NGVD.

Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are 15 vehicular floodgates in this area and 6 railroad floodgates. From a drainage standpoint there are 4 floodgates that may be used for drainage if needed. These floodgates have sill elevations of 4.33 feet NGVD or below. Many of these floodgates, particularly the overhead roller type will fail if subject to any appreciable reverse head. The location and information can be seen in Table E-4A-2. Reopening with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Access will be by road, (from the outside), boat or helicopter. Emergency interim repairs with crushed stone and gravel will be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) Gravity Drainage Structures - There are no drainage structures in area E-4A

d) Navigation Structures - There are no navigation structures in area E-4A.

e) Pumping Stations – There are eight pumping stations in the area. Two of the eight stations were visited. Of these, the least susceptible to damage from interior flooding are Pump Stations #14 and #16, which can withstand flooding to elevation 17.1 feet NGVD.

E. Area E-4B – Orleans Parish East Bank – New Orleans East – Bayou Sauvage Refuge

1) Description

a) General - The area is shown on plate 1 and plate E-4B. The area is located in Orleans Parish and has a land area of 22.2 square miles. It is mostly a wildlife refuge and wetlands. It is generally bounded by Maxent Canal Levee on the west, Lake Pontchartrain on the north, Lake St. Catherine on the east, and the Intracoastal Waterway on the south. Topography is flat with ground elevations ranging from +2 to –5 feet NGVD in the interior of the area. Approximately 20 percent of the area is below sea level.

b) Levees and floodwalls - The area is protected by 27.3 miles of levees and floodwalls as shown on plate E-4B and as indicated in the tabulation below. The segments described begin at Lakefront and the Maxent Canal Levee and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown in Table E-4B-1. The controlling elevation for the entire area is +13.5 feet NGVD located in segment 2. A storm surge height that exceeds this elevation at this location will inundate this area.

Table E-4B-1
Area E-4B: New Orleans East
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	NO East Lakefront	Levee	6.52	14	14	Clay
2	NO East	Levee	8.36	14-17.5	13.5	Clay
3	NO East Back	Levee	4.26	19	18.5	Clay
4	Local Interior Levee	Levee	8.20	3.0	3	Clay
	Total Length		27.3	Miles		

Segment 1 Extends from Paris Road to South Point. The levee consists of a sand core covered by a clay blanket and berm. The levee was constructed on the Little Woods Canal bottom.

Segment 2 Extends from South Point to the GIWW. I-10, Highway 11 and Highway 90 cross the levee. There is a floodgate at the Highway 11 crossing and a floodgate under construction at the Highway 90 crossing. There is a railroad crossing with a floodgate south of the Highway 90 crossing.

Segment 3 Extends from the South Point to GIWW levee to Pumping Station No. 15.

Segment 4 Is a local levee and extends from Pumping Station No. 15 to the lakefront.

c) Gravity drainage structures - There are 3 floodgates in the protection system that provide for vehicular or railroad access. There are several sluice gates that provide reverse flow and flood protection at 4 gravity drainage structure locations. The locations of the drainage structures are shown on plate E-4B. Pertinent details of all structures are tabulated in Table E-4B-2 below.

Table E-4B-2
Area E-4B: New Orleans East (Bayou Sauvage)
Gravity Drainage Structures

Location	Gate #	Type	Opening (W x H)	Sill Elevation (feet NGVD)	Gate Type
Bayou Sauvage:					
L&N RR tracks	86	Swing	18 x 4.55	sill 9.45	RR
Hwy 90	87	Bottom roller	74 x 5.12	sill 9.38	Road
Hwy 11	88	Bottom roller	84.7 x 4.7	sill 9.8	Road
GIWW – South Point	NA	Sluice	5@ 6.3x4.3	sill –2.4	Box Culvert
GIWW – South Point	NA	Sluice	3@3.5	sill –1.0	CMP
GIWW – South Point	NA	Sluice	3@4	sill –1.0	CMP
GIWW – South Point	NA	Sluice	4@4.5	sill –1.2	CMP

d) Pumping Stations - There is 1 pumping station that drains the protected area. It is operated by Orleans Parish Sewerage and Water Board. The location of the pumping station is shown on plate E-4B and pertinent details are tabulated in Table E-4B-3 below. Note: Additional detailed information in the pumping stations, if available, is contained in Appendix B and the New Orleans District Emergency Data Container ("Black Box").

Table E-4B-3
Area E-4B: Orleans Parish - New Orleans East (Bayou Sauvage)
Pumping Station Summary

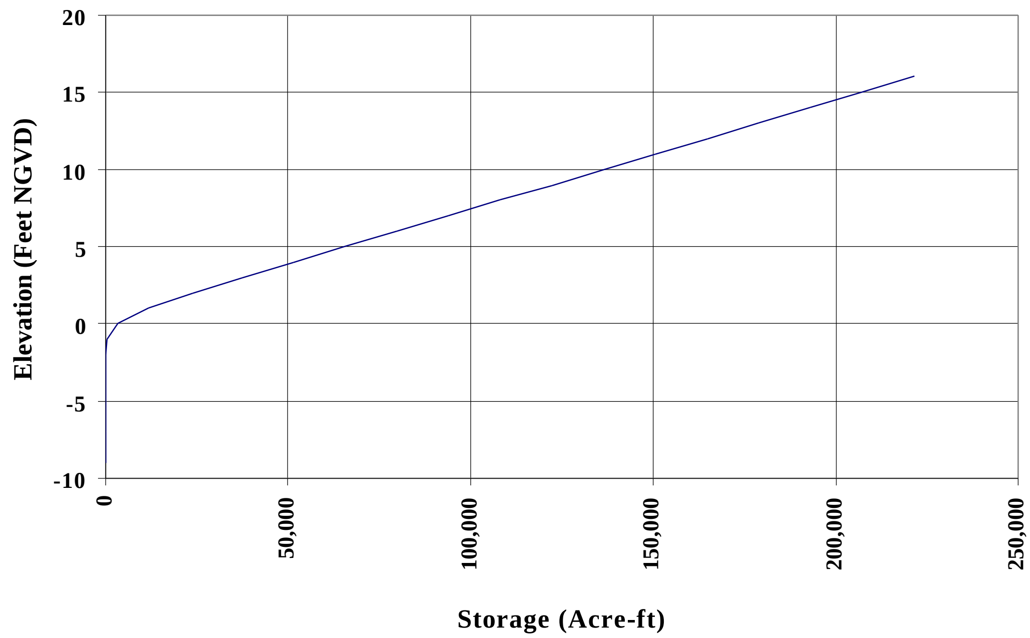
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est) feet NGVD	Pump Flow (cfs)*	No. Pump	Pump Type	Driver Type	Freq. (Hz)
OP-15	PS 15	Chef Menteur	30.02992	-89.8681	19.6	750	3	V	D/E	60

* -- Total station capacity
V – Vertical pump
H – Horizontal pump
C – Centrifugal pump
D -- Diesel engine
E -- Electrical engine
-- Additional information in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +13.5 feet NGVD. The lowest ground elevation in the interior is about – 5.0 feet NGVD. The ponding of storm surge may range anywhere between these two extremes. Stage - storage relationship is shown in figure E-4B-1. In the event of catastrophic flooding the area may experience water elevations in excess of 20.0 feet NGVD. Within a few hours after storm passage water levels in the levee areas would recede only to the elevation of the top of the levees, about + 13.5 feet NGVD, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 18.0 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet NGVD. Water levels most likely would remain above normal for another 1-2 weeks while marshes surrounding Lake Pontchartrain drain their surcharge of floodwater. A detailed discussion of drainage after inundation is contained in Appendix C. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

Figure E-4B-1
Area E-4B: Orleans Parish
New Orleans East (Bayou Sauvage)



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling locations (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse head. Intentional levee breaches will be constructed within the reaches shown on plate E-4B in levee segment 3. The breaches may be dug to a combined width of 400 feet and a depth of + 2 feet NGVD by means of mechanical equipment. Access to the area will be via levee berm on the flood side of the levees wherever practicable, by barge in the GIWW, or by helicopter airlift as the situation demands. In the event that breaching of the line of protection is necessary, drainage of most of the area to normal outside water level will take one or more days depending upon the width of the breach. See Appendix C. This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until exterior water levels return to normal, interior floodwater elevations for those areas that can drain freely into surrounding water bodies will reach about 1.5 feet. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags or by temporary steel sheet piling. The levees breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation + 7.0 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are 2 vehicular and 1 railroad floodgates in this area. From a drainage standpoint the sill elevations are too high to be used for drainage effectively. Reopening with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Access will be by road, (from the outside), boat or helicopter. Emergency interim repairs with crushed stone and gravel will be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) Gravity Drainage Structures - There are 4 drainage structures in Area E-4B all equipped with manually operated sluice gates. Reopening is not expected to present any problems other than access. Access may be by boat, truck or helicopter.

d) Navigation Structures - There are no navigation structures in this area.

e) Pumping Stations - There is 1 pumping station in the area. It was not visited; therefore, damages from interior flooding can not be determined.

F. Area E-5A – Saint Bernard Parish – Chalmette (includes part of Orleans Parish East Of Inner Harbor Navigation Canal and Violet, LA

1) Description

a) General - The area is shown on plate 1 and plate E-5A. The area is located in Saint Bernard Parish, has a land area of 31.4 square miles and a population of 88,400 people protected from hurricane storm surge by levees and floodwalls. Area E-5A is essentially a high density residential community. It is generally bounded by Orleans Parish on the west, St. Bernard Interior Local Levee on the north and east, and the Mississippi River on the south. Topography is flat with ground elevations ranging from +12 feet NGVD on the alluvial ridges along the Mississippi River to –5 feet NGVD in the interior of the area. Approximately 20 percent of the area is below sea level.

b) Levees and floodwalls - The area is protected by 45.0 miles of levees and floodwalls as indicated in the tabulation below. The segments described begin at Mississippi River and the Orleans Parish line and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown in Table E-5A-1. The controlling elevation for the entire area is located in segment 4. A storm surge height that exceeds this elevation at this location will inundate this area. In addition, any storm surge that inundates Area E-5B will also inundate Area E-5A, since the interior levee separating the two areas is only +8 feet NGVD. The controlling elevation for E-5B is +14 feet NGVD.

Table E-5A-1
Area E-5A: St. Bernard Parish - developed
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	IHNC Lock-Florida Ave	Floodwall	1.3	15	15	
2	Interior Local Levee	Levee/floodwall	21.4	8	8	Clay
3	Verret-Caernarvon	Levee/floodwall	8.3	16.5	16	Clay
4	Caernarvon Diversion	Floodwall	0.8	13.5	13.5	
5	Miss. River Levee	Levee	13.2	20.0 – 22.5	20.0	Clay
	Total Length		45.0	Miles		

Segment 1 Extends from the IHNC lock to a local internal earthen levee. It is a floodwall which parallels the Inner Harbor Navigation Canal (IHNC).

Segment 2 Is a low internal earthen levee with intermediate floodwall atop seperates a highly developed area from a marsh wetlands. It extends from IHNC to the Lake Borgne Canal where it ties into high natural contour adjacent to Highway 39 at Violet, LA. It then extends back along the south side of the Lake Borgne Canal continuing south until tying into the Federal Hurricane Protection System in the area of Verret, LA.

Segment 3 Consists of an all earthen levee with a pump station and drainage structure along this segment.

Segment 4 Consists of a sheet pile wall atop a clay levee parallel to the Caernarvon fresh water diversion canal. It includes a highway roller gate at Highway 39 and a railroad gate before tying into the Mississippi River Levee.

Segment 5 Is the Mississippi River levee. This segment closes the West side of the cell. The levee is an all clay levee with crushed stone surfacing on the 10' wide crown. It extends from the Inner Harbor Lock in the Orleans East Levee District 1.7 miles to the St. Bernard Parish line and continues 11.5 miles within the Lake Borgne Basin Levee District to the Plaquemines Parish line at Caernarvon, LA. This segment is not shown on plate E-5A but the levee parallels the Mississippi River.

c) Gravity drainage structures - There are a total of 6 structures in the protection system. Of these, 2 are drainage structures and 4 provide for vehicular or railroad access. Pertinent details are tabulated in Table E-5A-2 below.

Table E-5A-2
Area E-5A: St. Bernard Parish - developed
Gravity Drainage Structures

Location	Gate #	Type	Opening (W x H)	Elevation (feet NGVD)	Gate Type
REACH 5a					
St. Bernard Parish:					
Florida Ave. Complex East:					
Florida Ave.	1	Overhead roller	40 x 11.28	sill 2.72	Road
Drainage Canal	2	Sluice gates	2 @ 12.5 x 13	Inv. -21.43	
Southern RR	3	Swing	20 x 6.2	sill 7.8	RR
Lower St. Bernard Parish:					
Creedmore canal	9	Sluice gates	2 @ 6' dia.	Inv. -5.81	
Hwy 39, Caernarvon	10	Swing	23 x 8.45	sill 5.55	RR
Hwy 39, Caernarvon	11	Bottom roller	45 x 6	sill 8.0	Road

d) Pumping Stations - There are 9 pumping stations that drain the protected area. Eight of these are operated by St. Bernard Parish Drainage Department and one by Orleans Parish Sewerage and Water Board. The locations of the St. Bernard pumping stations are shown on plate E-5A and pertinent details are tabulated in Table E-5A-3 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and the New Orleans District Emergency Data Container ("Black Box").

Table E-5A-3
Area E-5A: Orleans & St. Bernard Parishes - Developed
Pumping Station Summary

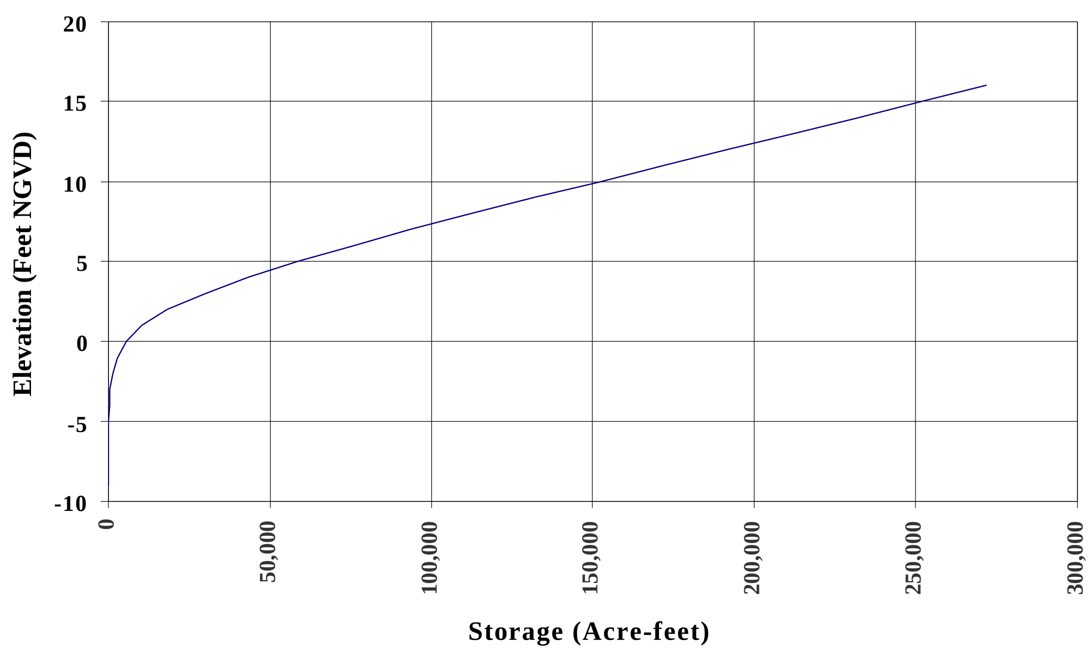
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab Elev (ft NGVD)	Pump		Pump Type	Driver Type	Freq. (Hz)
						Flow (cfs)	No. Pump			
OP-5	PS 5	New Orleans	29.98011	-90.0191	3.6	2260	7	H/C	E	25
F-1	PS 1 – Fortification #	St. Bernard	29.96622	-89.9749	16	1214	3	V	D/E	60
JL-6	PS 6 - Jean Lafitte #	St. Bernard	29.96622	-89.9749	16	1003	3	V	D	
G-2	PS 2 – Guichard #	St. Bernard	29.96161	-89.9645	0	724	4	H	D	
BV-3	PS 3 - Bayou Villere	St. Bernard	29.95139	-89.9343	10	501	3	H	D	
BD-7	PS 7 - Bayou Ducros	St, Bernard	29.94697	-89.9220	16	1003	3	H	D	
M-4	PS 4 – Meraux	St. Bernard	29.92117	-89.8911	16	1214	3	V	D/E	60
EJG-5	PS 5 - E.J. Gore #	St. Bernard	29.87978	-89.8747	2	668	6	H	D	
SM-8	PS 8 - St. Mary #	St. Bernard	29.85439	-89.79539	16	836	3	V	D	

* -- Total station capacity
V – Vertical pump
H – Horizontal pump
C – Centrifugal pump
D -- Diesel engine
E -- Electrical engine
-- Additional information in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +13.5 feet NGVD. The lowest ground elevation in the interior is about – 5.0 feet NGVD. The ponding of storm surge may range anywhere between these two extremes. Stage - storage relationship is shown in figure E-5A-1. In the event of catastrophic flooding the area may experience water elevations in excess of 20.0 feet NGVD. Within a few hours after storm passage water levels in the levee areas would recede only to the elevation of the top of the levees, about + 13.5 feet NGVD, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 18.5 feet after the storm. Within 72 hours after passage of the storm water levels in the surrounding water bodies, the IHNC, MRGO, and Lake Borgne, would recede to a normal high level of +3 to +4 feet NGVD. Water levels most likely would remain above normal for another 1-2 weeks while marshes surrounding Lake Pontchartrain drain their surcharge of floodwater through this area to the Gulf of Mexico. A detailed discussion of drainage after inundation is contained in Appendix C. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

Figure E-5A-1
Area E-5A: St. Bernard Parish (Developed Area)



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling locations (lowest spots) as discussed in paragraph 3) a) above. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse head. Intentional levee breaches will be constructed within the reaches shown on plate E-5A in levee segment 1. The breaches will be dug to a combined width of 600 feet and a elevation of + 2 feet NGVD by means of mechanical equipment. Access to the area will be via levee berm on the flood side of the levees wherever practicable, by barge in the MRGO/GIWW, or by helicopter airlift as the situation demands. In the event that breaching of the line of protection is necessary, drainage of most of the area to normal outside water level will take one or more days depending upon the width of the breach. See Appendix C. This would leave the interior stage at +4 to +1.5 feet NGVD depending upon the exterior stage. If the breach can remain open until exterior water levels return to normal, interior floodwater elevations for those areas that can drain freely into surrounding water bodies will reach about 1.5 feet. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags, or by temporary steel sheet piling. The levees breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation + 7 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are 2 vehicular and 2 railroad floodgates in this area. From a drainage standpoint there is one floodgate that may be used for drainage if necessary. This floodgate has sill elevation of 2.72 feet NGVD. It will likely fail if subjected to an appreciable reverse head. Information can be seen in Table E-5A-2. Reopening of floodgates with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Access will be by road, (from the outside), boat or helicopter. Emergency interim repairs with crushed stone and gravel will be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) Gravity Drainage Structures - There are 2 drainage structures and 4 floodgates with the potential of being used for drainage in area E-5A. Reopening of the drainage structures is not expected to present any problems other than access. Access may be by boat, truck or helicopter.

d) Navigation Structures - There are no navigation structures in this area.

e) Pumping Stations - There are 9 pumping stations in Area E-5A. Five of the nine stations were visited. Of these, the most susceptible to damage from interior flooding is P.S. #5, which can only withstand flooding to elevation + 3.5 feet NGVD. P.S. #1 is the least susceptible to flood damage and can withstand flooding to about elevation 18.0 feet NGVD.

G. Area E-5B– St. Bernard Parish (Sump)

1) Description

a) General - The area is shown on plate 1 and plate E-5B. The area is located in St. Bernard Parish east of the Inner Harbor Navigation Canal (IHNC), between the Mississippi River – Gulf Outlet (MRGO) and the Mississippi River. It has a land area of 43.8 square miles and a population of 0 people protected from hurricane storm surge by levees and floodwalls. Area E-5B is essentially a marsh with very few buildings in the area. It is generally bounded by the St. Bernard interior local levee on the south and west and MRGO on the north and east. Topography is a natural marsh where the water levels vary with the tide approximately +1.5 feet NGVD. The bottom of ponds in this area reach as low as –7 feet NGVD, however this cannot be used as storage since it is already underwater. Therefore, none of the area can be considered below sea level.

b) Levees and floodwalls - The area is protected by 43.2 miles of levees and floodwalls as indicated in the tabulation below. The segments described begin at IHNC and proceed clockwise around the area, along the MRGO southeast to near Verret where it turns southwest to the St. Bernard interior local levee. From there local levees proceed northwest returning to IHNC. The controlling (lowest) elevation for each segment is shown in Table E-5B-1. The lowest exterior levee elevations for the entire area are located in segment 2 along the MRGO.

Table E-5B-1
Area E-5B: St. Bernard Parish (Sump)
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	IHNC	Floodwall	.4	16	16	
2	M.R.-G.O.	levee/floodwall	6.8	14	14	
3	Bienvenue-Verret	levee/floodwall	14.6	17.5	17.5	Clay
4	Interior	levee/floodwall	21.4	8	8	Clay
Total Length			43.2Miles			

Segment 1 Consists of a floodwall and all clay levee that runs parallel to the Inner Harbor Navigational Canal with a railroad gate at the immediate start of the tie-in.

Segment 2 Is a predominately clay levee which includes several vehicular gates and segments of I-Wall atop. It extends from the Inner

Harbor Navigational Canal along the Mississippi River Gulf outlet and ties into the Bayou Bienvenue Control Structure.

Segment 3 Is an all earth levee except for isolated locations where poor stability dictated the use of steel sheet pile atop clay levee. It extends from the Bayou Bienvenue Control Structure to the vicinity of Verret, LA. It is not accessible to vehicular traffic. Wetlands are along the West side while the M.R.-G.O. on the east. The floodgate on each side does not accommodate vehicular traffic.

Segment 4 Is a low internal earthen levee with intermediate floodwall that separates a highly developed area from a marsh wetlands. It extends from IHNC to the Lake Borgne Canal where it ties into high natural contour adjacent to Highway 39 at Violet, LA. It then extends back along the south side of the Lake Borgne Canal continuing south until tying into the Federal Hurricane Protection System in the area of Verret, LA.

c) Gravity drainage structures - There are 2 floodgates in the protection system that provide for navigation access. These allow the pumped water from area E-5A to drain into the MRGO and surrounding waters. Pertinent details are tabulated in Table E-5B-2 below.

Table E-5B-2
Area E-5B: St. Bernard Parish (Sump)
Gravity Drainage Structures

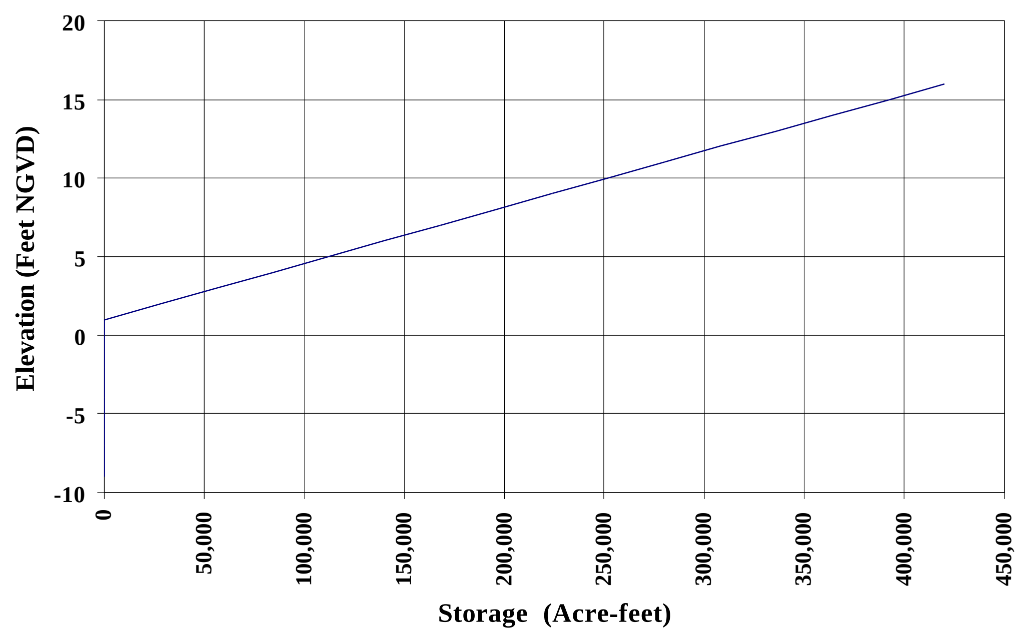
LOCATION	GATE #	TYPE	OPENING (W x H) (feet)	ELEVATION (feet NGVD)	GATE TYPE
MRGO Levee:					
Bayou Dupre		Sector	56 x 28.28	sill –10.78	Nav.
Bayou Bienvenue		Sector	56 x 28.28	sill –10.78	Nav.

d) Pumping stations - There are no pumping stations that drain this area.

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is 14 feet NGVD. The normal water elevation in the interior (natural marsh) is about +1.5 feet NGVD. The ponding of storm surge may range anywhere between these two extremes. Stage - storage relationship is shown below in Figure E-5B-1. In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet NGVD. Within a few hours after storm passage water levels in the levee areas would recede only to the elevation of the top of the levees, about +14 ft. feet NGVD, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths could be as much as 12.5 feet above normal after the storm. Within 72 hours after passage of the storm water levels in the IHNC, MRGO, and Lake Borgne would recede to a normal high level of +3 to +4 feet NGVD. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the lake drain their surcharge of flood water. A detailed discussion of drainage after inundation is contained in Appendix C.

Figure E5B-1
Area E-5B: St. Bernard Parish (Sump)



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling locations (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur but failure is not expected. Intentional levee breaches may be constructed within the reaches shown on plate E-5B in levee segment 3. The breaches will be dug to a combined width of 500 feet to an elevation of + 2 feet NGVD by means of mechanical equipment. Access to the area will be via levee berm on the flood side of the levees wherever practicable, by barge in the MRGO, or by helicopter airlift as the situation demands. In the event that breaching of the line of protection is necessary, drainage of most of the area to surrounding water levels will take one or more days depending upon the width of the breach. See Appendix C. This would leave the interior stage at +4 to +1.5 depending upon the outside stage. If the breach can remain open until surrounding water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags or by temporary steel sheet piling. The levees breaches will be repaired to an interim grade of 3 feet above the average annual high water or to about elevation + 7 feet NGVD.

Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are no vehicular floodgates in this area.

c) Gravity Drainage Structures - There are 2 drainage structures in area E-5B. Pertinent data is presented in Table E-5B-2. Additional data is contained in the New Orleans District Emergency Data Container. If flooding damages the operating machinery or power supply of these structures they cannot be operated (opened) until the equipment has been repaired/rehabilitated. If the structures are operable, care must be taken if opening with a significant reverse head, as flow velocities will be high and the potential for scour will be great.

d) Navigation Structures - There are 2 navigation structures in area E-5B. These are the same structures that were discussed in the previous paragraph (Gravity Drainage Structures).

e) Pumping Stations – There are no pumping stations in the area.

10. West Bank Area

A. Area W-1 - Cataouatche

1) Description

a) General - The area is shown on plate 1 and on plate W-1. The area is located in Jefferson Parish and is generally bounded by the Mississippi River and its alluvial ridge to the north and the Lake Cataouatche levee to the west, south and east. Topography is flat with ground elevations ranging from +7.5 feet NGVD on the alluvial ridges along the Mississippi River to –5 feet NGVD in the interior of the area. Approximately 40 percent of the area is below sea level. The surface area is 22.6 square miles and the population is approximately 23,800.

b) Levees and floodwalls - The area is protected by 25.4 miles of levees, natural ridges and floodwalls as indicated in table W-1-1 below. The segments described begin at the northwest corner and proceed counter clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevation for the entire area is +4.0 feet NGVD located in segment 7. A storm surge height that exceeds this elevation at this location will inundate at least a part of this area. Segment 2 (+2.0 feet NGVD) is not the controlling elevation for flooding as the storm surge will have to overtop US Hwy 90 before reaching this segment.

Table W-1-1
Area W-1: Jefferson Parish – West Bank – Cataouatche Basin
11. **Levees and Floodwalls**

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	MRL to Railroad	Natural Contour	1.7	5.0 - 7.5	5.0	
2	South Kenner Road	Crushed Stone	1.8	6.5	2.0	road
3	Dike Parallel Hwy 90	Small Clay Dike	0.15	6.5	7.0	median
4	Hwy 90 – Cata. P.S.	Clay Levee	3.8	9.5 – 10.5	7.0	clay
5	Cata. P.S. to Segnette State Park	Clay Levee	4.2	10.5	5.5	clay
6	Segnette State Park	Floodwall	1.3	9.5 - 10.5	5.5	under constr
7	Segnette Pump S. –Old Westwego P. S.	Floodwall	0.8	9.0 – 9.5	4	under constr
8	Co. Canal to MRL	NA	1.4	4.0 – 7.5	4	
9	Miss. River Levee	Levee	10.2	26.0 – 27.0	26.0	clay
	Total Length		25.4	Miles		

Segment 1 Extends from the main line Mississippi River levee (MRL) to the Texas and Pacific railroad tracks. There are no levees or dikes in this area. The natural contour of the area provides the protection, but this segment is listed since it is possible storm surges to flank the Segment 2 levee reach and cause flooding.

Segment 2 Location of proposed levee that follows the crushed stone roadway from the railroad tracks that becomes an asphalt roadway used by the land fill operator in the area.

Segment 3 Is a small dike built parallel Hwy 90. Hwy 90 is a 4-lane road with a raised median in the center. The median provides the higher level of protection. The road rises as a low relief ramp at the beginning of segment 4.

Segment 4 Is an earthen levee extending from Hwy 90 to the Cataouatche Pumping Station. The discharge lines of the first pumping station pass over the levee. The discharge lines of the second pump station (immediately adjacent to the first station) pass through a sheetpile wall.

Segment 5 Is an all clay levee that extends from the Cataouatche Pumping Station to the I-Wall which is currently (Aug 00) under construction in the Segnette State Park.

Segment 6 Is a concrete I-Wall atop a clay levee. This segment is currently under construction. The controlling grade listed for this area is the preconstruction levee grade. The area will have 2 vehicular gates.

Segment 7 Part of this segment is the same status as Segment 6. The remainder is completed floodwalls. It lies between the Segnette Pump Station and the Old Westwego Pump Station.

Segment 8 This segment extends from the floodwall at the head of Company Canal (closest line of flood protection to the Mississippi River) to the MRL. The natural contour of the area provides the protection.

Segment 9 Is the West Jefferson Levee District Mississippi River levee. This all clay levee closes the north end of the cell and extends from Westwego to the St. Charles Parish line.

a) Gravity drainage structures - There are a total of 7 floodgates in the protection system that provides for vehicular or pedestrian access. Sill elevations of these floodgates are at or above the current controlling elevation so these gates are not now a factor in draining the area. Pertinent details are tabulated in table W-1-2 below.

b) Pumping stations - There are 4 pumping stations that drain the protected area. The locations of the pumping stations are shown on plate W-1 and pertinent details are tabulated in Table W-1-3 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box").

Table W-1-2
Area W-1: Jefferson Parish – West Bank – Cataouatche Basin
Gravity Drainage Structures

LOCATION	GATE #	TYPE	OPENING (feet) (W x H)	ELEVATION (feet NGVD)	GATE TYPE
Lake Cataouatche Levee					
Segnette State Park Floodwall					
Sta 605+39.80 W/L	1	Double Swing Gate	28 x 4.75	Sill 5.25	Road
Sta 636+90.13 W/L	2	Double Swing Gate	28 x 2.25	Sill 6.75	Road
Sta 672+60.85 W/L	3	Double Swing Gate	28 x 3.1	Sill 5.90	Road
Sta 675+49.83 W/L	4	Swing Gate	24 x 5.3	Sill 4.70	Road
Sta 678+19.87 W/L	4A	Swing Gate	8 x 4.5	Sill 5.0	Pedestrian
Sta 679+31.47 W/L	4B	Swing Gate	8 x 4.5	Sill 5.0	Pedestrian
Sta 680+81.40 W/L	5	Swing Gate	24 x 4	Sill 5.0	Road

Table W-1-3
Area W-1: Jefferson Parish - Cataouatche Basin
Pumping Station Summary

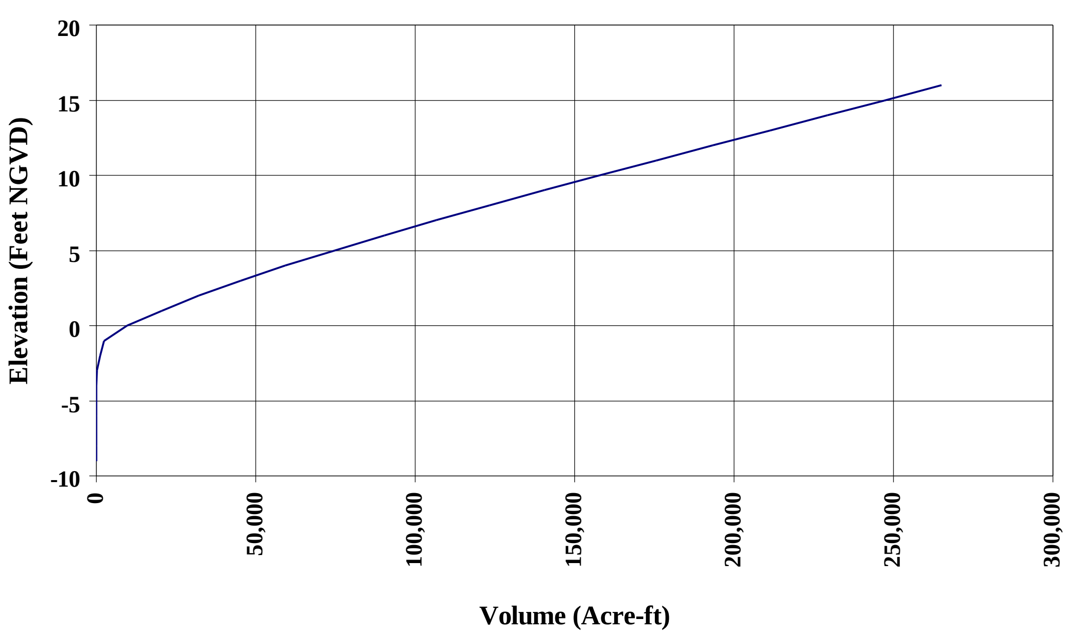
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) NGVD	Pump		Pump Type	Driver Type	Freq Hertz
						Flow* (CFS)	No. Pump			
LC1-PS	Lake Cataouatche 1	New Orleans	29.8722	-90.2286	7	500	2	V	D	
LC2-PS	Lake Cataouatche 2	New Orleans	29.87125	-90.2285	7	600	2	V	D	
BS-PS	Bayou Segnette #	New Orleans	29.89753	-90.1582	6.8	936	6	V	D	
H90-PS	Highway 90	Hahnville	29.90590	-90.2594		90				

V -- Vertical pump
D -- Diesel engine
* -- Total for station
# -- Additional information in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is currently Segment 7, which has a controlling elevation of +4 feet NGVD. This segment is under construction and once completed the controlling elevation will be Segment 5 at +5.5 feet NGVD. The lowest ground elevation in the interior is about –5 feet NGVD. Flooding elevations may range anywhere between these extremes. The area may experience storm surges in excess of +20 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevations (+4 to +5.5 feet NGVD) unless failure of a levee or floodwall occurred. A stage-storage curve for the area is shown in Figure W-1-1. A detailed discussion of drainage that would occur after inundation is contained in Appendix C.

Figure W1-1
Area W-1: Jefferson Parish Westbank - Cataouatche Basin



3) Emergency Response Plan

a) Levees and Floodwalls - Intentional levee breaches may be constructed within the reaches shown on plate W-1 in levee segment 5. The breaches can be dug to a combined bottom width of 400 feet at elevation of +2 feet NGVD by means of a barge mounted dragline. Access to the area will be via Lake Cataouatche and a canal leading northward to the breach site.

Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections. The levee breaches will be repaired to an interim grade of +6 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are 5 vehicular and 2 pedestrian floodgates in this area. None are effective for drainage purposes.

c) Gravity Drainage Structures - There are no gravity drainage culverts that pass through the protection system for Area W-1.

d) Navigation Structures - There are no navigation structures in this area.

e) Pumping Stations – There are four pumping stations in the area. One of the four stations was visited; therefore, the most & least susceptible to damage from interior flooding can not be determined.

B. Area W-2 – Jefferson Parish -Westwego to Harvey Canal

1) Description

a) General - The area is shown on plate 1 and on plate W-2. The area is located in Jefferson Parish and is generally bounded by the Mississippi River and its alluvial ridges on the north, the Harvey Canal on the east and marshes/wetlands on the south and west. Topography is flat with ground elevations ranging from +7.5 feet NGVD on the alluvial ridges along the Mississippi River to –4 feet NGVD in the interior of the area. Approximately 40 percent of the area is below sea level. The surface area is 21.4 square miles and the population is approximately 66,700.

b) Levees and floodwalls - The area is protected by 27.5 miles of levees and floodwalls as indicated in table W-2-1 below. The segments described begin at the Old Westwego Pump Station and proceed counter clockwise around the area. The controlling (lowest) elevation for each segment is shown in table W-2-1. The controlling elevation for the entire area is +6.0 feet NGVD located in segments 10 and 11. A second low area is Segment 3 with a controlling elevation of +7.0 feet NGVD. A storm surge height that exceeds these elevations at these locations will inundate this area.

c) Gravity drainage structures - There are a total of 12 floodgates that provide vehicular or pedestrian access through the protection system. In the event that floodwater is impounded to +6.0 feet NGVD in the protected area, opening these floodgates will provide gravity drainage through the openings. Pertinent details are tabulated in table W-2-2 below.

Table W-2-1 Area W-2: Jefferson Parish – Westwego To Harvey Canal Levees And Floodwalls						
Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	Old Westwego P.S.- New Westwego P.S.	Floodwall	0.5	9.0 - 9.5	9.0	
2	New Westwego P.S. - Dugues Canal	Clay Levee	1.1	10.0	10.0	geotextiles
3	Dugues Canal - New Westminster P.S.	Clay Levee	1.4	10.0	7.0	
4	New Westminster P.S. - Orleans Village P.S.	Clay Levee	1.4	11.0	11.0	geotextiles
5	Orleans Village P.S. to Oak Cove P.S.	Clay Levee - Floodwall	2.1	11.0	11.0	
6	Oak Cove P.S. to LA Hwy 45	Clay Levee T-Wall I-Wall	3.5	12.0	12.0	
7	LA Hwy 45 to Hwy 3134	Floodwall	1.4	12.0	12.0	
8	Hwy 3134 to Old Estelle P.S.	Clay Levee	2.8	9.5	9.5	
9	Old Estelle P.S. Outfall Canal	Clay Levee	0.7	9.5	9.5	
10	Outfall Canal to LaPalco Bridge	Clay Levee - Floodwall	3.2	9.5	6.0	
11	LaPalco Bridge to Harvey Lock	Floodwall	2.8	10.0	6.0	
12	Miss. River Levee	Clay Levee	6.6	24.0 - 26.0	24.0	
	Total Length		27.5	Miles		

Segment 1 It is a floodwall stretching between the Old and New Westwego Pumping Stations and connects the Cataouatche (W-1) cell to Westwego to Harvey Canal (W-2) cell. The segregation of these two cells is not very pronounced. The general contour tie to the Mississippi River levee is described in Segment 8 of the W – 1: Cataouatche cell.

Segment 2 The Westwego Levee is a geosynthetic reinforced, clay levee running parallel to Mayronne Canal between the New Westwego Pumping Station and Dugues Canal-Westwego Seaplane Airport. A 400’ canal closure is currently under construction at the head of the Dugues Canal.

Segment 3 Running between Dugues Canal and the New Westminster Pump Station is the North-South Levee. This levee is all clay.

Segment 4 The Westminster Levee, which parallels the Grand Cross Canal, stretches between New Westminster Pumping Station and Orleans Village Pumping Station (out of service). This clay levee is geosynthetically reinforced.

Segment 5 Orleans Village levee is all clay and paralleling Glasco Canal between Orleans Village Pumping Station (out of service) and Oak Cove Pumping Station. Along this reach is the Ames and Mount Kennedy Pumping Stations connected by floodwall.

Segment 6 This segment consists of the Oak Cove and Hwy 45 clay levees running between Oak Cove Pumping Station and the Hwy 45 crossing. Also found along this length are areas of T-Wall, I-Wall, and one vehicular floodgate at Hwy 45.

Segment 7 The V-Line Levee is an I-Wall between LA Hwy 45 and Hwy 3134.

Segment 8 This segment stretches from the V-Line Levee floodwall to the Old Estelle Pumping Station and is an all clay levee with one main road crossing.

Segment 9 It is an all clay levee running parallel along the North bank of the Old Estelle Pumping Station Outfall Canal. It runs to the Harvey Canal.

Segment 10 This is the West bank Harvey Canal Levee It consists of a clay levee running from the mouth of the Harvey Canal to the LaPalco bridge. Along this segment is the New Estelle Pumping Station, a floodwall at the Bridgeline pipeline, and three areas of sheetpile closure required because of unstable earthen levee sections.

Segment 11 Stretches from LaPalco bridge to the Harvey Lock, paralleling the Harvey Canal. This floodwall includes the Harvey and Cousins Pumping Stations, a vehicular gate and ties the Westwego and Harvey Canal cell back into the Mississippi River Main Line levee.

Segment 12 This is the West Jefferson Levee District Mississippi River levee. It encloses the north side of the cell between Westwego and Harvey Canal and is an all clay levee.

Table W-2-2 Area W-2: Jefferson Parish – Westwego To Harvey Canal Gravity Drainage Structures					
LOCATION	GATE #	TYPE	OPENING (Feet) (W x H)	ELEVATION (Feet) (NGVD)	GATE TYPE
Westwego to Harvey Canal Company Canal Floodwall					
Sta 1+32 W-L	1	Swing Gate	5 x 5.75	Sill 3.75	Pedestrian
Sta 6+23.5 W-L	2	Swing Gate	5 x 5.75	Sill 3.75	Pedestrian
Sta 8+96.5 W-L	3	Swing Gate	6 x 5.75	Sill 3.75	Pedestrian
Sta 10+41 W-L	4	Swing Gate	5 x 5.75	Sill 3.75	Pedestrian
Sta 12+17 W-L	5	Swing Gate	5 x 5.75	Sill 3.75	Pedestrian
Sta 13+93 W-L	6	Swing Gate	5 x 5.75	Sill 3.75	Pedestrian
Sta 15+40 W-L	7	Swing Gate	5 x 4.75	Sill 4.75	Pedestrian
Sta 15+40 W-L	8	Swing Gate	5 x 4.75	Sill 4.75	Pedestrian
Old to New Westwego Pumping Sta Floodwall					
Sta 1+30 W-L	1	Swing Gate	30 x 5	Sill 4.0	Road
Sta 26+87 W-L	2	Swing Gate	5 x 5	Sill 4.0	Pedestrian
Sta 28+59 W-L	3	Swing Gate	6 x 5	Sill 4.0	Pedestrian
V Levee and Floodwall					
Sta 711+44.77 W-L	1	Miter Swing Gate	36 x 7	Sill 5.0	Road

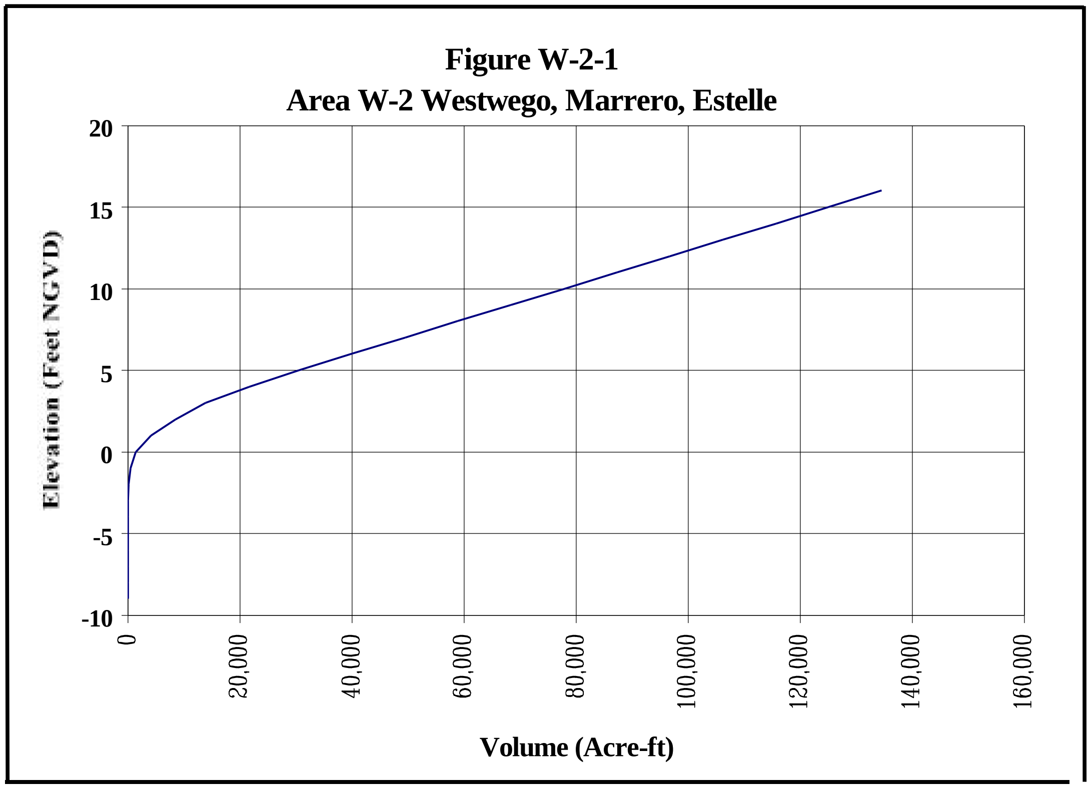
d) Pumping stations - There are 11 pumping stations that drain the protected area. The location of the pumping stations are shown on plate W-2 and pertinent details are tabulated in Table W-2-3 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box")

Table W-2-3 Area W-2: Jefferson Parish – Westwego To Harvey Canal Pumping Stations										
					Slab El	Pump				
Map ID	Name	15 Min. Quad	Latitude	Longitude	(Est ft) NGVD	Flow* (CFS)	No. Pump	Pump Type	Driver Type	Freq Hertz
W2-PS	Westwego 2 Pump Station	New Orleans	29.89040	-90.1560	11.0	936	3	V	D-E	60
Harv-PS	Harvey Pump Station	New Orleans	29.88325	-90.0762	5.0	960	3	V	E	60
W-PS	Westminster Pump Station	New Orleans	29.87320	-90.1379	9.0	1200	4	V	E	60
C1-PS	# Cousins 1 Pump Station	New Orleans	29.87125	-90.0735	4.1	960	4	V	D-E	60
C2-PS	# Cousins 2 Pump Station	New Orleans	29.87088	-90.0735	3.6	2300	2	H	D	
A-PS	# Ames Pump Station	New Orleans	29.85535	-90.1197	4.3 7.3	1930	3	V-H	D-E	60
E2-PS	Estelle 2 Pump Station	New Orleans	29.83390	-90.0668	4.0	1140	2	H	D	
EST1	Estelle 1 Pump Station	New Orleans	29.8275	-90.0832	5.1	550	N/A	N/A	N/A	N/A
MTKN	Mt. Kennedy Pump Station	New Orleans	29.854	-90.121	6.5	274	N/A	N/A	N/A	N/A
WEG1	Old Westwego Pump Station	New Orleans	29.8961	-90.1568	11.6	311	N/A	N/A	N/A	N/A
OakC	Oak Cove Pump Station	New Orleans	29.8471	-90.1301	5.7	80	N/A	N/A	N/A	N/A

* -- Total Station Capacity
V -- Vertical
H -- Horizontal
D -- Diesel Engine
E -- Electric Motor
-- Additional information in Appendix B

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +6.0 feet NGVD. The lowest ground elevation in the interior is about –4 feet NGVD. Flooding elevation may range anywhere between these two extremes. The area may experience storm surges in excess of +20.0 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevation of +6.0 feet NGVD unless failure of a levee or floodwall occurs. A stage-storage curve for this area is shown in Figure W-2-1. A detailed discussion of drainage that would occur after inundation is contained in Appendix C.



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse heads. Intentional levee breaches may be constructed within the reaches shown on plate W-2 in levee segment(s) 4, 5, 9 & 10. The breaches can be dug to a combined bottom width of 200 feet at elevation of +2 feet NGVD by means of barge-mounted dragline. Access to the area will be via water using the GIWW, Harvey Canal, and pump station outfall canals. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, sandbags, or by temporary sheet piling. The levees breaches will be repaired to an interim grade of +6.0 feet NGVD,. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are 2 vehicular floodgates in this area. These gates may fail if subjected to reverse head conditions. Reopening with a reverse head must be done carefully, with expert use of small explosive charges to blow open the gate latches. Access will be by road (from the outside), boat or helicopter. In addition, there are 10 pedestrian gates that can be opened to relieve interior flooding after a hurricane surge. Emergency interim repairs with crushed stone and gravel may be necessary to repair roadways damaged by erosion due to floodgate failure or reopening under reverse head. An emergency contract will be required after the storm event to repair damaged floodgates and roadways.

c) Pumping Stations – There are eleven pumping stations in the area. Three of the eleven stations were visited. Of these, the most susceptible to damage from interior flooding is Cousins 2 Pump Station, which can only withstand flooding to elevation 3.6 feet NGVD. Ames Pump Station is the least susceptible to damage and can withstand flooding to elevation 11.3 feet NGVD.

C. Area W-3A – Harvey Canal to Algiers Canal (Jefferson & Plaquemines Parishes)

1) Description

a) General - The area is shown on plate 1 and plate W-3A. The area is located in Jefferson and Plaquemines Parish and is generally bounded by the Mississippi River on the north, the Jefferson, Plaquemines & Orleans Parish lines on the east, the Algiers Canal on the south, and the Harvey Canal on the west. Topography is flat with ground elevations ranging from +15 feet NGVD on the alluvial ridges along the Mississippi River to -5 feet NGVD in the interior of the area. Approximately 40 percent of the area is below sea level. The surface area is 18.8 square miles and the population is approximately 77,000.

b) Levees and floodwalls - The area is protected by 21.3 miles of levees and floodwalls as indicated in the tabulation below. The segments described begin at the northwest corner (Harvey Lock) and proceed counter clockwise around the area. The controlling (lowest) elevation for each segment is shown in table W-3A-1. The controlling elevation for the entire area is +5.0 feet NGVD located in segments 1, 2 and 3. A storm surge height that exceeds this elevation at these locations will inundate this area.

Table W-3A-1
Area W-3A: Harvey Canal to Algiers Canal
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	Harvey Lock to Hero P.S.	Levee	5.9	9.5	5.0	Clay
2	Hero P.S. to Algiers Canal	Levee	1.3	9.5	5.0	Clay
3	Algiers Canal to Orleans Parish Line	Levee	6.5	9.5	5.0	Clay
4	Interior Local Levee	Levee	4.0	3.0 - 4.0	3.0	clay
5	Mississippi River Levee	Levee	3.6	23.5 - 24.0	23.5	clay/I-Wall
Total Length			21.3Miles			

Segment 1 Extends from the Harvey Canal Lock at the Mississippi River down the East bank of the Harvey Canal to the Hero Pumping Station where the pumping station discharge lines pass through a T-Wall. This levee is a local levee in a heavily industrialized

area. The Federal project will build T-Walls through much of the area in future years.

Segment 2 Extends from the South end of the Hero Pumping Station around the bend where it ties into the Algiers Canal levee. The levee is also a local levee in a heavily industrialized area.

Segment 3 Picks up where segment 2 ended and continues along the West bank of the Algiers Canal. The clay levee is interrupted by floodwall segments that cross over the Belle Chasse tunnel and in front of Planters Pumping Station. It ends at the tie-in of the local levee separating Plaquemines and Orleans Parishes. A railroad track crosses over the top of the existing levee. A future floodgate is planned for the area.

Segment 4 This all clay levee runs along the length of the Orleans Parish line between Algiers Canal and the Mississippi River levee at the Greater New Orleans Bridge.

Segment 5 Is the West Jefferson Levee District Mississippi River Levee stretching between the Harvey Canal and the Orleans Parish line beneath the Greater New Orleans Bridge. This levee consists of all clay levees with short reaches of concrete I-Wall atop clay levees with railroad and vehicular gates.

c) Gravity drainage structures - There are presently no floodgates, control structures, or drainage structures in the protection system. Future construction under the Federal project will provide floodgates at some locations.

d) Pumping stations - There are 2 pumping stations that drain the protected area. The location of the pumping stations are shown on plate W-3A and pertinent details are tabulated in Table W-3A-2 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box")

Table W-3A-2 Area W-3A: Jefferson-Plaquemines Parishes Harvey Canal to Algiers Canal (Gretna) Pumping Station Summary										
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) NGVD	PUMP Flow * (CFS)	PUMP No. Pump	Pump Type	Driver Type	Freq. Hertz
Hero-PS	# Hero Pump Station	New Orleans	29.87090	-90.0562	-.5.0 0.5 6.5	3902	10	H/C	D/E	60
P-PS	# Planters Pump Sta.	New Orleans	29.8836	-90.0042	3.6	2360	9	V	D/E	60

* -- Total station capacity
H – Horizontal
C – Centrifugal
E - Electric
V – Vertical
D – Diesel Engine
-- Additional information in Appendix B

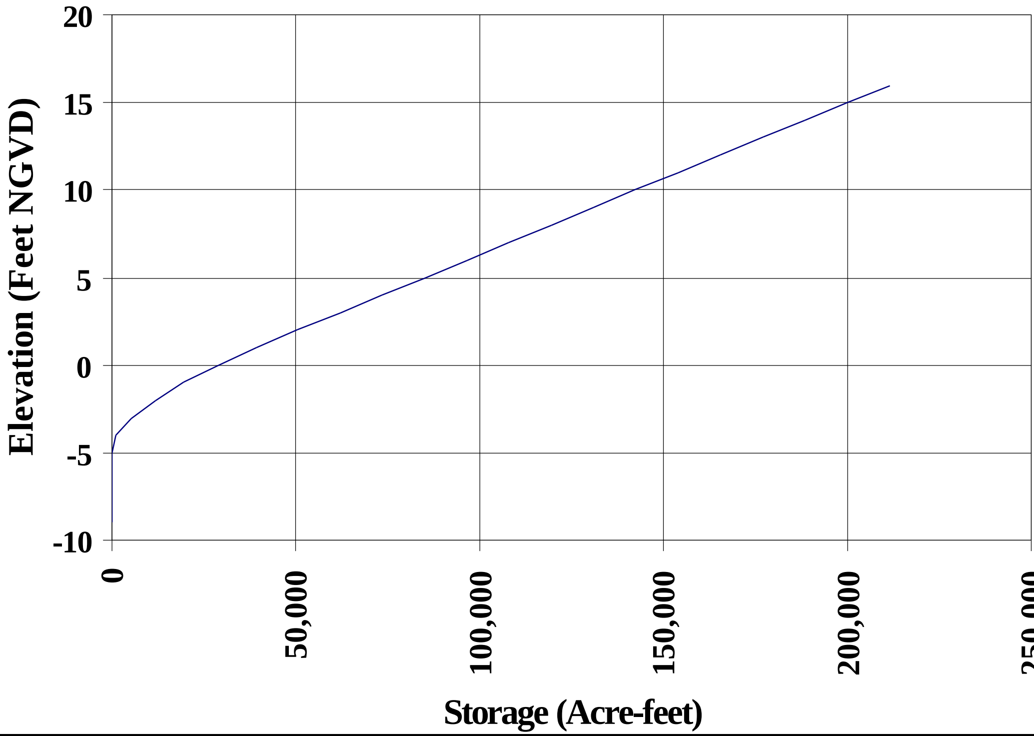
2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +5.0 feet NGVD. The lowest ground elevation in the interior is about –5 feet NGVD. Flooding elevation may range anywhere between these two extremes. The area may experience storm surges in excess of +20.0 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevation of +5.0 feet NGVD unless failure of a levee or floodwall occurs. A stage-storage curve for the area is shown in Figure W-3A-1. A detailed discussion of drainage that would occur after inundation is contained in Appendix C.

3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse heads. Intentional levee breaches may be constructed within the reaches shown on plate W-3A in levee segment(s) 1 and 2. The breaches can be excavated to a combined bottom width of 300 feet at elevation of +2 feet NGVD by means of draglines and backhoes. Access to the area will be via water using the GIWW, Harvey Canal or Algiers Canal. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags or by temporary sheet piling. The levee breaches will be repaired to an interim grade of +5.0 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

Figure W-3A-1
Area W-3A: Jefferson/Plaquemines Parish (Gretna)
Harvey Canal to Algiers Canal



b) Vehicular and Railroad Access - There are no access floodgates in this area.

c) Pumping Stations - There are 2 pumping stations in the area. The most susceptible to damage from interior flooding is Hero Pump Station, which can only withstand flooding to elevation 3.5 feet NGVD. Planters Pump Station is the least susceptible to damage and can withstand flooding to elevation 5.1 feet NGVD.

D. Area W-3B – Harvey Canal to Algiers Canal

1) Description

a) General - The area is shown on plate 1 and plate W-3B. The area is located in Orleans Parish and is generally bounded by the Mississippi River, the Algiers Canal, and the Orleans-Jefferson-Plaquemines Parish boundary. Topography is flat with ground elevations ranging from +10 feet NGVD on the alluvial ridges along the Mississippi River to –5 feet NGVD in the interior of the area. Approximately 25 percent of the area is below sea level. The surface area is 6.3 square miles and the population is approximately 57,000.

b) Levees and floodwalls - The area is protected by 12.6 miles of levees and floodwalls as shown on plate W-3B and as indicated in table W-3B-1 below. The segments described begin at the northwest corner (intersection of Mississippi River levee and the Orleans-Jefferson Parish line) and proceed counter clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevation for the entire area is elevation +5.5 feet NGVD located in segment 2. A storm surge height that exceeds this elevation at this location will inundate this area.

Table W-3B-1
Area W-3B: Orleans Parish - Algiers
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	Interior Local Levee	Levee	4.0	3.0 - 4.0	3.0	clay
2	Jefferson Parish Line to Algiers Lock	Levee	1.8	9.5	5.5	
3	Mississippi River Levee	Levee	6.8	22.0 - 23.5	22.0	clay/I-Wall
	Total Length		12.6 Miles			

Segment 1 This all clay levee runs along the Jefferson Parish line from the Greater New Orleans Bridge at the Mississippi River levee to the Algiers Canal levee.

Segment 2 Is the West bank Algiers Canal levee that extends between the local interior levee and the Algiers Lock. The clay levee is interrupted by a floodwall segment that crosses in front of N.O.S.&W.B .Pumping Station #13.

Segment 3 Is the Orleans West Levee District Mississippi River Levee extending from the Orleans Parish Line (beneath the Greater New Orleans Bridge) to the Algiers Canal Lock. This River levee closes the north end of the cell. The levee is predominately an all clay levee with small reaches of short concrete I-Walls atop a clay levee base.

c) Gravity drainage structures - There are no floodgates, drainage culverts or control structures in the protection system

d) Pumping stations - There is one pumping station that drains the protected area. The location of the pumping station is shown on plate W-3B and pertinent details are tabulated in Table W-3B-2 below. Note: Additional detailed information on the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box")

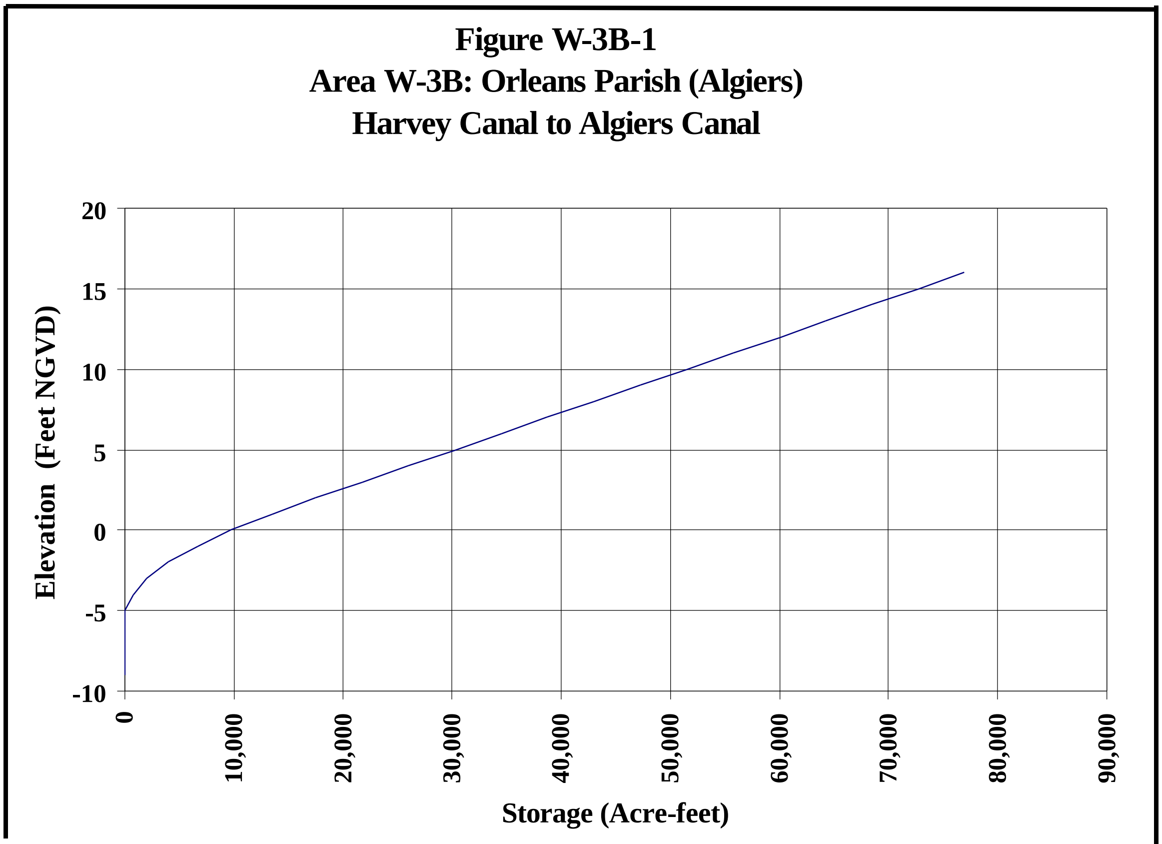
Table W-3B-2
Area W-3B: Orleans Parish - Algiers
Harvey Canal to Algiers Canal
Pumping Station Summary

Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) NGVD	Pump Flow* (CFS)	Pump No. Pump	Pump Type	Driver Type	Freq. Hertz
OP-13	PS 13	St. Bernard	29.8959	-89.9978	3.6	4650	7	V/H	D/E	60

* -- Total station capacity
V -- Vertical
H -- Horizontal
D -- Diesel Engine
E -- Electric Motor

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +5.5 feet NGVD. The lowest ground elevation in the interior is about –5 feet NGVD Flooding elevation may range anywhere between these two extremes. The area may experience storm surges in excess of +20.0 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevations of +5.5 FEET NGVD, unless a failure of the levees or floodwalls occurred. A stage-storage curve is shown in Figure W-3B-1. A detailed discussion of drainage after inundation is contained in Appendix C.



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse heads. Intentional levee breaches may be constructed within the reaches shown in levee segment 2. The breaches can be constructed to a combined bottom width of 100 feet and at elevation of +2 feet NGVD by means of dragline and backhoe. Access to the area will be via water using the GIWW, Harvey Canal & Algiers Canal. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbags or by temporary steel sheet piling. The levees breaches will be repaired to an interim grade of +5.5 feet NGVD.

b) Vehicular and Railroad Access - There are no access floodgates in this area.

c) Pumping Stations - There is one pumping station in the area. It was not visited; therefore, damages from interior flooding can not be determined.

E. Area W-4A – Algiers Canal to Hero Canal - Plaquemines Parish

1) Description

a) General - The area is shown on plate 1 and on plate W-4A. The area is located in Plaquemines Parish and is generally bounded by the Algiers Canal, the GIWW, the Hero Canal, the Mississippi River and the Orleans-Plaquemines Parish line. Topography is flat with ground elevations ranging from +12 feet NGVD on the alluvial ridges along the Mississippi River to –5 feet NGVD in the interior of the area. Approximately 50 percent of the area is below sea level. The surface area is 14.1 square miles and the population is approximately 8,600.

b) Levees and floodwalls - The area is protected by 29.5 miles of levees and floodwalls as shown on plate W-4A and as indicated in table W-4A-1 below. The segments described begin at the southeast corner (intersection of Hero Canal and Mississippi River) and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevation for the entire area is +5.5 feet NGVD located in segment 3. A storm surge height that exceeds this elevation at this location will inundate this area.

Table W-4A-1
Area 4-A: Algiers Canal to Hero Canal – Plaquemines Parish
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (ft NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	Miss. River Levee to Hero Canal	Natural Contour	0.2	5.0 - 7.5	5.0	
2	Hero Canal	Levee	3.75	9.0 – 10.5	6.5	Clay
3	Algiers Canal to Orleans Parish Line	Levee	8.5	9.5	5.5	Clay
4	Local Interior Levee	Levee	5.6	3.0 – 4.0	3.0	Clay
5	Miss. River Levee	Levee	11.4	17.0 – 22.0	17.0	Clay
Total Length			29.5Miles			

Segment 1 Extends from the main Line Mississippi River levee (MRL) to the all clay levee at the head of the Hero Canal. There is a very low dike between the Hero Canal Levee and Hwy 23. The natural contour of the area provides the protection from the highway to the MRL.

Segment 2 Extends from the head of the Hero Canal along the canal North bank to a point where the levee transitions to the Algiers Canal Federal R/W. This is an all clay levee.

Segment 3 Picks up where segment 2 ended and continues around the bend and parallels the Algiers Canal. The clay levee is interrupted by floodwall segments that cross over the Belle Chasse tunnel and front 2 large pumping stations. It ends at the tie-in of the local levee separating Plaquemines and Orleans Parishes. A railroad track crosses over the top of the existing levee. A future floodgate is planned for the area.

Segment 4 Consists of a low all earth levee separating Orleans Parish from Jefferson Parish. It extends from the Algiers Canal levee to the MRL.

Segment 5 Is the Plaquemines West Levee District Mississippi River levee. This segment closes the East side of the cell. The levee is an all clay levee with crushed stone surfacing on the 10' wide crown. It extends from the Orleans Parish line to the community of Oakville, just below Belle Chasse, LA.

c) Gravity drainage structures - There are no floodgates, drainage structures or control structures in the protection system.

d) Pumping stations - There are 2 pumping stations that drain the protected area. The location of the pumping stations are shown on plate W-4A and pertinent details are tabulated in Table W-4A-2 below. Note: Additional detailed information in the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box")

Table W-4A-2
Area W 4A: Plaquemines Parish, Algiers Canal to Hero Canal (Belle Chasse)
Pumping Station Summary

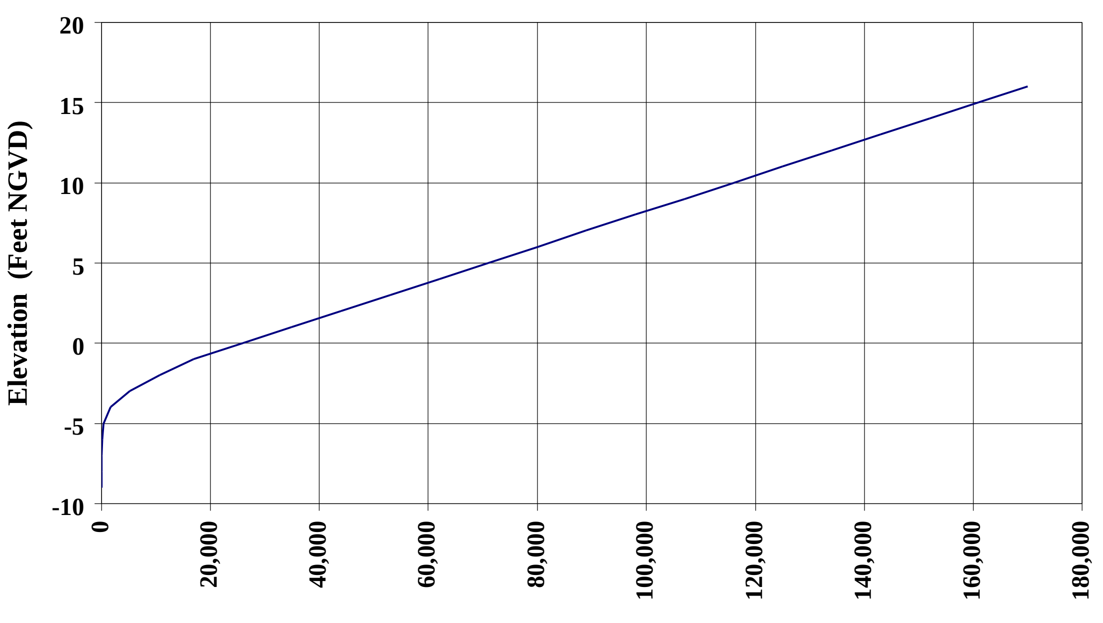
Map ID	Name	15 Min. Quad	Latitude	Longitude	(Slab El Est ft) NGVD	Pump		Pump Type	Driver Type	Freq. Hertz
						Flow* (CFS)	No. Pump			
BC-1	Belle Chasse #1	New Orleans	29.85167	-90.0167	7.6	3556	5	V/H	D	
BC-2	Belle Chasse #2	St. Bernard	29.88460	-89.9975	10.5	990	3	V	D	

* -- Total station capacity
V -- Vertical
H -- Horizontal
D -- Diesel engine

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +5.5 feet NGVD. The lowest ground elevation in the interior is about –5 feet NGVD. Residual flooding elevation may range anywhere between these two extremes. The area may experience storm surges in excess of +20 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevation of +5.5 feet NGVD unless failure of a levee or floodwall occurred. A stage-storage curve is shown in figure W-4A-1. A detailed discussion of drainage that would occur after inundation is contained in Appendix C.

Figure W4a-1
Area W-4A: Plaquemines Parish Belle Chasse
Algiers Canal to Hero Canal



3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse heads. Intentional levee breaches may be constructed within the reaches shown on plate W-4A in levee segment 3. The breaches can be constructed to a combined bottom width of 200 feet to elevation of +2 feet NGVD by means of a dragline or backhoe. Access to the area will be via water using the GIWW, Harvey Canal and Algiers Canals. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbagging or by use of steel sheet piling. The levees breaches will be repaired to an interim grade of +5.5 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

b) Vehicular and Railroad Access - There are no vehicular floodgates in this area.

c) Pumping Stations - There are 2 pumping stations in the area. The most susceptible to damage from interior flooding is Belle Chasse No. 1 Pump Station, which can withstand flooding to elevation 9.0 feet NGVD. Belle Chasse #2 Pump Station is the least susceptible to damage and can withstand flooding to elevation 11.5 feet NGVD.

F. Area W-4B Orleans Parish (Algiers Canal to Hero Canal)

1) Description

a) General - The area is shown on plate W-4B. The area is located in Orleans Parish and is generally bounded by a portion of the Algiers Canal, the Mississippi River and the Orleans-Plaquemines Parish line. Topography is flat with ground elevations ranging from +5 feet NGVD on the alluvial ridges along the Mississippi River to –7 feet NGVD in the interior of the area. Approximately 40 percent of the area is below sea level. The surface area is 4.7 square miles and the population is approximately 300.

b) Levees and floodwalls - The area is protected by 15.0 miles of levees and floodwalls as shown on plate W-4B and as indicated in tabulation W-4B-1 below. The segments described begin at the intersection of the Orleans-Plaquemines Parish line with the Mississippi River and proceed clockwise around the area. The controlling (lowest) elevation for each segment is shown. The controlling elevation for the entire area is +5.5 feet NGVD located in Area W-4A. Once Area W-4A is inundated, it will overtop the local interior levee (Segment 1) and flood Area W-4B. A storm surge height that exceeds this elevation at this location will inundate this area.

Table W-4B-1
Area W-4B: Algiers Canal to Hero Canal
Levees and Floodwalls

Segment Number	Description	Type	Length (miles)	Design Elevation (feet NGVD)	Controlling Elevation (ft NGVD)	Remarks
1	Local Interior Levee	Levee	5.6	3.0 – 4.0	3.0	Clay
2	Interior Levee to Algiers Canal Lock	Levee	2.0	9.5	6.0	Clay
3	Miss. River Levee	Levee	7.4	22.0	22.0	Clay
Total Length			15.0Miles			

Segment 1 Consists of a low all earth levee separating Orleans Parish from Jefferson Parish. It extends from the main line Mississippi River levee (MRL) to the Algiers Canal levee.

Segment 2 Is the East bank Algiers Canal levee that extends between the local interior levee and the Algiers Lock. The clay levee is interrupted by a floodwall segment that crosses in front of a NOS&WB Pumping Station #11.

Segment 3 Is the Orleans West Levee District Mississippi River levee. This segment closes the North and East side of the cell. The levee is an all clay levee with crushed stone surfacing on the 10' wide crown. It extends from the Algiers Canal Lock to the Plaquemines Parish line within the U.S. Coast Guard Reservation.

c) Gravity drainage structures - There are no floodgates, drainage structures or control structures in the protection system

d) Pumping stations - There is one pumping station that drains the protected area. The location of the pumping station is shown on plate W-4B and pertinent details are tabulated in Table W-4B-2 below. Note: Additional detailed information in the pumping stations, if available, is contained in Appendix B and in the New Orleans District Emergency Data Container ("Black Box")

Table W-4B-2
Area W-4B: Orleans Parish Algiers Canal to Hero Canal (English Turn)
Pumping Station Summary

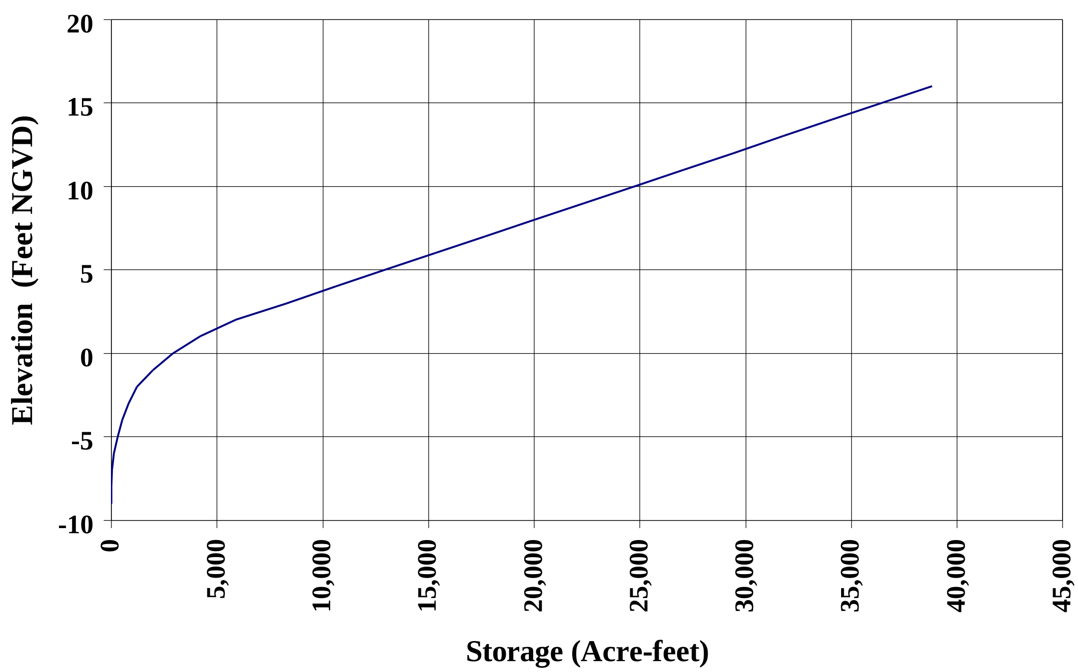
Map ID	Name	15 Min. Quad	Latitude	Longitude	Slab El (Est ft) feet NGVD	Pump Flow (CFS) *	No. Pump	Pump Type	Driver Type	Freq Hertz
OP-11	PS 11	St.Bernard	29.90962	-89.978	NA	1530	5	V	E	25/60

* -- Total station capacity
V -- Vertical
E -- Electric motor

2) Potential flooding

The controlling elevation for the levees and floodwalls protecting this area is +5.5 feet NGVD. The lowest ground elevation in the interior is about –7 feet NGVD. Flooding elevation may range anywhere between these two extremes. The area may experience storm surges in excess of +20 feet NGVD. Within a few hours of the storm passage, the water level would recede to the current controlling elevation of +5.5 feet NGVD unless failure of a levee or floodwall occurred. A stage storage curve for the area is shown in Figure W-4A-1. A detailed discussion of drainage that would occur after inundation is contained in Appendix C.

Figure W-4B-1
Area W-4B: Orleans Parish English Turn
Algiers Canal to Hero Canal

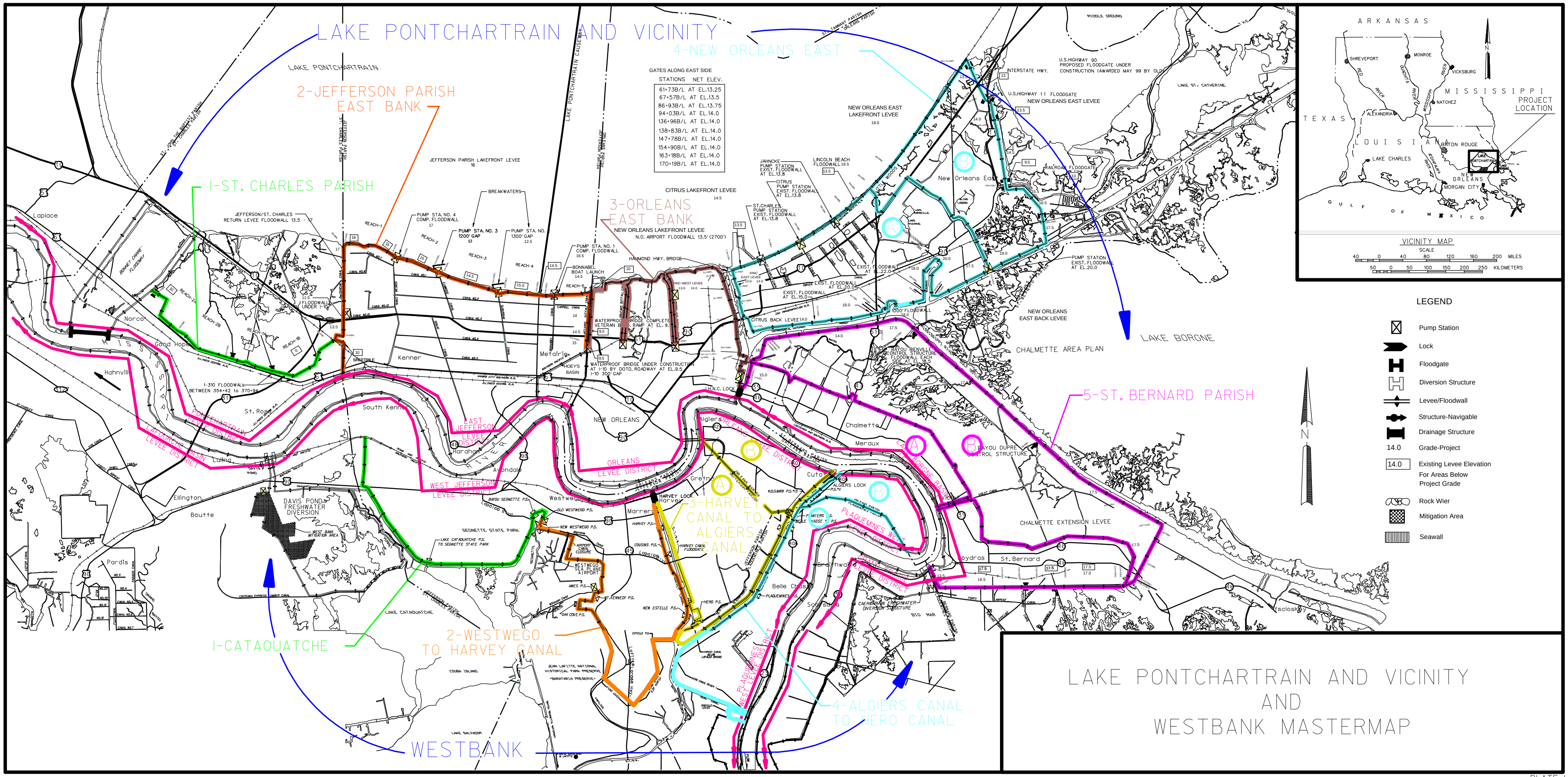


3) Emergency Response Plan

a) Levees and floodwalls - The most likely location for damage is at the controlling location(s) (lowest spots) that have been previously identified. These are where overtopping will occur first and last longest. Damages may range from minor levee erosion to complete breaches. Erosion around floodwalls may occur and failure may occur from reverse heads. Intentional levee breaches will be constructed within the reaches shown on plate W-4B in levee segment 2. The breaches can be excavated to a combined bottom width of 200 feet to elevation +2 feet NGVD by means of a barge mounted dragline. Access to the area will be via water using the Algiers Canal. Immediate interim repair of levee breaches and levee erosion will be by use of material obtained from degrading of adjacent levee sections, by sandbagging or by use of steel sheet piling. The levee breaches will be repaired to an interim grade of +7 feet NGVD. Emergency construction contracts will be awarded to fully restore the levees and floodwalls from the initial interim repair condition. These contracts will be based on post-event field inspection and surveys to identify damaged areas. They will include the replacement of all degraded levee material used during interim repairs.

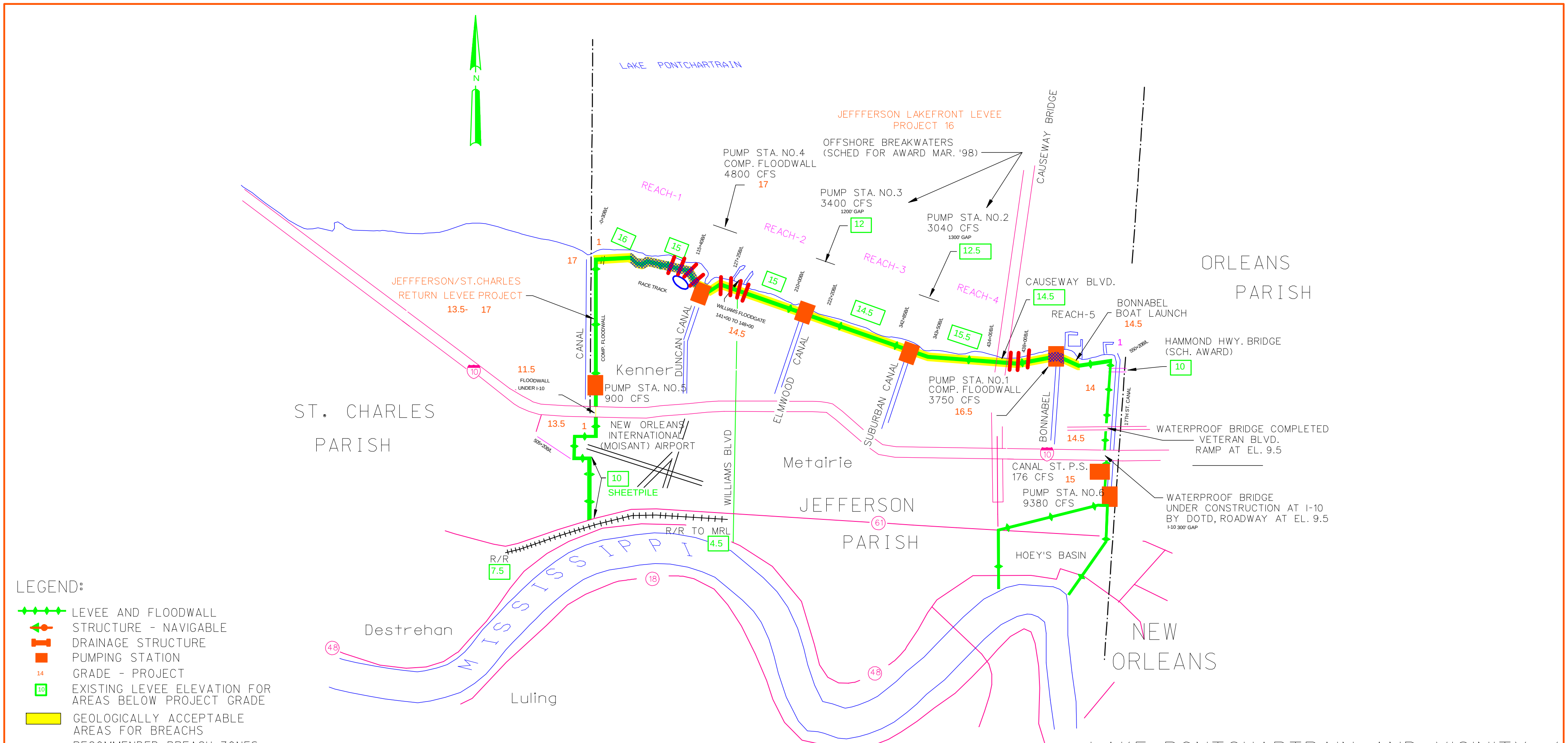
b) Vehicular and Railroad Access - There are no vehicular floodgates in this area.

c) Pumping Stations - There is one pumping station in the area. It was not visited; therefore, damages from interior flooding can not be predetermined.



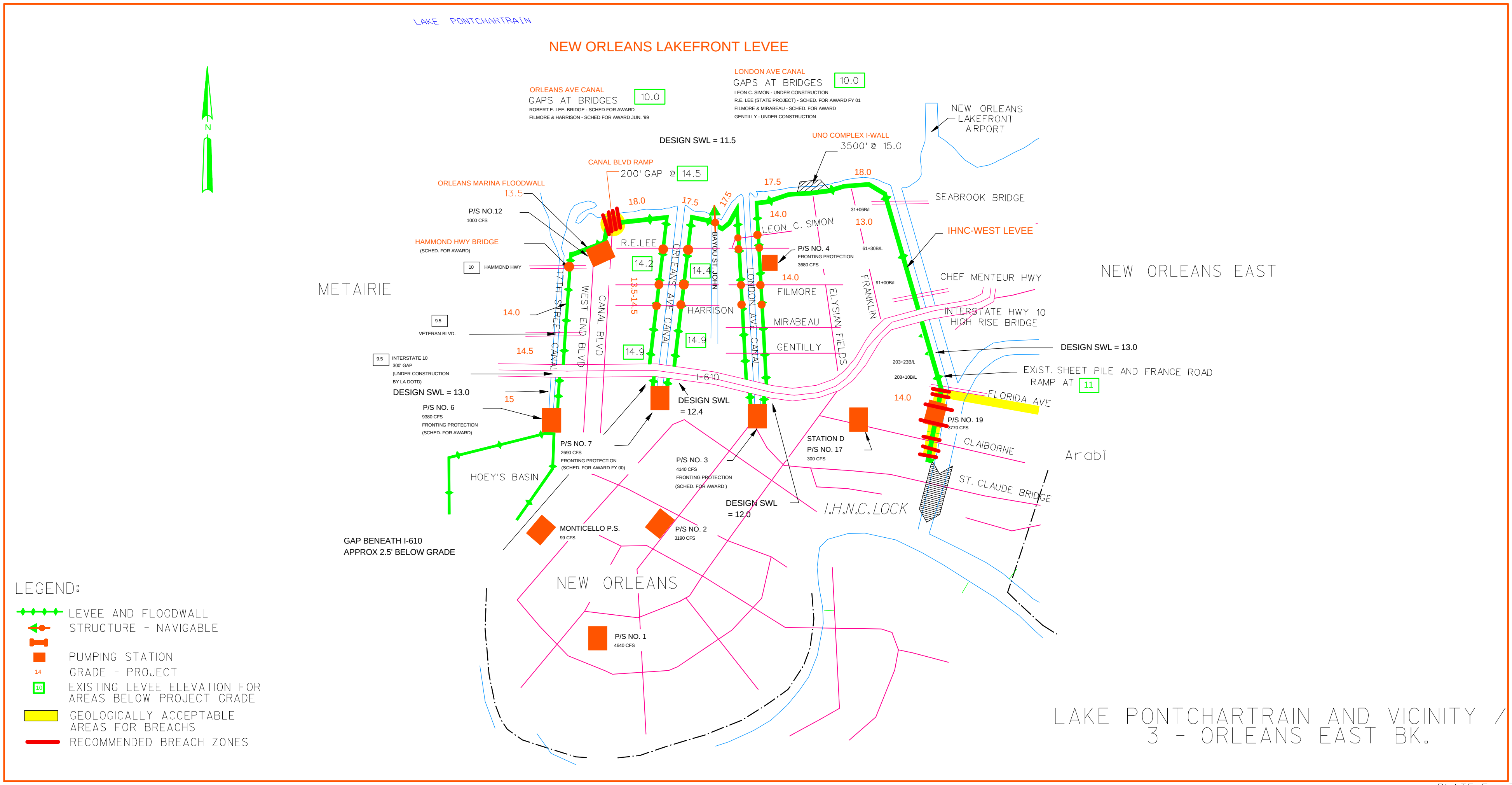
LAKE PONTCHARTRAIN AND VICINITY
LAKE PONTCHARTRAIN
2-JEFFERSON PARISH EAST BANK
1-ST. CHARLES PARISH
3-ORLEANS EAST BANK
4-NEW ORLEANS EAST
5-ST. BERNARD PARISH
LAKE BORGNE
CHALMETTE AREA PLAN
CHALMETTE EXTENSION LEVEE
NEW ORLEANS EAST BACK LEVEE
NEW ORLEANS EAST LAKEFRONT LEVEE
JEFFERSON PARISH LAKEFRONT LEVEE
CITRUS LAKEFRONT LEVEE
NEW ORLEANS LAKEFRONT LEVEE
GATES ALONG EAST SIDE
STATIONS NET ELEV.
61+73B/L AT EL.13.25
67+57B/L AT EL.13.5
86+93B/L AT EL.13.75
94+03B/L AT EL.14.0
136+96B/L AT EL.14.0
138+83B/L AT EL.14.0
147+78B/L AT EL.14.0
154+90B/L AT EL.14.0
163+18B/L AT EL.14.0
170+19B/L AT EL.14.0
3-HARVEY CANAL TO ALGIERS CANAL
2-WESTWEGO TO HARVEY CANAL
1-CATAOUATCHE
4-ALGIERS CANAL TO HERO CANAL
WESTBANK
DAVIS POND FRESHWATER DIVERSION
EAST JEFFERSON LEVEE DISTRICT
ORLEANS LEVEE DISTRICT
WEST JEFFERSON LEVEE DISTRICT
LAFOURCHE BASIN LEVEE DISTRICT
PLAQUEMINES WEST LEVEE DISTRICT
Laplace
Norco
Good Hope
Hahnville
St. Rose
Luling
Boutte
Ellington
Paradis
Kenner
Metairie
South Kenner
Harahan
Avondale
Westwego
Marrero
Harvey
Gretna
Algiers
NEW ORLEANS
New Orleans East
Chalmette
Meraux
Poydras
St. Bernard
Belle Chasse
Scarsdale
VICINITY MAP
ARKANSAS
MISSISSIPPI
TEXAS
LOUISIANA
GULF OF MEXICO
SHREVEPORT
MONROE
VICKSBURG
NATCHEZ
ALEXANDRIA
BATON ROUGE
LAKE CHARLES
NEW ORLEANS
MORGAN CITY
PROJECT LOCATION
LEGEND
Pump Station
Lock
Floodgate
Diversion Structure
Levee/Floodwall
Structure-Navigable
Drainage Structure
14.0 Grade-Project
14.0 Existing Levee Elevation For Areas Below Project Grade
Rock Wier
Mitigation Area
Seawall
LAKE PONTCHARTRAIN AND VICINITY AND WESTBANK MASTERMAP

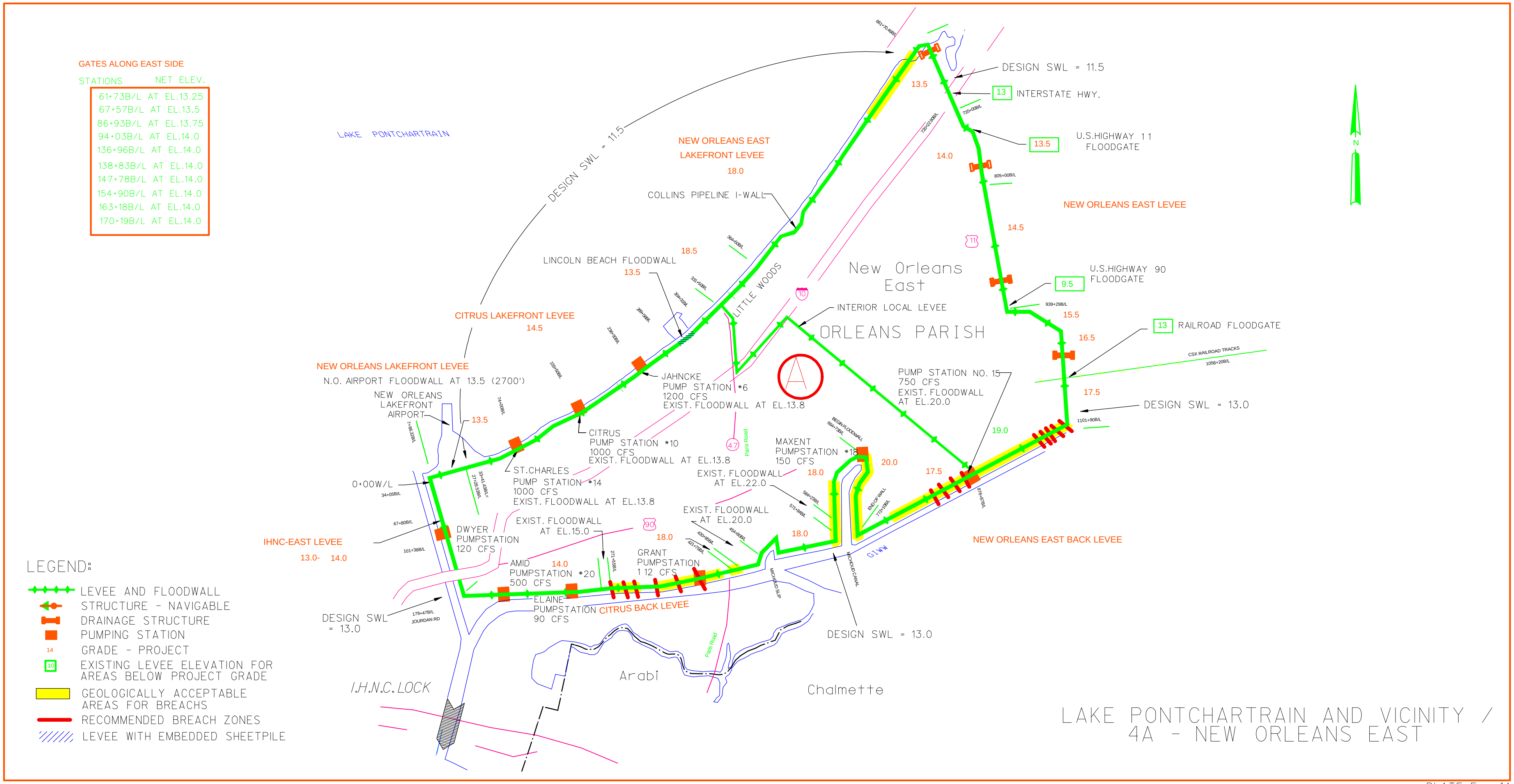
PLATE I



LAKE PONTCHARTRAIN AND VICINITY / 2 - JEFFERSON PARISH EAST BANK

PLATE E - 2


LAKE PONTCHARTRAIN
NEW ORLEANS LAKEFRONT LEVEE
N
ORLEANS AVE CANAL
GAPS AT BRIDGES 10.0
ROBERT E. LEE BRIDGE - SCHED FOR AWARD
FILMORE & HARRISON - SCHED FOR AWARD JUN. '99
LONDON AVE CANAL
GAPS AT BRIDGES 10.0
LEON C. SIMON - UNDER CONSTRUCTION
R.E. LEE (STATE PROJECT) - SCHED. FOR AWARD FY 01
FILMORE & MIRABEAU - SCHED. FOR AWARD
GENTILLY - UNDER CONSTRUCTION
NEW ORLEANS LAKEFRONT AIRPORT
DESIGN SWL = 11.5
UNO COMPLEX I-WALL
3500' @ 15.0
CANAL BLVD RAMP
200' GAP @ 14.5
ORLEANS MARINA FLOODWALL
13.5
18.0
17.5
17.5
17.5
18.0
14.0
13.0
P/S NO.12
1000 CFS
HAMMOND HWY BRIDGE
(SCHED. FOR AWARD)
10 HAMMOND HWY
R.E.LEE
14.2
14.4
LEON C. SIMON
P/S NO. 4
FRONTING PROTECTION
3680 CFS
SEABROOK BRIDGE
IHNC-WEST LEVEE
NEW ORLEANS EAST
METAIRIE
CHEF MENTEUR HWY
FILMORE
HARRISON
MIRABEAU
GENTILLY
FRANKLIN
ELYSIAN FIELDS
LONDON AVE CANAL
BAYOU ST. JOHN
ORLEANS AVE CANAL
CANAL BLVD
WEST END BLVD
17TH STREET CANAL
13.5-14.5
14.0
14.9
14.9
INTERSTATE HWY 10
HIGH RISE BRIDGE
9.5 VETERAN BLVD.
14.5
9.5 INTERSTATE 10
300' GAP
(UNDER CONSTRUCTION
BY LA DOTD)
DESIGN SWL = 13.0
DESIGN SWL = 13.0
I-610
EXIST. SHEET PILE AND FRANCE ROAD
RAMP AT 11
FLORIDA AVE
14.0
15
P/S NO. 6
9380 CFS
FRONTING PROTECTION
(SCHED. FOR AWARD)
DESIGN SWL
= 12.4
P/S NO. 19
3770 CFS
STATION D
P/S NO. 17
300 CFS
CLAIBORNE
Arabi
P/S NO. 7
2690 CFS
FRONTING PROTECTION
(SCHED. FOR AWARD FY 00)
P/S NO. 3
4140 CFS
FRONTING PROTECTION
(SCHED. FOR AWARD)
HOEY'S BASIN
ST. CLAUDE BRIDGE
DESIGN SWL
= 12.0
I.H.N.C. LOCK
GAP BENEATH I-610
APPROX 2.5' BELOW GRADE
MONTICELLO P.S.
99 CFS
P/S NO. 2
3190 CFS
NEW ORLEANS
P/S NO. 1
4640 CFS
LEGEND:
LEVEE AND FLOODWALL
STRUCTURE - NAVIGABLE
PUMPING STATION
14 GRADE - PROJECT
10 EXISTING LEVEE ELEVATION FOR
AREAS BELOW PROJECT GRADE
GEOLOGICALLY ACCEPTABLE
AREAS FOR BREACHS
RECOMMENDED BREACH ZONES
LAKE PONTCHARTRAIN AND VICINITY /
3 - ORLEANS EAST BK.



LAKE PONTCHARTRAIN AND VICINITY /
4A - NEW ORLEANS EAST

PLATE E - 4A

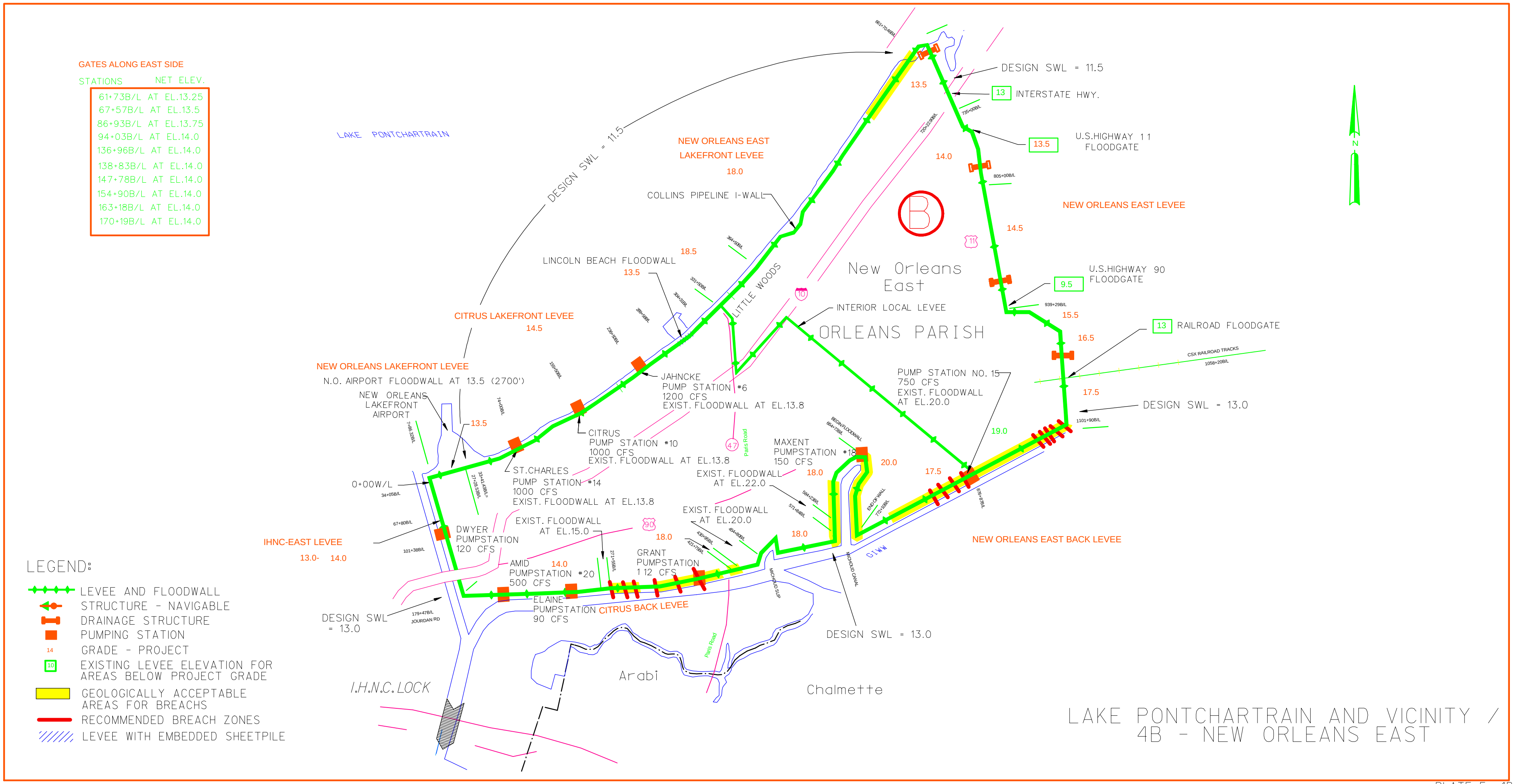

GATES ALONG EAST SIDE
STATIONS NET ELEV.
61+73B/L AT EL.13.25
67+57B/L AT EL.13.5
86+93B/L AT EL.13.75
94+03B/L AT EL.14.0
136+96B/L AT EL.14.0
138+83B/L AT EL.14.0
147+78B/L AT EL.14.0
154+90B/L AT EL.14.0
163+18B/L AT EL.14.0
170+19B/L AT EL.14.0
LAKE PONTCHARTRAIN
DESIGN SWL = 11.5
NEW ORLEANS EAST LAKEFRONT LEVEE
18.0
COLLINS PIPELINE I-WALL
LINCOLN BEACH FLOODWALL
18.5
13.5
CITRUS LAKEFRONT LEVEE
14.5
NEW ORLEANS LAKEFRONT LEVEE
N.O. AIRPORT FLOODWALL AT 13.5 (2700')
NEW ORLEANS LAKEFRONT AIRPORT
13.5
LITTLE WOODS
DESIGN SWL = 11.5
13 INTERSTATE HWY.
13.5 U.S.HIGHWAY 11 FLOODGATE
14.0
NEW ORLEANS EAST LEVEE
14.5
New Orleans East
9.5 U.S.HIGHWAY 90 FLOODGATE
INTERIOR LOCAL LEVEE
15.5
ORLEANS PARISH
16.5
13 RAILROAD FLOODGATE
CSX RAILROAD TRACKS
JAHNCKE PUMP STATION #6 1200 CFS EXIST. FLOODWALL AT EL.13.8
PUMP STATION NO. 15 750 CFS EXIST. FLOODWALL AT EL.20.0
17.5
DESIGN SWL = 13.0
CITRUS PUMP STATION #10 1000 CFS EXIST. FLOODWALL AT EL.13.8
19.0
MAXENT PUMPSTATION #18 150 CFS
20.0
17.5
0+00W/L
ST.CHARLES PUMP STATION #14 1000 CFS EXIST. FLOODWALL AT EL.13.8
EXIST. FLOODWALL AT EL.22.0
18.0
EXIST. FLOODWALL AT EL.20.0
EXIST. FLOODWALL AT EL.15.0
18.0
18.0
IHNC-EAST LEVEE
13.0- 14.0
DWYER PUMPSTATION 120 CFS
NEW ORLEANS EAST BACK LEVEE
GIWW
AMID PUMPSTATION #20 500 CFS
14.0
GRANT PUMPSTATION 112 CFS
ELAINE PUMPSTATION 90 CFS
CITRUS BACK LEVEE
DESIGN SWL = 13.0
DESIGN SWL = 13.0
JOURDAN RD
I.H.N.C.LOCK
Arabi
Chalmette
LEGEND:
LEVEE AND FLOODWALL
STRUCTURE - NAVIGABLE
DRAINAGE STRUCTURE
PUMPING STATION
GRADE - PROJECT
EXISTING LEVEE ELEVATION FOR AREAS BELOW PROJECT GRADE
GEOLOGICALLY ACCEPTABLE AREAS FOR BREACHS
RECOMMENDED BREACH ZONES
LEVEE WITH EMBEDDED SHEETPILE
LAKE PONTCHARTRAIN AND VICINITY / 4B - NEW ORLEANS EAST

PLATE E- 4B

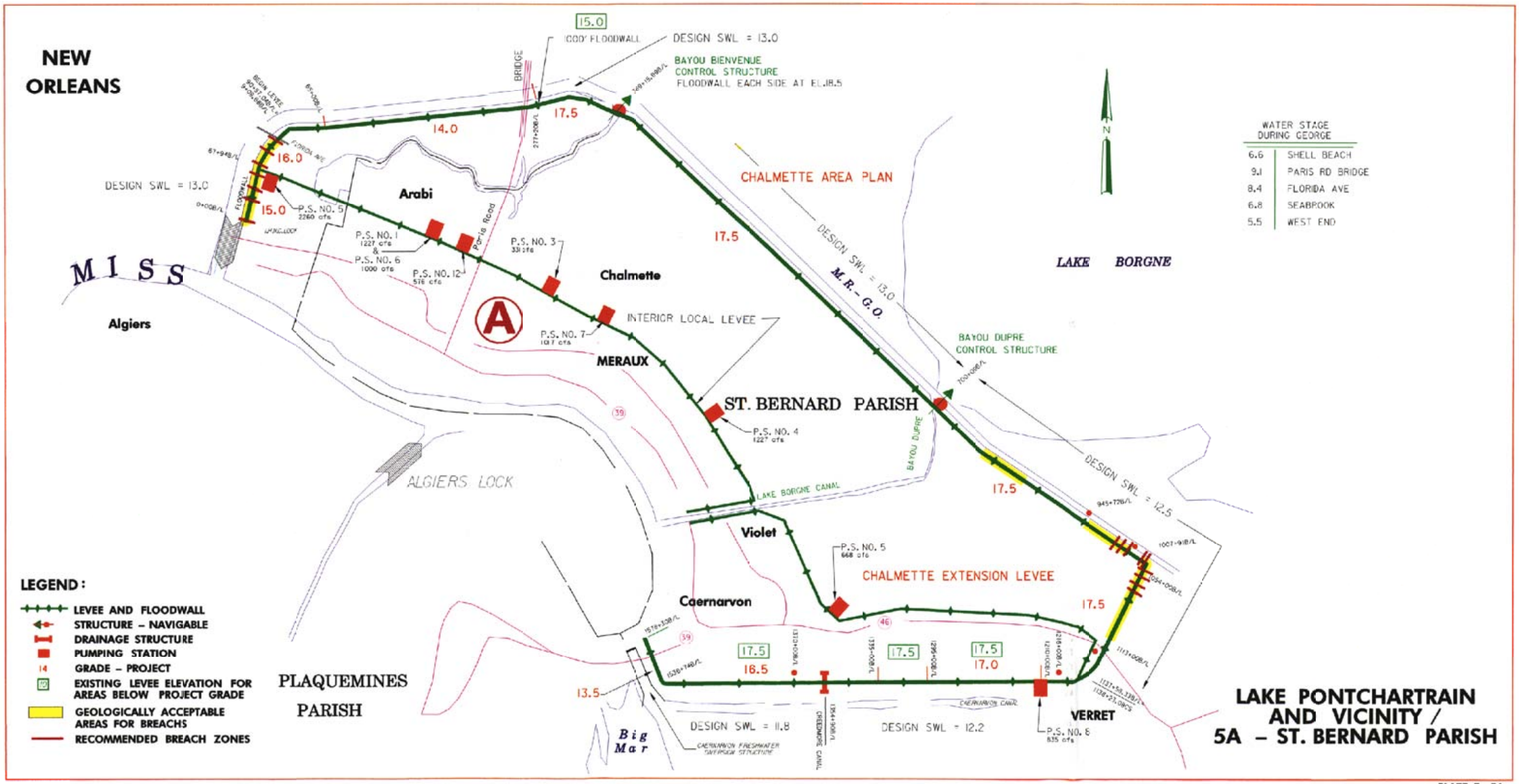
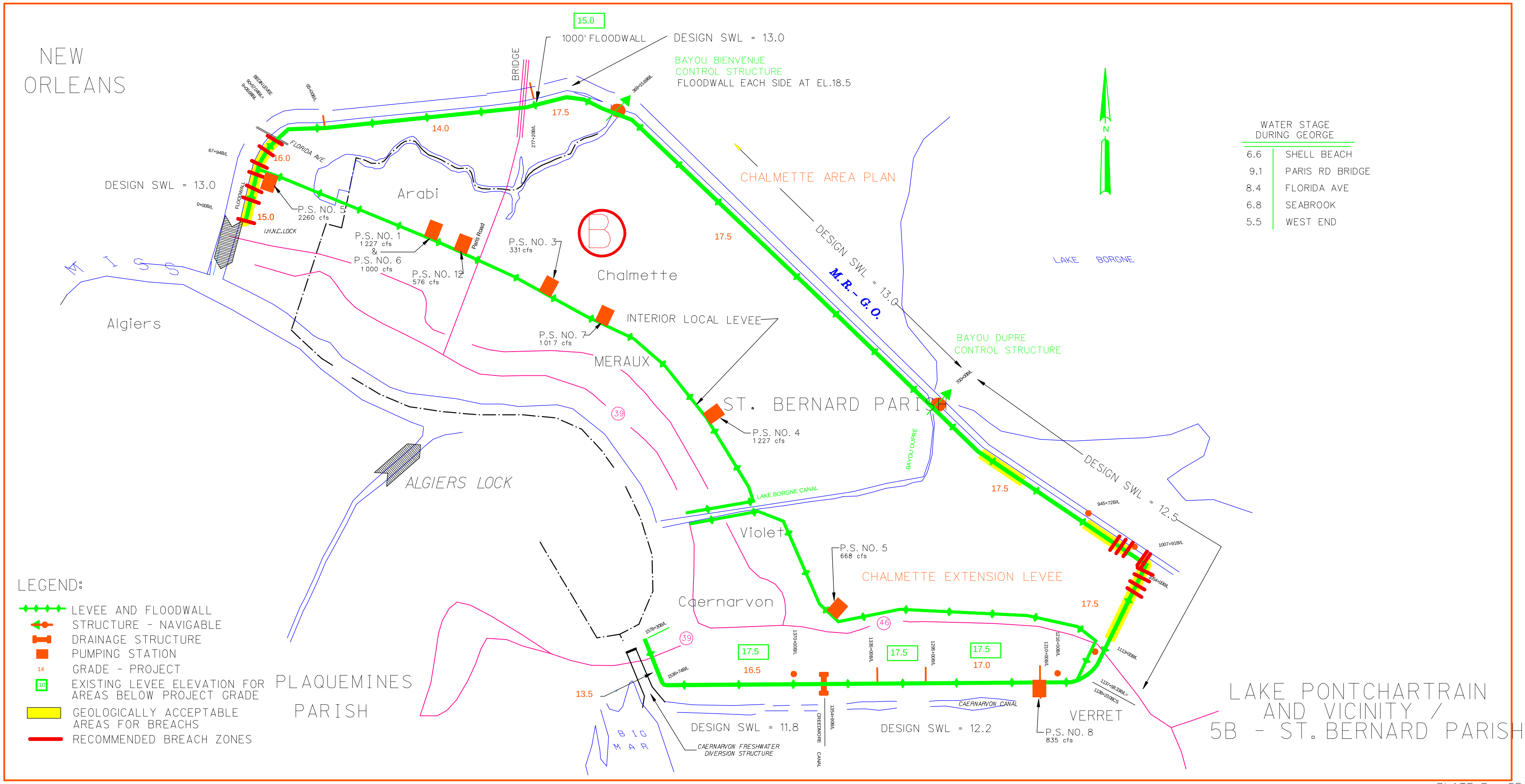
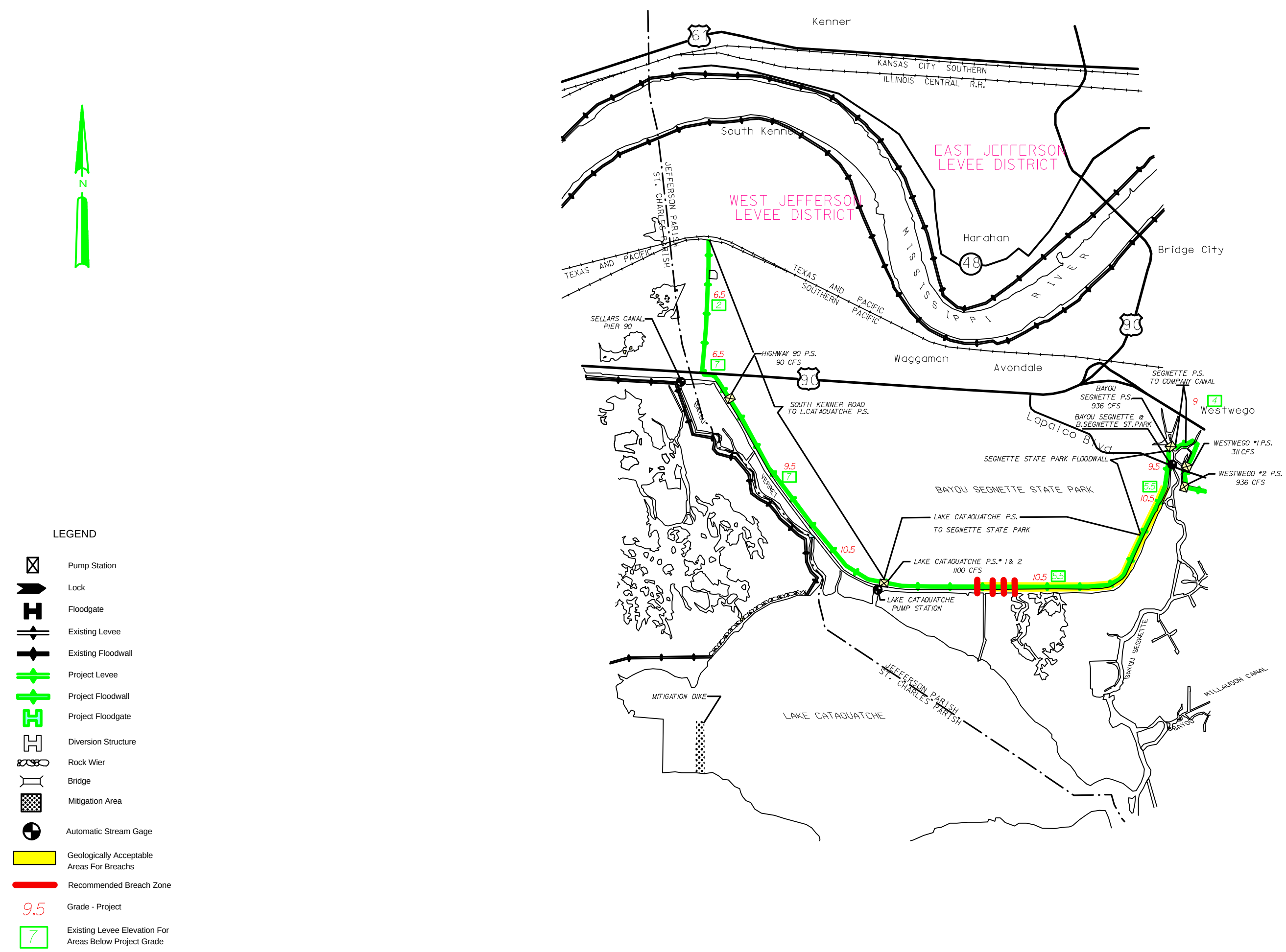

NEW ORLEANS
MISS
Algiers
Arabi
Chalmette
MERAUX
ST. BERNARD PARISH
Violet
Caernarvon
VERRET
PLAQUEMINES PARISH
LAKE BORGNE
Big Mar
ALGIERS LOCK
DESIGN SWL = 13.0
DESIGN SWL = 13.0
DESIGN SWL = 13.0
DESIGN SWL = 12.5
DESIGN SWL = 11.8
DESIGN SWL = 12.2
1000' FLOODWALL
BAYOU BIENVENUE CONTROL STRUCTURE FLOODWALL EACH SIDE AT EL.18.5
BAYOU DUPRE CONTROL STRUCTURE
CHALMETTE AREA PLAN
CHALMETTE EXTENSION LEVEE
INTERIOR LOCAL LEVEE
M.R.-G.O.
LAKE BORGNE CANAL
BAYOU DUPRE
BRIDGE
Paris Road
P.S. NO. 1 1227 cfs
P.S. NO. 6 1000 cfs
P.S. NO. 12 576 cfs
P.S. NO. 3 331 cfs
P.S. NO. 7 1017 cfs
P.S. NO. 4 1227 cfs
P.S. NO. 5 2260 cfs
P.S. NO. 5 668 cfs
P.S. NO. 8 835 cfs
14.0
16.0
15.0
15.0
17.5
17.5
17.5
17.5
16.5
17.0
13.5
WATER STAGE DURING GEORGE
6.6 SHELL BEACH
9.1 PARIS RD BRIDGE
8.4 FLORIDA AVE
6.8 SEABROOK
5.5 WEST END
LEGEND:
LEVEE AND FLOODWALL
STRUCTURE – NAVIGABLE
DRAINAGE STRUCTURE
PUMPING STATION
14 GRADE – PROJECT
EXISTING LEVEE ELEVATION FOR AREAS BELOW PROJECT GRADE
GEOLOGICALLY ACCEPTABLE AREAS FOR BREACHS
RECOMMENDED BREACH ZONES
LAKE PONTCHARTRAIN AND VICINITY / 5A – ST. BERNARD PARISH

PLATE E- 5A

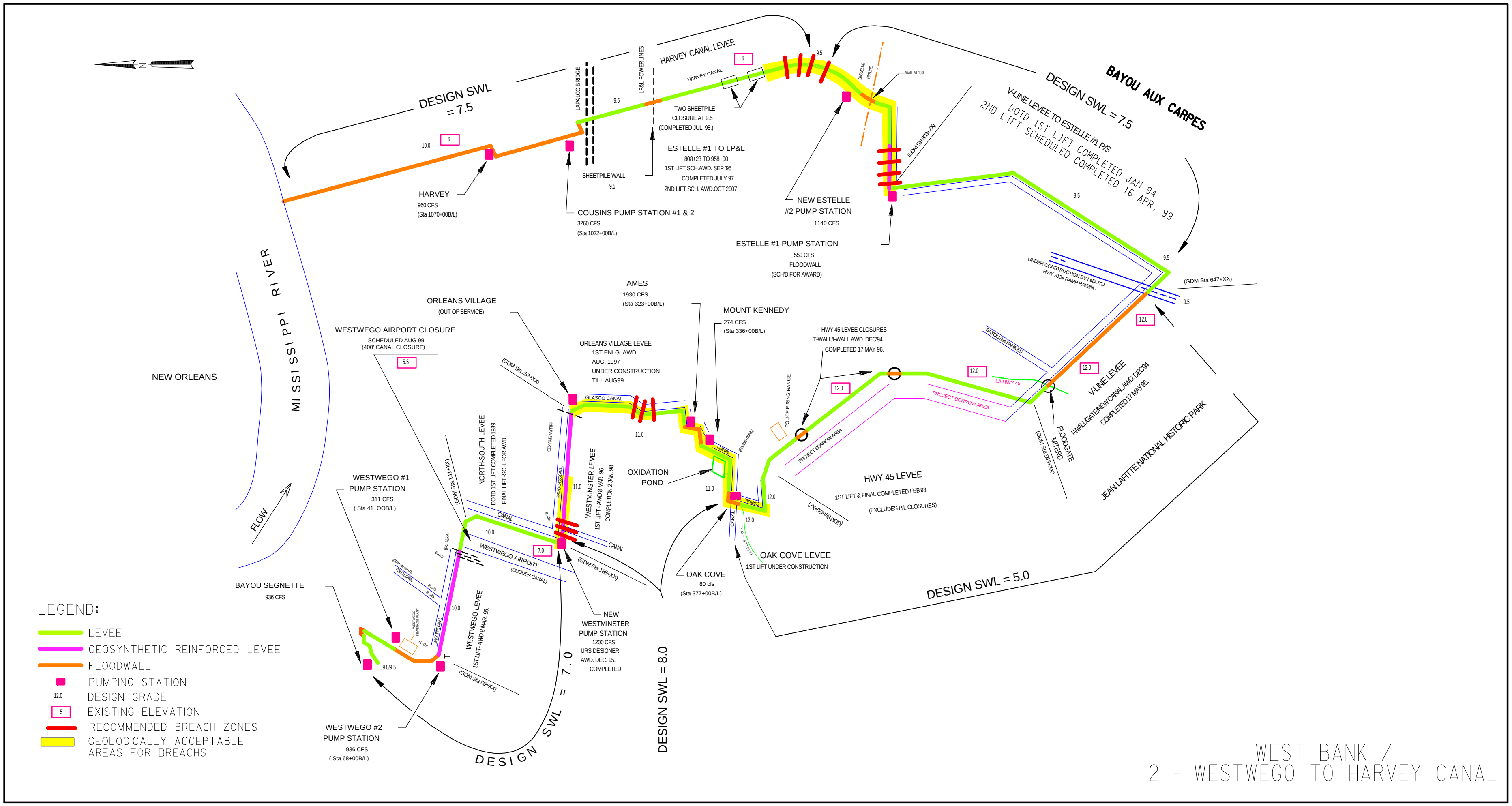


LAKE PONTCHARTRAIN AND VICINITY / 5B - ST. BERNARD PARISH

PLATE E - 5B

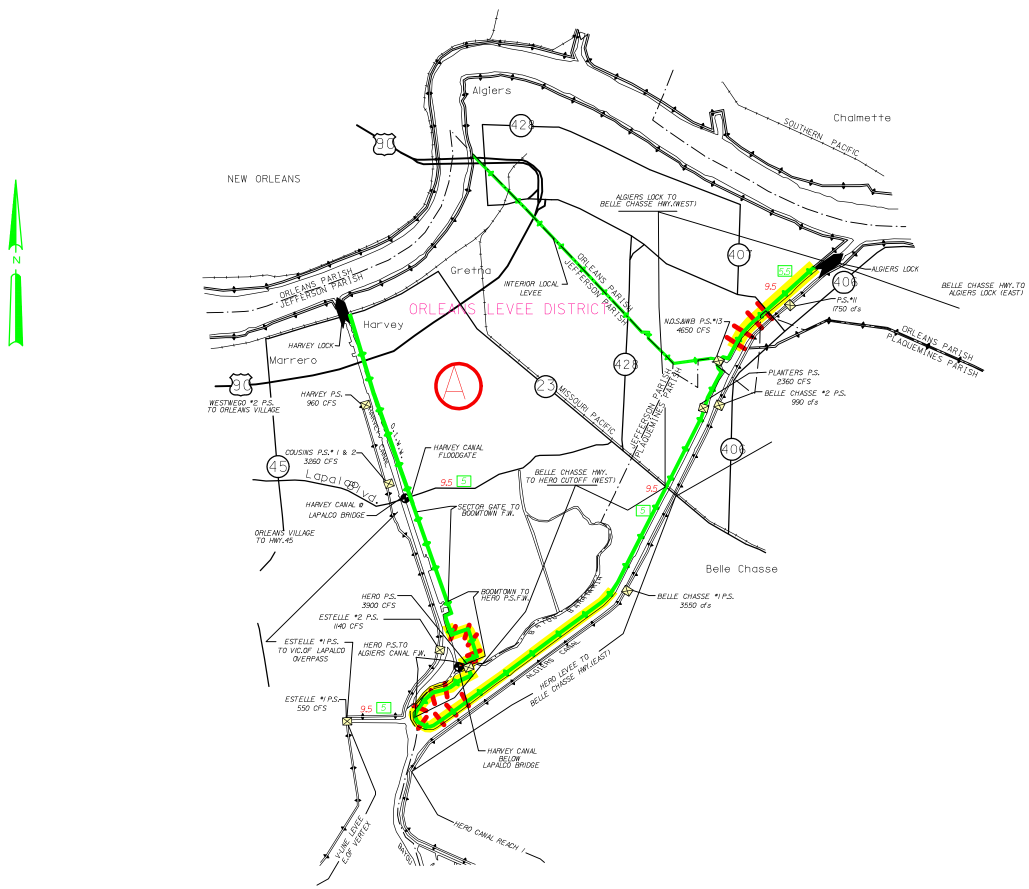


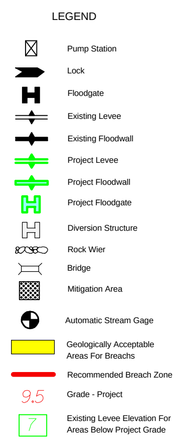
WEST BANK /
I- CATAOUATCHE



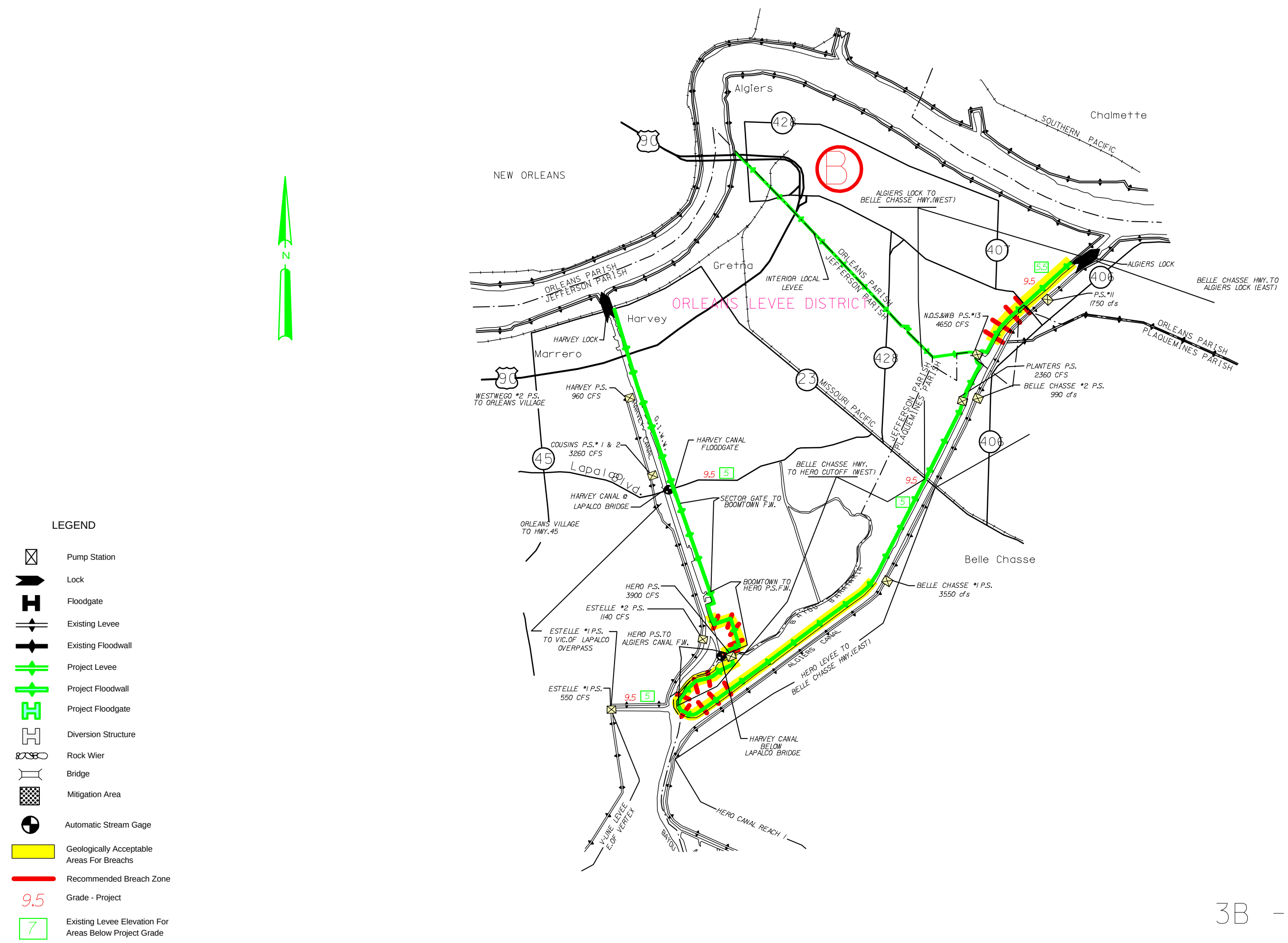
DESIGN SWL = 7.5
HARVEY CANAL LEVEE
LAPALCO BRIDGE
LP&L POWERLINES
HARVEY CANAL
TWO SHEETPILE CLOSURE AT 9.5 (COMPLETED JUL. 98.)
ESTELLE #1 TO LP&L
808+23 TO 958+00
1ST LIFT SCH.AWD. SEP '95
COMPLETED JULY 97
2ND LIFT SCH. AWD.OCT 2007
SHEETPILE WALL
HARVEY
960 CFS
(Sta 1070+00B/L)
COUSINS PUMP STATION #1 & 2
3260 CFS
(Sta 1022+00B/L)
NEW ESTELLE
#2 PUMP STATION
1140 CFS
ESTELLE #1 PUMP STATION
550 CFS
FLOODWALL
(SCH'D FOR AWARD)
BAYOU AUX CARPES
DESIGN SWL = 7.5
V-LINE LEVEE TO ESTELLE #1 P/S
DOTD 1ST LIFT COMPLETED JAN 94
2ND LIFT SCHEDULED COMPLETED 16 APR. 99
UNDER CONSTRUCTION BY LaDOTD
HWY 3134 RAMP RAISING
(GDM Sta 647+XX)
MISSISSIPPI RIVER
NEW ORLEANS
FLOW
AMES
1930 CFS
(Sta 323+00B/L)
ORLEANS VILLAGE
(OUT OF SERVICE)
WESTWEGO AIRPORT CLOSURE
SCHEDULED AUG 99
(400' CANAL CLOSURE)
MOUNT KENNEDY
274 CFS
(Sta 336+00B/L)
HWY.45 LEVEE CLOSURES
T-WALL/I-WALL AWD. DEC'94
COMPLETED 17 MAY 96.
ORLEANS VILLAGE LEVEE
1ST ENLG. AWD.
AUG. 1997
UNDER CONSTRUCTION
TILL AUG99
GLASCO CANAL
NORTH-SOUTH LEVEE
DOTD 1ST LIFT COMPLETED 1989
FINAL LIFT -SCH FOR AWD.
WESTMINSTER LEVEE
1ST LIFT - AWD 8 MAR. 96
COMPLETION 2 JAN. 98
OXIDATION POND
POLICE FIRING RANGE
PROJECT BORROW AREA
HWY 45 LEVEE
1ST LIFT & FINAL COMPLETED FEB'93
(EXCLUDES P/L CLOSURES)
LA HWY 45
V-LINE LEVEE
I-WALL/GATE/NEW CANAL AWD. DEC'94
COMPLETED 17 MAY 96.
FLOODGATE MITERD
JEAN LAFITTE NATIONAL HISTORIC PARK
WESTWEGO #1
PUMP STATION
311 CFS
(Sta 41+OOB/L)
WESTWEGO AIRPORT
(DUGUES CANAL)
CANAL
NEW
WESTMINSTER
PUMP STATION
1200 CFS
URS DESIGNER
AWD. DEC. 95.
COMPLETED
OAK COVE
80 cfs
(Sta 377+00B/L)
OAK COVE LEVEE
1ST LIFT UNDER CONSTRUCTION
DESIGN SWL = 5.0
BAYOU SEGNETTE
936 CFS
WESTWEGO LEVEE
1ST LIFT: AWD 8 MAR. 96.
WESTWEGO #2
PUMP STATION
936 CFS
(Sta 68+00B/L)
DESIGN SWL = 7.0
DESIGN SWL = 8.0
LEGEND:
LEVEE
GEOSYNTHETIC REINFORCED LEVEE
FLOODWALL
PUMPING STATION
DESIGN GRADE
EXISTING ELEVATION
RECOMMENDED BREACH ZONES
GEOLOGICALLY ACCEPTABLE AREAS FOR BREACHS
WEST BANK /
2 - WESTWEGO TO HARVEY CANAL

PLATE W - 2

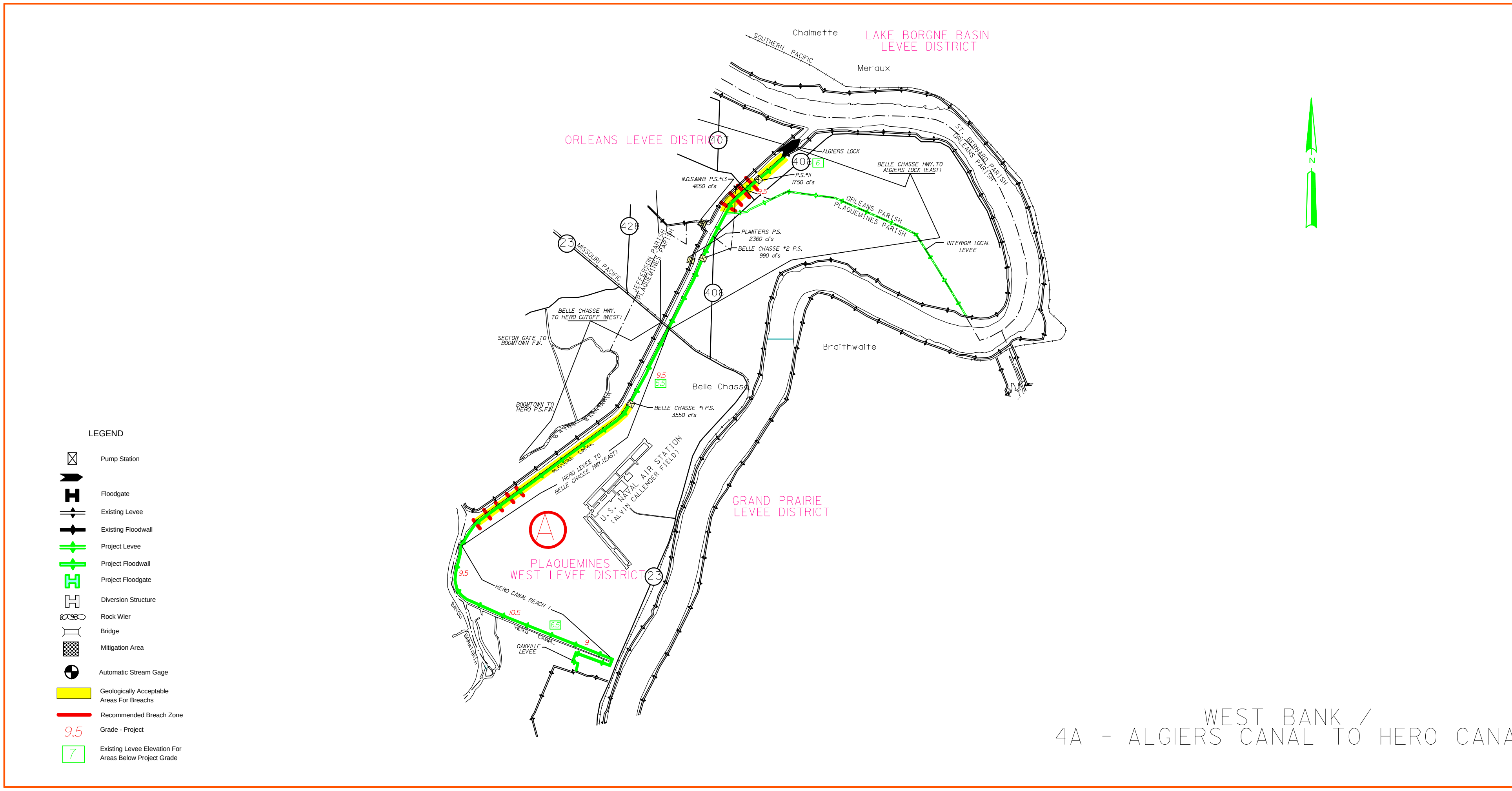




WESTBANK /
3A - HARVEY CANAL TO ALGIERS CANAL

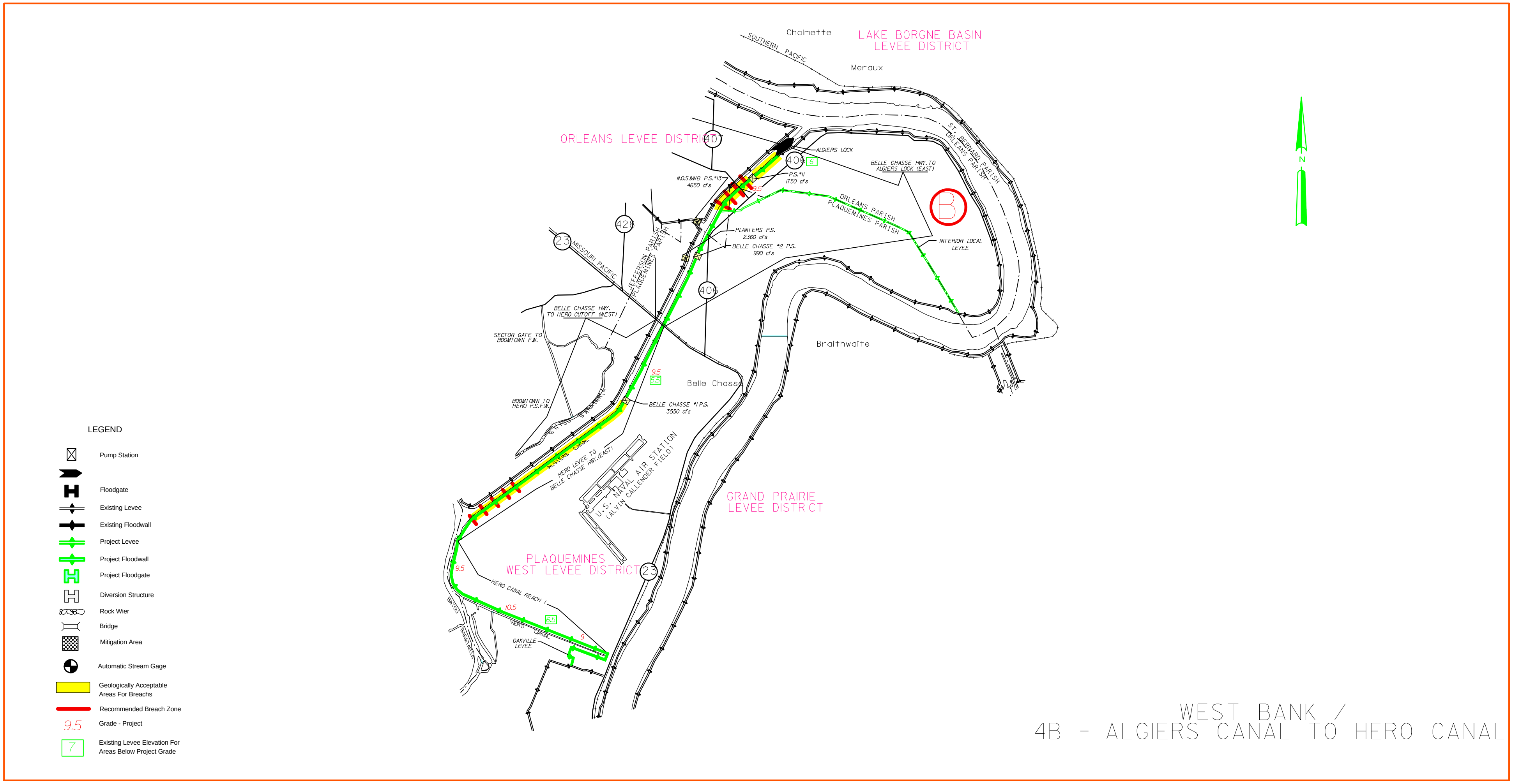


WESTBANK /
3B - HARVEY CANAL TO ALGIERS CANAL



WEST BANK /
4A - ALGIERS CANAL TO HERO CANAL

PLATE W - 4A



WEST BANK / 4B - ALGIERS CANAL TO HERO CANAL

PLATE W - 4B

APPENDIX A

US Army Corps of Engineers
New Orleans District
Project Maps

GULF INTRACOASTAL WATERWAY BETWEEN
APALACHEE BAY, FLA., AND THE MEXICAN BORDER
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1989

Project

River and Harbor Act of 24 July 1946, Senate Document 242, 79th Congress, 2nd Session, and prior R&H Acts, provide for a waterway 384.1 miles long, 12 feet deep and 125 feet wide at mean low gulf from Lake Borgne Light No. 29 (formerly No. 41), near the mouth of the Rigolets to the Sabine River, Louisiana and Texas, except in the section between Lake Borgne Light No. 29 and New Orleans (33.1 miles long via land cut through the marsh and the Industrial Canal) where a width of 150 feet is provided. An alternate route 40.5 miles long, 9 feet deep by 100 feet wide between Lake Borgne Light No. 29 and New Orleans *via Rigolets, Lake Pontchartrain, and Industrial Canal), an alternate connection with the Mississippi River below Algiers approximately 9 miles long, 12 feet deep and 125 feet wide with a lock (Algiers Lock) at the river end; an alternate route 12 feet deep and 125 feet wide from Morgan City, Louisiana to Port Allen, Louisiana via the East Atchafalaya Basin Protection Levee borrow Pit, Bayou Sorrel Lock (constructed with MR&T funds), Lower Grand River and Bayou Plaquemine to Indian Village thence via Bayou Grosse Tete and new land cut to the Mississippi River passing through a terminal lock in levee at Port Allen opposite Baton Rouge; a channel 9 feet deep and 100 feet wide from Indian Village via Bayou Plaquemine to Plaquemine, Louisiana, improvement of Franklin Canal as a connecting channel from GIWW (mile 121) to Franklin, Louisiana, 8 feet deep by 60 feet wide, with its upper 300 feet having a width of 100 feet. The construction of a lock at Harvey, Louisiana (Harvey Lock), a saltwater guard lock (Leland Bowman Lock) in the waterway at mile 182.8 west of Harvey lock, a saltwater guard lock (Calcasieu Lock) in the waterway at mile 238.5 west of Harvey Lock, and a lock at mile 93.5 (Bayou Boeuf Lock) west of Harvey Lock, constructed under the existing project, "Flood Control, Mississippi River and Tributaries". The project also provides for the following: Widening of bends, passing places, morring basins, such as railroad and highway bridges over artificial cuts as are necessary; purchase of pipeline dredge; construction and operation of new drainage canals and pumping facilities to restore parish drainage systems where intercepted; construction of a double leaf bascule four-lane highway bridge* with approaches at Louisiana State Highwy No. 47; construction of movable bridges at M.P.R.R. and Louisiana State Highway Nos. 23** and 406; fixed trestle bridges for crossing of proposed landside drainage canals, lift bridges at Louisiana State Highway No. 1*** at Port Allen, Louisiana, T&P R.R. at Port Allen, Louisiana, T&P.R.R. at Morley, Louisiana; construction of bulkheads and jetties at Lake Borgne and Chef Menteur, Louisiana, if found necessary, and for annual payments to the Board of Commissioners of the Port of New Orleans for use of a portion of the Inner Harbor Navigation Canal and Lock. The length of waterway within the U.S. Army Engineer District, New Orleans, is 384.1 miles via the northernly or Port Allen route and 299.4 miles via the southernly or Harvey Canal route.

Modification authorized by River and Harbor Act of 23 October 1962, House Document 556, 87th Congress, 2nd Session, provides for a channel 16 feet deep.

Canal, except in the vicinity of Houma, La., (mile 50.5 to 63-5); a by-pass route at Houma; a channel 16 feet deep and 200 feet wide through the reach from Atchafalaya River to the Sabine River; and four highway bridges (United States to contribute 58% of construction costs).

Replacement of the Vermilion Lock under the Provisions of Section 6 of the Rivers and Harbors Act of 3 March 1909 was approved by the Secretary of the Army on 16 May 1967 (See Sheet 1-45A).

*Construction of this bridge has become unnecessary under this project due to the fact that the portion of the project over which the bridge was to be constructed has been incorporated in the project, "Mississippi River-Gulf Outlet," which provides for a fixed high level bridge. See Sheet 1-19 (2).

**In lieu of the bridge at State Highway No. 23, a tunnel was constructed and completed 15 February 1956. Additional cost over estimated cost of bridge was borne by local interests.

***In lieu of a lift bridge at La. State Hwy. No. 1 at Port Allen, a 4-lane fixed bridge was constructed by Department of Highway, State of Louisiana in accordance with Public Law 85-167, 85th Congress (F.Y. 1958 Appropriation Act) approved 26 August 1957, which contained the following proviso: "Provided further, that not to exceed $3,500,000 of the funds hereinafter provided for the Plaquemine-Morgan City Alternate Route, shall be available for the construction of a 4-lane, high level fixed bridge on Louisiana State highway number 1 (formerly Route No. 167) over the extension of the Plaquemine-Morgan City Route of the Gulf Intracoastal Waterway in West Baton Rouge Parish Louisiana."

Purpose

To provide an inland waterway for barge traffic.

Physical Data

Range of tide, 10 to 14 inches . A severe storm may cause a high tide of from 6 feet to 9 feet.

Progress of Work

The main stem of the waterway as authorized under R & H Act of 24 July 1946 was completed to a 12-foot depth in 1944.

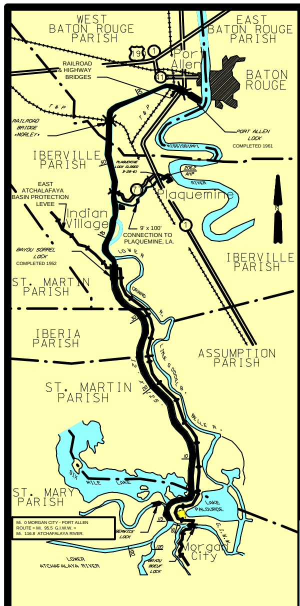
The remaining work to be done consists of: Enlarging the waterway, as provided by modification authorized 23 October 1962, House Document 556, 87th Congress, 2nd Session and any deferred construction that may be required under agreement for relocation of railroad facilities. The construction of bulkheads and jetties at Lake Borgne and Chef Menteur, La. are no longer necessary. This Feature was reviewed and deauthorized on 2 November 1979 under the Deauthorization Review Program.

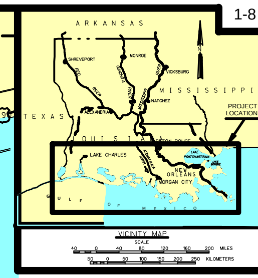
**GULF INTRACOASTAL WATERWAY BETWEEN
APALACHEE BAY, FLA., AND THE MEXICAN BORDER
U. S ARMY ENGINEER DISTRICT, NEW ORLEANS
CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1999
(continued)**

The project as modified is 61% complete. Relocation of the waterway at Chef Menteur-Pass was completed in Feb. 1972 and construction of the Leland Bowman Lock (Vermilion Lock replacement) was completed in March 1985.

Cost

$63,284,470





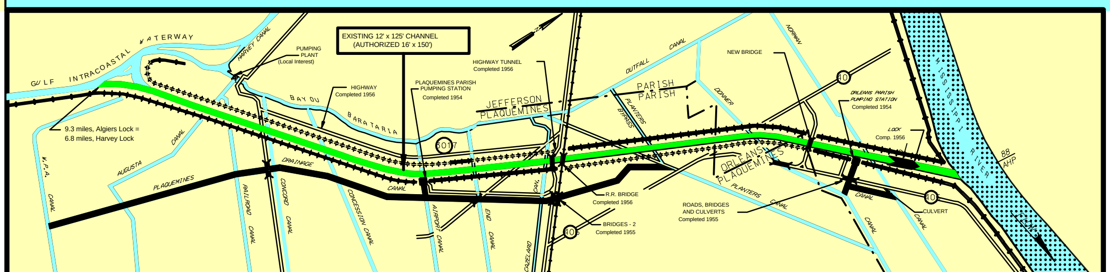
MORGAN CITY - PORT ALLEN ROUTE

COMPLETED 13 APRIL 1961

SCALES

MILES

KILOMETERS



Franklin Canal was completed to an interim 8- by 50 foot section in 1950. The canal was enlarged to 8- by 80 feet by local interests in 1953 between the main stem of G.I.W.W. and Bayou Yokely.

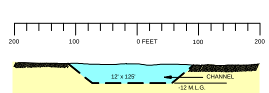
The Inner Harbor Navigation Canal and facilities were leased by the United States Government from the Board of Commissioners of the Port of New Orleans, effective 1 April 1944.

The Inner Harbor Navigation Lock Lease was terminated on 23 June 1986. the Corps now owns the lock in fee.	Completed 1923
Plaquemine Lock (Abondoned 29 September 1961)	Completed 1909
Vermilion Lock (Closed 1985)	Completed 1934
Harvey Lock	Completed 1935
Calcasieu Lock	Completed 1952
Bayou Sorrel Lock (MR&T)	Completed 1952
Bayou Boeuf Lock (MR&T)	Completed 1954
Algiers Lock	Completed 1956
Port Allen Lock	Completed 1961
Leland Bowman Lock (Vermilion Replacement)	Completed 1985

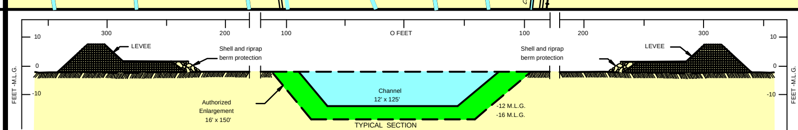
Enlargement of alternate route between Morgan City and Indian Village and construction of canal and appurtenant work from Indian Village to Port Allen and Port Allen Lock was completed and opened to navigation on 14 July 1961.

LEGEND

- Improvements Completed
- Improvements Authorized
- Lock
- Bridge
- Pumping plant existing (local interest)
- Pumping plant
- Road
- Levee completed



TYPICAL SECTION



TYPICAL SECTION

ALTERNATE CONNECTIONS BELOW ALGIERS

SCALES

MILES

KILOMETERS

ALTERNATE CONNECTION BELOW ALGIERS

(ALGIERS LOCK AND CANAL)

SCALES

MILES

KILOMETERS

MISSISSIPPI VALLEY DIVISION WORK

RIVER AND HARBOR IMPROVEMENTS

GULF INTRACOASTAL WATERWAY

CHEF MENTEUR PASS TO SABINE RIVER

SCALES AS SHOWN

OFFICE OF THE DISTRICT ENGINEER , NEW ORLEANS, LA.

REVISED 30 SEPTEMBER 1999

MISSISSIPPI RIVER BATON ROUGE TO THE GULF OF MEXICO, LA.

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1995

Project

River and Harbor Act of 2 March 1945, House Document 215, 76th Congress, 1st Session, and prior River and Harbor Acts, provide for channel dimensions as follows: Baton Rouge to New Orleans Section, 35 ft. deep Low Water Reference Plane (L.W.R.P.) by 500 ft. wide, 129.3 miles long; within limits of the Port of New Orleans Section 35 feet deep Mean Low Gulf (M.L.G.) by 1,500 ft. wide, 17.8 miles long; lower limits of the Port of New Orleans to Head of Passes Section, 40 ft. deep (M.L.G.) by 1,000 ft. wide, 86.7 miles long; Southwest Pass 40 ft. deep (M.L.G.) by 800 ft. wide, 17.5 miles long; Southwest Pass Lower Jetty and Bar Channel, 40 ft. deep (M.L.G.) by 600 ft. wide; South Pass, 30 ft. deep (M.L.G.) by 450 ft. wide, 13.5 miles long; South Pass Bar Channel, 30 ft. deep (M.L.G.) by 600 ft. wide.

River and Harbor Act of 23 October 1962 (Public Law no. 87-874, Senate Document No. 36, 87th Congress, 1st Session) provides for a channel 40 feet deep and 500 feet wide from Baton Rouge to the upper limits of the Port of New Orleans and also 40 feet deep for a width of 500 feet within the presently authorized 35-by 1,500-foot channel in the port limits of New Orleans.

See Map 1-51 for Mississippi River Ship Channel Project which will deepen the river and Southwest pass.

Phase I dredging construction was initiated on 1 July 1987. A 45 foot channel from the Gulf to mile 181 was completed on 17 December 1988.

Phase II provided for the dredging of a 45 foot channel from mile 181 to Baton Rouge. Phase II dredging construction was completed on 10 December 1995.

The General Design Memorandum, Supplement No. 2 approved by OCE 9 January 1985 included major changes in the scope of the project. These changes included rebuilding the eroded river banks from Venice to Head of Passes, and Southwest Pass, with bank nourishment and foreshore protection. The uncompleted work in South Pass has been eliminated.

Purpose

The purpose of the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana project is to provide adequate navigation passage to assure the most economical use of the waterway. The bank restoration works will reduce annual maintenance dredging requirements.

Physical Data

Normal range of tide at mouth is one foot; tide due to storms is 2 to 6 feet and hurricane 14 to 18 feet. During low river discharge, tidal variations are 0.8 foot at New Orleans and 0.2 foot at Baton Rouge. Maximum stages from spring floods on the Mississippi River are 20 feet above (M.S.L.) at New Orleans, and 45 feet above (M.S.L.) at Baton Rouge.

Progress of Work

Work authorized under the Acts prior to 1945 is complete.

Work authorized under the Act of 1962 is complete.

Work authorized under the modification to Act of 1945 (GDM, Suppl No. 2) is complete.

South Pass

In keeping with Corps of Engineers policy that projects only be maintained consistent with reasonable needs of existing commerce, the channel through South Pass will be maintained to provide a depth of -17.0 feet Mean Low Gulf (M.L.G.) and a width of 450 feet, and through South Pass Bar Channel a depth of -17.0 feet M.L.G. and a width of 600 feet.

MISSISSIPPI RIVER - GULF OUTLET, LOUISIANA
CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1997

AUTHORIZATION: The project was authorized by the River and Harbor Act of 1956, the Water Resources Development Act of 1976, and the Water Resources Development Act of 1986.

PROJECT: The plan of improvement consists of four basic items: (1) a completed channel extending from the Inner Harbor Navigation Canal to the minus 38-foot contour in the Gulf of Mexico; (2) completed jetties and dikes along the channel in Breton Sound; (3) a new lock with connecting channels; construction to begin soon (4) foreshore protection along the south side of the ship channel extending from the Inner Harbor Navigation Canal to the end of the hurricane protection levee & along the northside of the Inner Harbor Navigation Canal & along the northbank of the MRGO between Mi 41-Mi 56.0.

LOCAL COOPERATION: Assurances of local cooperation of items 1, 2, and 4 above were furnished by the Board of Commissioners of the Port of New Orleans and were accepted on behalf of the United States on 29 August 1957. The Board of Commissioners executed amended assurances covering the provisions of the Uniform Relocations Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, which were accepted on behalf of the United States on 21 April 1975 for the new lock. Supplemental assurances reflecting the changes made necessary by enactment of the Water Resources Development Act of 1976 were requested on 11 September 1978. By letter of 18 September 1978, local interests stated that they could not respond to our requests because plans for the lock at the Inner Harbor Navigation Canal site were in a very preliminary stage. In November 1983, the Board of Commissioners was informed of the selected plan and its costs, including their share, based on traditional cost sharing. By letter of 17 February 1984, the Board stated that it could not support the plan at that time because of the uncertainty of cost sharing and the financial situation of the State of Louisiana. However, by letter dated 11 February 1985, the Governor of Louisiana provided the necessary assurances to proceed with the coordination of an appropriate course of action for public involvement and to process the Evaluation Report. The public involvement program was initiated consistent with the Evaluation Report schedule. The final Evaluation Report was submitted to Higher Authorities on 3 April 1997 and is scheduled for Final Approval in December 1997. The project is recommended for new start construction during FY 99. The Shiplock will be cost shared in accordance with the provisions of Section 844 of the Water Resources Development Act of 1986, PL 99-662

PROGRESS: Work on the channel was initiated 17 March 1958. The construction of the channel is completed and is maintained at a depth of 36 feet and 500 feet width from the INHC lock to Mile 0.0 and maintained at a depth of 38 feet by 600 feet width from Mile 0.0 to the 38 foot contour in the Gulf of Mexico. The extension of the Southwest Jetty to mile 14.8 is completed. The foreshore protection along the north side of the Inner Harbor Navigation Canal and the south side of the MRGO from Bayou Bienvenue to the end of the hurricane protection levee is complete. The remaining foreshore protection is on hold until the need arises. The existing lock was completed in 1923, by non-Federal interests, and had been leased by the Federal Government since 1944. On 1 July 1986, the lock, adjacent land, and facilities were purchased from the Board of Commissioners of the Port of New Orleans for $3,800,000. By purchasing the lock, the Corps received fee title to the lock and appurtenances with operation and maintenance responsibility for the St. Claude and Florida Avenue Bridges transferring to the Board of Commissioners of the Port of New Orleans. A General Re-evaluation Report is presently being prepared for a new lock and connecting channels. The final site and size for the new lock have not been determined. The report is scheduled for completion in 1995.

Access Channel (28 by 149 feet), G.I.W.W. to Breton Sound	27 Mar 61
Interim Channel (36 by 250 feet), Paris Road to Gulf of Mexico	5 Jul 63
Project Channel (36 by 500 feet)	
Inner Harbor Navigation Canal to Vicinity of Paris Road	7 May 59
Vicinity to Paris Road to Mile -9.4	14 Mar 65
Turning Basin (Vic. Mile 66.0) and appurtenant work is physically complete	22 Jul 65
Plug at Paris Road Removed	20 Jan 68
High Level Bridge (Louisiana State Highway 47), initiated 1 June 1964 completed	14 Nov 67
Removal of Pontoon Bridge at Paris Road initiated 24 July 1967 completed	22 Sep 67
Retention Dikes:	
Shell Core and RipRap (both dikes))	26 Aug 61
Capping (both dikes)) to Mile 20.2	29 Oct 62
Rockfacing (both dikes))	3 Nov 63

Extension of southwest jetty to Mile 14.8 (Sta. 2700). 1st Phase, completed. Remaining jetty across Breton Sound not yet started because the cost cannot be justified.

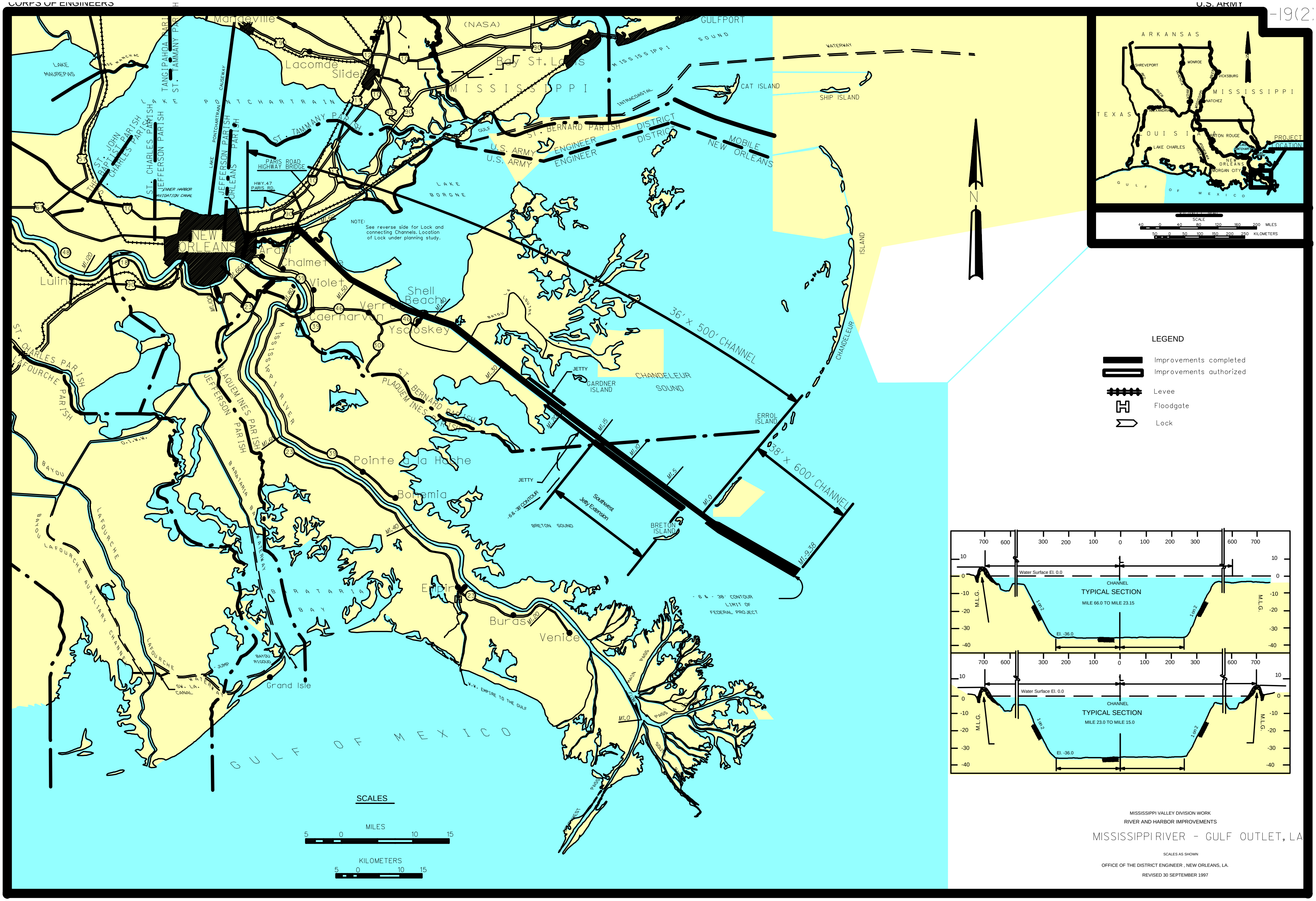
A 3.5 mile reach of north bank foreshore protection was completed on 19 February 1993, and a 2 mile reach of north bank foreshore protection completed 9 Feb 98. Another 2 mile reach to be constructed spring of 2000 and a final 1 1/2 mile reach to be completed in 2001. North bank foreshore protection located between Mi.41 and Mi.56 as directed by Public Law 102-104, 17 August 1991, Energy and Water Development Appropriation Act of 1992.

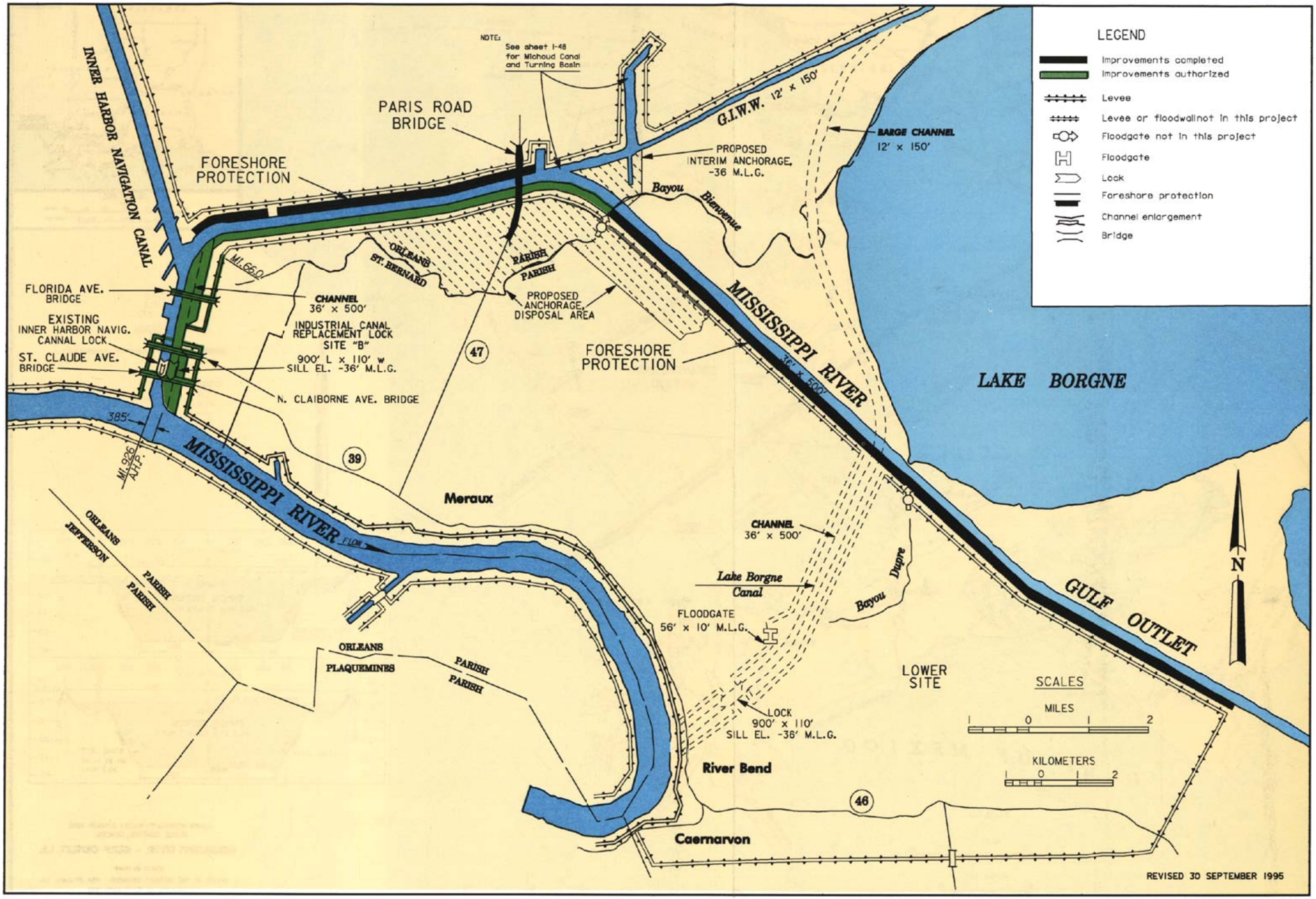
4 Prefabricated steel survey towers and 25 timber pile station markers	23 Jun 61
3 Concrete survey towers and 25 timber pile station markers	24 Jul 61

Channel maintained at 36 foot depth from IHNC lock to Mile 0.0 and at 38 foot depth from Mile 0.0 to the 38 foot contour in the Gulf Of Mexico.

COST:	Federal	$640,000,000
	Non-Federal	$124,000,000
	Total Project	$764,000,000

CORPS OF ENGINEERS U.S. ARMY -19(2)




LEGEND
Improvements completed
Improvements authorized
Levee
Levee or floodwallnot in this project
Floodgate not in this project
Floodgate
Lock
Foreshore protection
Channel enlargement
Bridge
NOTE:
See sheet I-48
for Michoud Canal
and Turning Basin
PARIS ROAD
BRIDGE
FORESHORE
PROTECTION
G.I.W.W. 12' x 150'
BARGE CHANNEL
12' x 150'
PROPOSED
INTERIM ANCHORAGE,
-36 M.L.G.
Bayou Bienvenue
INNER HARBOR NAVIGATION CANAL
MI. 66.0
ORLEANS
ST. BERNARD
PARISH
PARISH
FLORIDA AVE.
BRIDGE
CHANNEL
36' x 500'
PROPOSED
ANCHORAGE,
DISPOSAL AREA
EXISTING
INNER HARBOR NAVIG.
CANNAL LOCK
INDUSTRIAL CANAL
REPLACEMENT LOCK
SITE "B"
900' L x 110' w
SILL EL. -36' M.L.G.
ST. CLAUDE AVE.
BRIDGE
N. CLAIBORNE AVE. BRIDGE
47
FORESHORE
PROTECTION
MISSISSIPPI RIVER
36' x 500'
LAKE BORGNE
385'
MI. 92.6
AHP.
39
MISSISSIPPI RIVER
FLOW
Meraux
ORLEANS
JEFFERSON
PARISH
PARISH
CHANNEL
36' x 500'
Lake Borgne
Canal
Bayou Dupre
FLOODGATE
56' x 10' M.L.G.
ORLEANS
PLAQUEMINES
PARISH
PARISH
LOCK
900' x 110'
SILL EL. -36' M.L.G.
LOWER
SITE
GULF OUTLET
N
SCALES
MILES
1 0 1 2
KILOMETERS
1 0 1 2
River Bend
46
Caernarvon
REVISED 30 SEPTEMBER 1995

MISSISSIPPI RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LOUISIANA

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1995

AUTHORIZATION: The project was authorized by the Supplement Appropriation Act of 1985, (Public Law 99-88 dated 15 August 1985). The Water Resources Development Act (WRDA) of 1986, (Public Law 99-662) provides for innovative cost sharing between the Federal Government and non-Federal interests for construction and maintenance of the project.

PROJECT: The Mississippi River Ship Channel, Gulf to Baton Rouge, La., project will provide more efficient deep draft navigation access to the New Orleans and Baton Rouge reaches of the Mississippi River via Southwest Pass by enlarging the existing channel to a project depth of 55 feet, enlarging the adjacent channel along the left descending bank in New Orleans Harbor to a 40 foot depth, constructing a turning basin at Baton Rouge, constructing training works in the passes to reduce maintenance dredging and constructing saltwater intrusion mitigation features which are required as a result of deepening the channel.

LOCAL COOPERATION: A Local Cooperation Agreement (LCA) between the Government and the State of Louisiana was signed on 30 June 1986. The first supplement to the LCA was signed on 15 June 1987 to comply with the cost sharing and financing concepts reflected in the WRDA of 1986. A second supplement to the LCA was signed on 25 June 1990 to incorporate language allowing relocation costs to be credited towards the 10% non-Federal repayment as per WRDA of 1988 and language disallowing the State to use any Federal funds for their cash contributions. The LCA and first supplement provide for cost sharing (75% Federal, 25% non-Federal) for dredging of a 45 foot channel from the Gulf of Mexico to mile 181.0 and the construction of saltwater mitigation features. This work is defined as Phase I. A third supplement to the LCA addresses construction of the saltwater mitigation features and was executed 28 May 1993. A Project Cooperation Agreement (PAC) for Phase II was executed on 3 September 1993. Phase II provides for the Dredging of a 45-foot channel from mile 181.0 to Baton Rouge.

PROGRESS: Phase I dredging construction was initiated on 1 July 1987. A 45 foot channel from the Gulf to mile 181.0 was complete in December 1988. An underwater sill at mile 64.0 was constructed in July 1988 as a mitigation measure to reduce saltwater intrusion during the drought conditions that year. Freshwater was also barged to three municipal water plants during 1988. Phase I mitigation construction (upgrades to the Plaquemines Parish water supply and distribution system on the west bank) was initiated after executing with the State of Louisiana on 28 May 1993 the third supplement to the LCA. When complete, barging freshwater will not be required.

Phase II dredging construction was initiated in July 1994. Construction involved deepening seven river crossings to 45 feet. Phase II was completed 9 December 1994.

MISSISSIPPI RIVER SHIP CHANNEL, GULF TO BATON ROUGE, LOUISIANA

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1997
(continued)

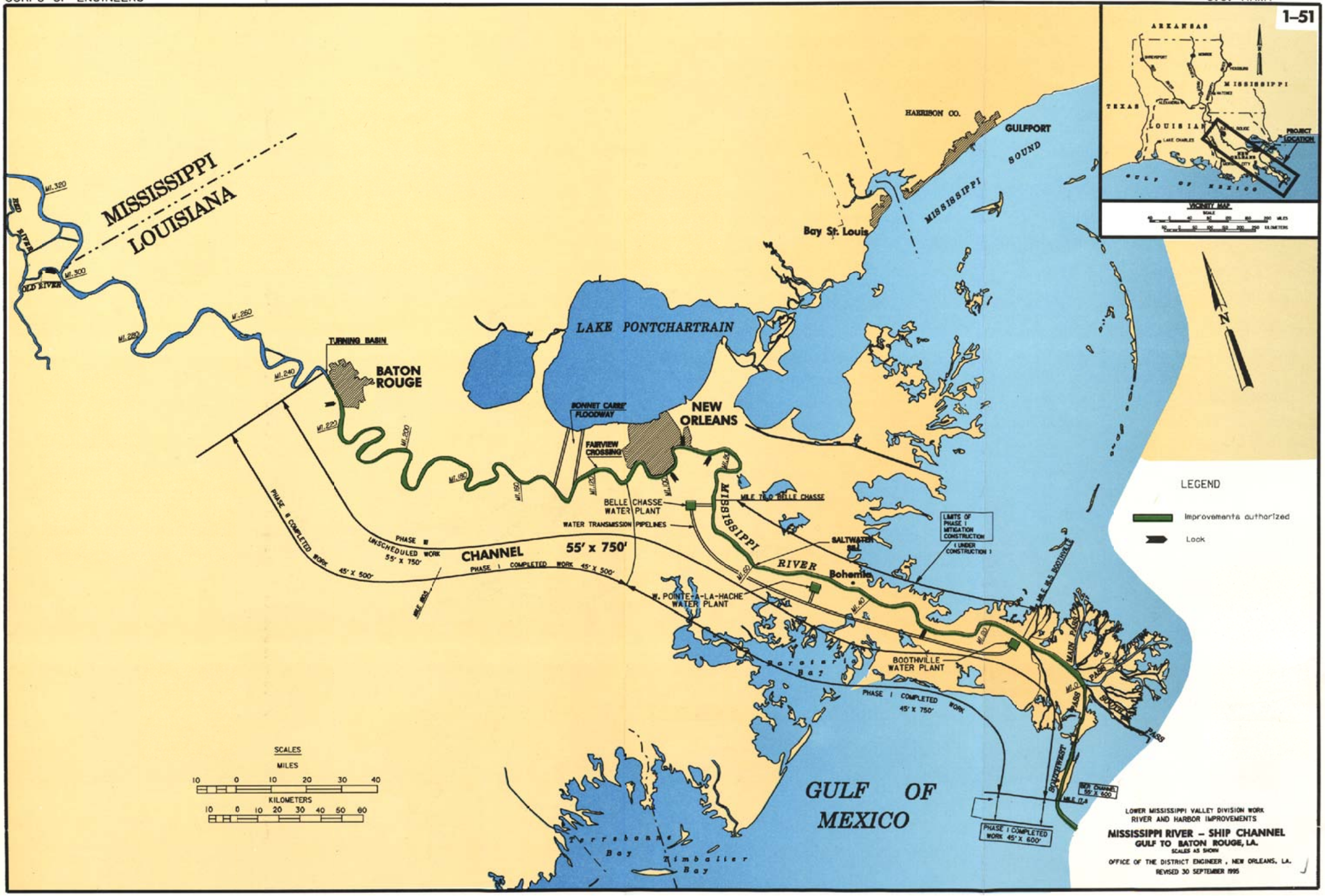
The State of Louisiana has requested that Phase III investigation proceed on the remaining authorized project features. We are preparing a Federal Design Memorandum documenting the results of our investigations into deepening the river to 50 and 55 feet.

COST:

	TOTAL	FEDERAL	NON-FEDERAL
Authorized Total Project	$471,000,000	$178,000,000	$293,000,000
Current Total Project Fully Funded Estimated Cost	$552,200,000	$161,000,000	$390,000,000
Current Phase I Fully Funded Estimated Cost	$44,203,000	$27,153,000	$17,050,000
Current Phase II Fully Funded Estimated Cost	$7,708,000	$5,014,000	$2,694,000

CORPS OF ENGINEERS

U.S. ARMY



LAKE PONTCHARTRAIN & VICINITY, LOUISIANA

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1995

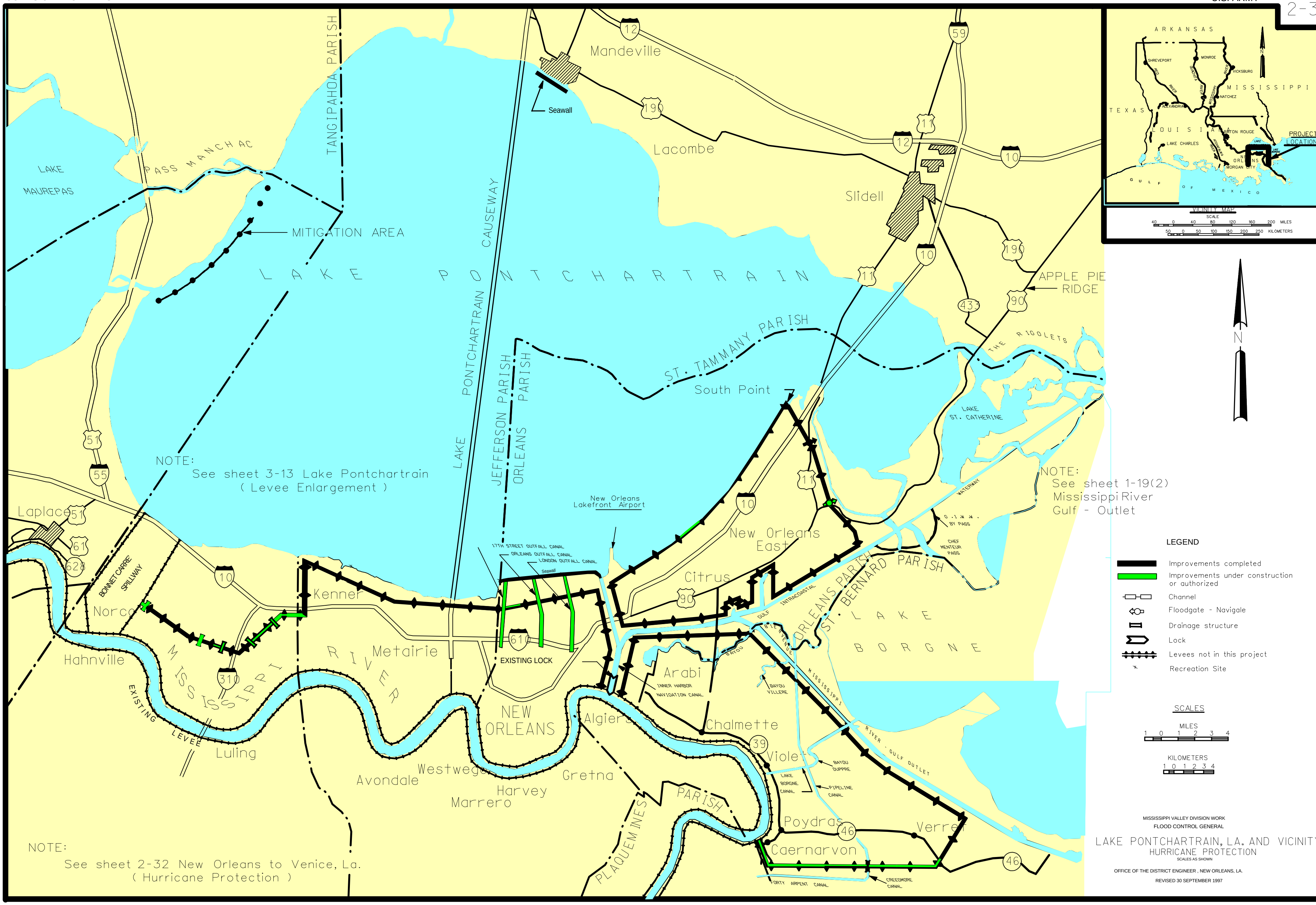
AUTHORIZATION: The project was authorized by Flood Control Act of 1965, and the Water Resources Act of 1974, 1986, 1990, and 1992.

PROJECT: The project provides for construction of the Lake Pontchartrain High Level Plan and the Chalmette Area Plan. The project includes a new levee parallel to and immediately north of U.S. Highway 61, between the levee along the Jefferson-St. Charles Parish boundary and the east Bonnet Carre' Spillway guide levee, an enlarged levee the Jefferson Parish Lakefront, an enlarged New Orleans Lakefront levee landward of the seawall, enlargement of existing levees of the Inner Harbor Navigation Canal in New Orleans, a new levee floodwall along the Lakefront extending from the floodwall at the New Orleans to South Point, an enlarged levee from South Point to the GIWW, a levee along and north of the Mississippi River-Gulf Outlet and Gulf Intracoastal Waterway from the Inner Harbor Navigation Canal to Chef Menteur, and a new levee from the Inner Harbor Navigation Canal Levee along and on the south bank of the Mississippi River-Gulf Outlet to a point approximately 2-1/2 miles northeast of Verret and then in a generally westerly direction to the Mississippi River Levee near Caernarvon. The strengthened Mandeville seawall on the north shore at present height. A new pumping station and vertical lift gates for the Florida Avenue Complex are included in this project. Mitigation for environmental damage will be provided by a segmented rock breakwater along the Manchac Wildlife Refuge to allow marsh creation.

LOCAL COOPERATION: Assurances are required for the two independently justified plans. The Chalmette Area Plans local sponsors are the Orleans Levee District, St. Bernard Parish Council and Lake Borgne Basin Levee District. The High Levee Plans local sponsors are the Orleans Levee District the New Orleans East unit, the East Jefferson Levee Board for the Jefferson parish portion of the New Orleans West unit and the Ponchartrain Levee District for the St. Charles Parish portion of the New Orleans East Unit.

PROGRESS: Funds to initiate pre-construction engineering and design were appropriated in FY 1966, and funds to initiate construction were appropriated in FY 1967. The project is approximately 80 percent complete and the estimated completion date is November 2013. The New Orleans East Unit is 90 percent complete, with a completion date of September 2009. The New Orleans West Unit is 12 percent complete with a completion date of November 2013. The Mandeville Unit is 100% complete as of September 1995. The Chalmette Unit is 98 percent complete with a completion date of September 2001.

COST: The total estimate of the project cost fully funded is $707,000,000. The remaining benefit-cost ratio is 3.4 to 1 at 3-1/4 percent.


LAKE PONTCHARTRAIN
LAKE MAUREPAS
PASS MANCHAC
TANGIPAHOA PARISH
MITIGATION AREA
LAKE PONTCHARTRAIN CAUSEWAY
Seawall
Mandeville
Lacombe
Slidell
APPLE PIE RIDGE
THE RIGOLETS
ST. TAMMANY PARISH
South Point
LAKE ST. CATHERINE
JEFFERSON PARISH
ORLEANS PARISH
NOTE:
See sheet 3-13 Lake Pontchartrain
(Levee Enlargement)
New Orleans Lakefront Airport
New Orleans East
Citrus
NOTE:
See sheet 1-19(2)
Mississippi River
Gulf - Outlet
Laplace
BONNET CARRE' SPILLWAY
Norco
Kenner
Metairie
Hahnville
MISSISSIPPI RIVER
EXISTING LEVEE
Luling
Avondale
Westwego
Marrero
Harvey
Gretna
Algiers
NEW ORLEANS
EXISTING LOCK
17TH STREET OUTFALL CANAL
ORLEANS OUTFALL CANAL
LONDON OUTFALL CANAL
GULF INTRACOASTAL WATERWAY
INNER HARBOR NAVIGATION CANAL
Arabi
Chalmette
Violet
Poydras
Verret
Caernarvon
PLAQUEMINES PARISH
ORLEANS PARISH
ST. BERNARD PARISH
LAKE BORGNE
MISSISSIPPI RIVER GULF OUTLET
BAYOU VILLERE
BAYOU DUPRE
LAKE BORGNE CANAL
PIPELINE CANAL
FORTY ARPENT CANAL
CREEDMORE CANAL
CHEF MENTEUR PASS
G.I.W.W. BY PASS
NOTE:
See sheet 2-32 New Orleans to Venice, La.
(Hurricane Protection)
ARKANSAS
MISSISSIPPI
TEXAS
LOUISIANA
SHREVEPORT
MONROE
VICKSBURG
NATCHEZ
ALEXANDRIA
BATON ROUGE
LAKE CHARLES
NEW ORLEANS
MORGAN CITY
GULF OF MEXICO
PROJECT LOCATION
VICINITY MAP
N
LEGEND
Improvements completed
Improvements under construction or authorized
Channel
Floodgate - Navigable
Drainage structure
Lock
Levees not in this project
Recreation Site
SCALES
MILES
KILOMETERS
MISSISSIPPI VALLEY DIVISION WORK
FLOOD CONTROL GENERAL
LAKE PONTCHARTRAIN, LA. AND VICINITY
HURRICANE PROTECTION
SCALES AS SHOWN
OFFICE OF THE DISTRICT ENGINEER , NEW ORLEANS, LA.
REVISED 30 SEPTEMBER 1997

WESTWEGO TO HARVEY CANAL, LOUISIANA
HURRICANE PROTECTION PROJECT

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1997

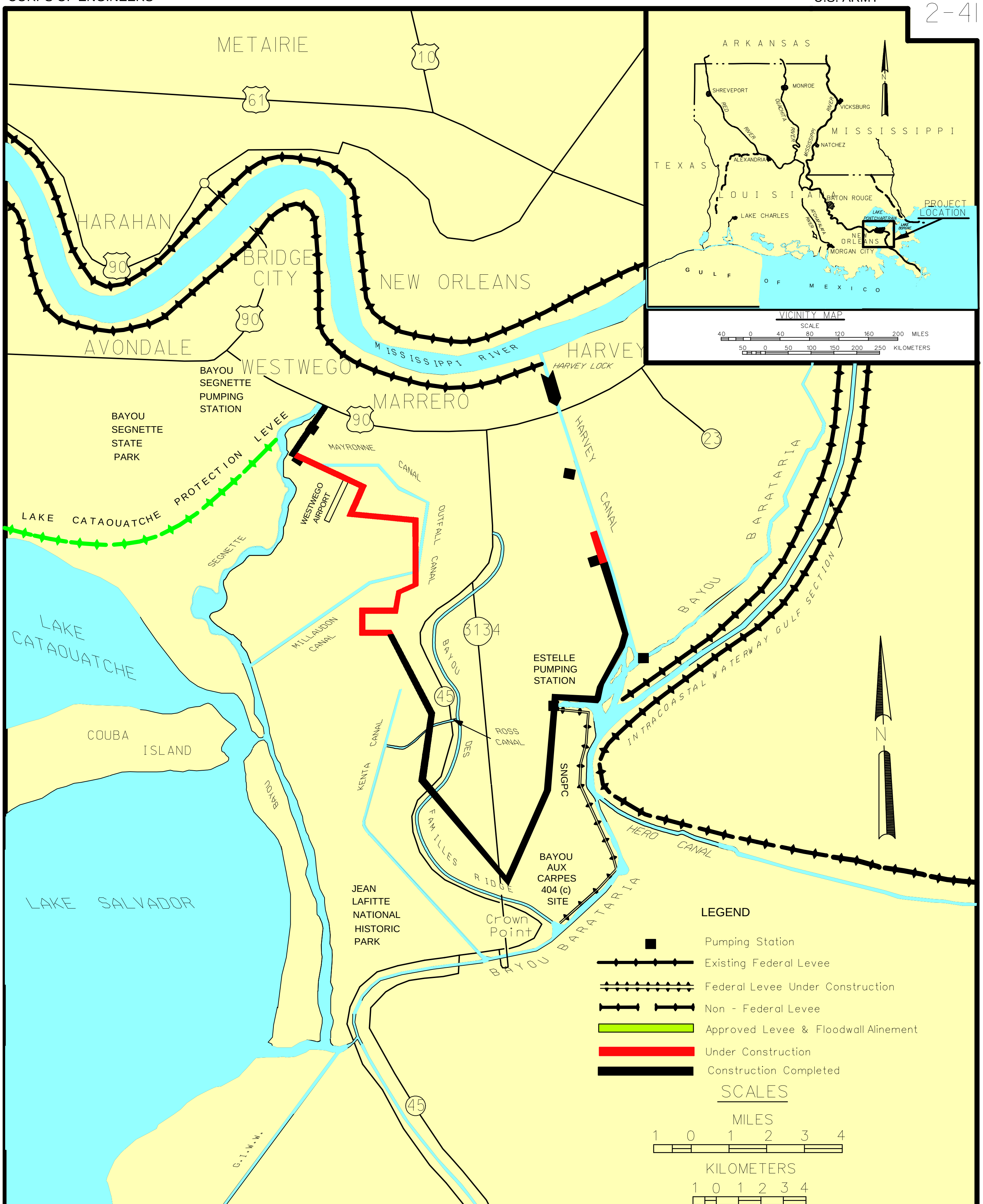
AUTHORIZATION: Public Law 99-662, the Water Resources Development Act of 1986, authorized the project, with the Lake Cataouatche portion added by the Water Resources Development Act of 1996. (Public Law 104-303)

PROJECT: The project will provide protection to the area between the City of Westwego and the Harvey Canal within Jefferson Parish, Louisiana on the west bank of the Mississippi River. The plan of protection consists of about 22 miles of new and enlarged levees and floodwalls designed to protect against floodwaters resulting from the standard project hurricane (SPH). The SPH has a frequency of recurrence of about 500 years. The elevation of the SPH floodwalls and levees varies from 9 feet NGVD to 17 feet NGVD. The project plan includes mitigation which consists of the construction of a timber pile and tire breakwater on the west bank of Lake Cataouatche adjacent to the Salvador Wildlife Management Area and the acquisition and management of 1024 acres of wooded wetlands. The Lake Cataouatche area eliminates a westside closure, and adds about 10 miles of levee and 2 miles of floodwalls to the project.

LOCAL COOPERATION: The Local Cooperation Agreement between the Department of the Army and the West Jefferson Levee District was signed on 18 December 1990. The project is cost shared 65% Federal, 35% non-Federal.

PROGRESS: Project construction began in February 1991. Construction has been completed on the Lake Cataouatche Mitigation Breakwater, the LA Hwy 45 Single Lift Levee, East of Vertex 1st Lift Levee (non-Federal contract) the Company Canal Floodwall. Estelle to LP&L Powerline Levee 1st lift, V-Levee Floodwall and Hwy 45 Levee Gap Closures and Old to New Westwego P.S. Floodwall. Construction is underway on the following features: (1) New Westwego P.S. to Orleans Village 1st lift and (2) Orleans Village to Hwy 45 1st lift. The following construction contracts are scheduled for award in FY 1998: (1) Westwego Airport (2) Estelle Levee 1st lift repairs (3) LA Hwy 3134 (Non-Fed) and (4) Estelle PS-LP&L FW. The project is 49% complete. Completion is scheduled for 2007.

COST: $95,200,000 ($61,900,000 Federal and $33,300,000 non-Federal).



MISSISSIPPI VALLEY DIVISION WORK

FLOOD CONTROL GENERAL

WESTWEGO TO HARVEY CANAL, LA.

HURRICANE PROTECTION

SCALES AS SHOWN

OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.

REVISED 30 SEPTEMBER 1997

WEST BANK - EAST OF HARVEY CANAL, LA. (HURRICANE PROTECTION)

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1997

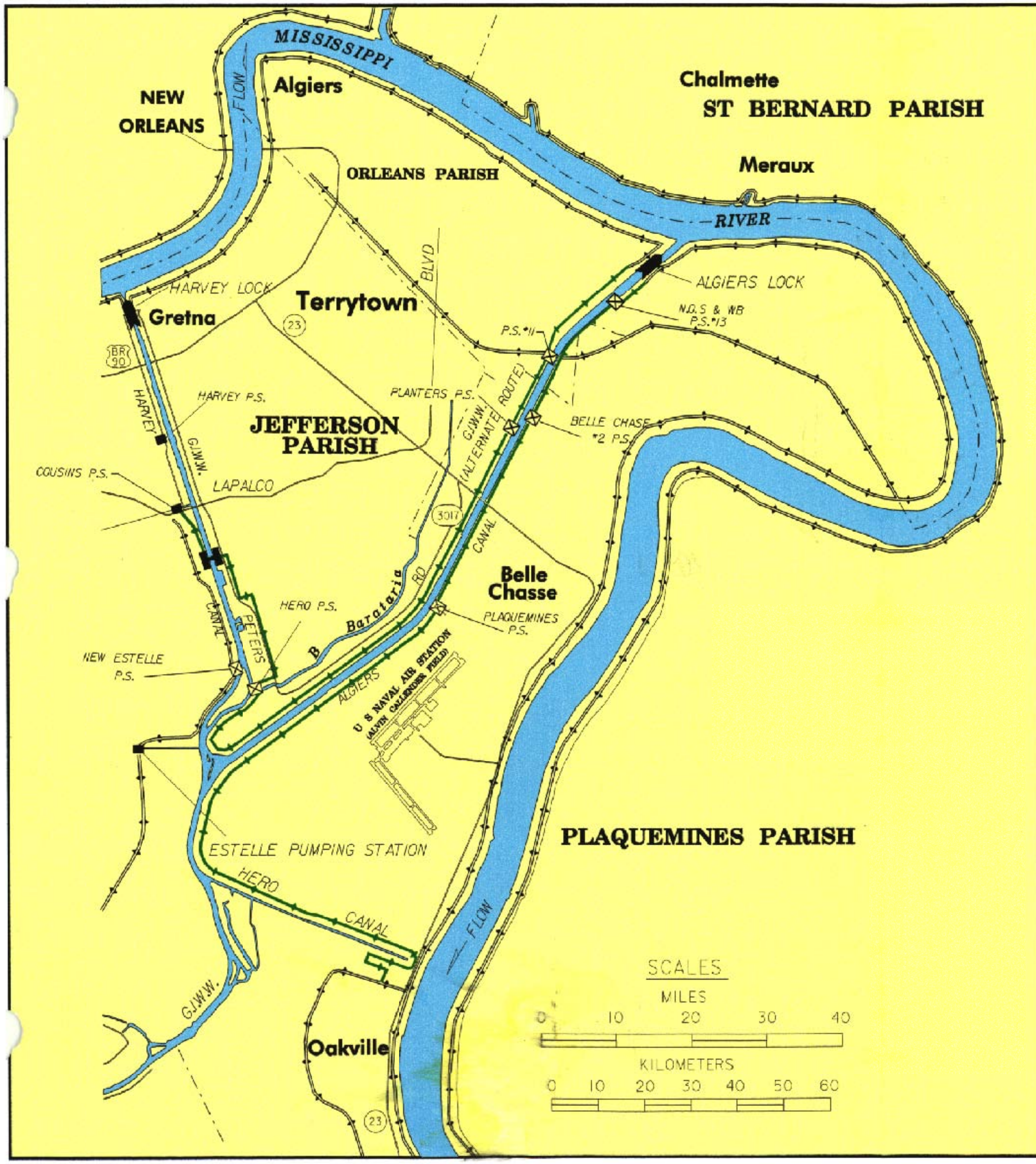
AUTHORIZATION: The Water Resources Development Act of 1996 (Sec 533).

PROJECT: The project will provide protection to the urban area east of the Harvey Canal on the Westbank of the Mississippi River in the Vicinity of New Orleans in Jefferson, Orleans, and Plaquemines Parishes. The project consists of a sector floodgate in the Harvey Canal below Lapalco Blvd, and about 23 miles of levees and 2 miles of floodwalls from the structure, southward along the east bank of the Harvey Canal to the Algiers Canal, then northeast along the north bank of the Algiers Canal to the existing Algiers Lock, then southwest bank of the Algiers Canal to the Hero Canal, then southeast along the north bank of the Hero Canal to the Mississippi River Levee and then around the Oakville Subdivision. Both portions of the Harvey and Algiers Canals involved in the project are part of the Gulf Intracoastal Waterway (GIWW).

LOCAL COOPERATION: A Project Cooperation Agreement (PCA) is being prepared and will be forwarded to Division and Headquarters by the end of FY 98.

PROGRESS: Design has begun but construction will not begin without an executed Project Cooperation Agreement. This project is expected to be complete by 2011.

COST: $184,000,000.00 ($120,000,000.00 Federal and $64,000,000.00 Non-Federal)



LEGEND

IMPROVEMENTS COMPLETED

IMPROVEMENTS AUTHORIZED

MAP SYMBOLS

EXISTING LEVEE

EXISTING PUMPING STATION

FLOODWALL

H FLOODGATE

LOCK

MISSISSIPPI VALLEY DIVISION WORK
FLOOD CONTROL GENERAL

WEST BANK
EAST OF HARVEY CANAL

OFFICE OF THE DISTRICT ENGINEER, NEW ORLEANS, LA.
REVISED 30 SEPTEMBER 1997

MISSISSIPPI RIVER LEVEES

CONDITION OF IMPROVEMENT, 30 SEPTEMBER 1995

AUTHORIZATION: Previous project authorized by Act of 28 June 1879 and amendments. Existing project authorized by Flood Act of 15 May 1928 and amendments.

Section 204e of the Flood Control Act of 17 May 1950 extends the aforementioned Act to include such flood control improvements in the parish of Orleans, Louisiana, to protect lands back of the levees from floodwaters of the Mississippi River and Lower Old River.

PROJECT: The project consists of operation and maintenance of mainline Mississippi river levees which were built to protect the adjacent lands, towns, cities, industrial plants, and people living in the area from flooding by annual high water in the river; restoration of levees; wavewash protection consisting of levee toe protection, slope paving and riprap; bank stabilization.

LOCAL COOPERATION: The levee districts along the Mississippi River have adopted resolutions assuring the United States that the requirements of local cooperation will be met. The local interests have acquired all rights-of-way for work completed and underway and have indicated that they will continue to do so in the future.

PROGRESS:

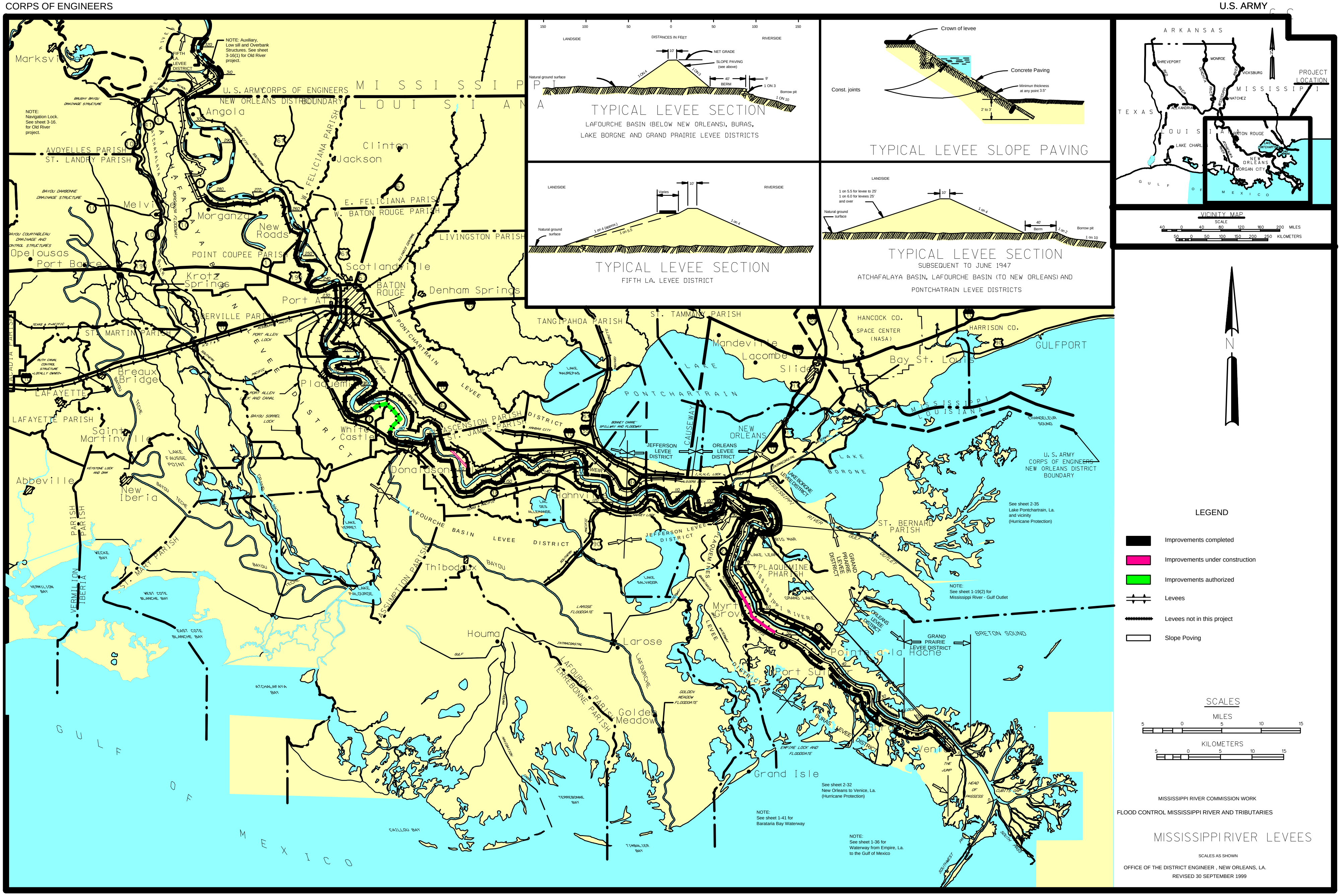
Total Mississippi River Levees	511.6 miles
Complete to Grade and Section	440.6 miles
Surface Roads	479.6 miles
Seepage Berms to be constructed	10.1 miles
Seepage Berms completed	1.1 miles

Wavewash protection works, consisting of levee toe protection and asphalt or concrete levee slope paving, have been constructed for protection of the levees. The project is about 93% complete and scheduled for completion in August 2008.

COST: $431,000,000.00 ($412,000,000.00 Federal)

CORPS OF ENGINEERS

U.S. ARMY



APPENDIX B

PUMPING

STATION DETAILS

Area E-2

BONNABEL PUMPING STATION JEFFERSON No 1 Looking North

Name : Jefferson Parish #1
Parish : Jefferson
Address : 1500 Beverly Gardens Dr.
Phone Numbers : 504-838-4730
Station Manager : Brion Adams
Position : Latitude 30:01.113 Longitude –90:08.716
Pump From : Bonnable Canal
Pump To: Lake Pontchatrain

Facility Floor Elevation: 0.1' NGVD

Capacity (CFS)

Pump1 = 300
Pump2 = 300
Pump3 = 1050
Pump4 = 1050
Pump5 = 1050

Click BlueText for additional pump information

Page 1

AREA E-2

P.S. #1-BONNABEL
Jefferson Parish, East Bank

UPPER SLAB EL 7.1 NGVD
MIDDLE SLAB EL 3.6 NGVD
LOWER SLAB EL 0.1 NGVD

<u>FLOOD DAMAGE RISK:</u>

ELEVATION 0.4	Exterior rear pump bearing for the three 1050cfs pumps will ingest water.
ELEVATION 3.6	Air intakes for diesel pump engines flood.
	84% loss of station capacity
ELEVATION 3.8	Fuel transfer pumps from the main storage tanks flood.
ELEVATION 4.6	Control panel for two 1050cfs, horizontal pump engines flood.
ELEVATION 4.6	Electric driven vacuum floods.
ELEVATION 4.6	Diesel engine lubrication pump flood.
ELEVATION 6.1	Diesel engine driven vacuum pump floods.
ELEVATION 7.6	Lower level of engine seals for the 1050cfs pumps become submerged.
ELEVATION 7.6	Electrical distribution control panel for the station floods.
	100% loss of station capacity
ELEVATION 7.6	Control panel for one 1050cfs pump engine floods.
ELEVATION 9.1	4160V, 1660kW generator that powers 60Hz motors for the two 300cfs, vertical pumps flood.

<u>WIND DAMAGE RISK:</u>

Building is concrete wall with metal truss and metal roof.
Row of windows along top of both sides of building.
One unbraced rollup door at one end.

SIPHON POTENTIAL: Yes

Area E-2

SUBURBAN CANAL PUMP STATION   JEFFERSON No 2

Looking North :
Name : Jefferson Parish #2
Parish : Jefferson
Address : Lake Villa and Avron
Phone Numbers : 504-838-1122
Station Manager : Larry Portier
Position : Latitude 30:01.210 Longitude –90:10.809
Pump From : Suburban Canal
Pump To: Lake Pontchartrain

Facility Floor Elevation: 7’ NGVD

Capacity (CFS)

Pump1 = 1050
Pump2 = 1050
Pump3 = 40
Pump4 = 300
Pump5 = 300
Pump6 = 300

AREA E-2

P.S. #2-SUBURBAN
Jefferson Parish, East Bank SLAB EL 7.0 NGVD

FLOOD DAMAGE RISK:

ELEVATION 7.0 Diesel engine driven vacuum pump floods.
ELEVATION 7.0 Two 1050cfs, horizontal pump bearings and pump reducer drives flood.
ELEVATION 7.1 Diesel fuel transfer pumps from the main storage tanks flood.
89% loss of station capacity
ELEVATION 7.6 Two 277/480V, 400kW generators flood.
100% loss of station capacity
ELEVATION 7.9 Electrical control panels flood**.**
ELEVATION 8.1 60Hz electrical driven 40cfs, vertical pump and vacuum pump floods.
ELEVATION 8.1 Diesel engines driving two 300cfs, vertical pumps flood.
ELEVATION 9.6 60Hz electrical driven 300cfs, vertical pump flood.

WIND DAMAGE RISK:

Building is concrete wall with concrete roof.
Windows are wired glass and protected from direct winds.
Two unbraced rollup doors at each end of building.

SIPHON POTENTIAL: Yes

Area E-2

ELMWOOD CANAL PUMP STATION   JEFFERSON No 3

Looking West:
Name : Jefferson Parish #3
Parish : Jefferson
Address : 5400 Caryota Dr.
Phone Numbers : 504-838-1124
Station Manager : Lee Comeaux
Position : Latitude 30:01.928 Longitude –90:13.145
Pump From : Elmwood Canal
Pump To: Lake Pontchartrain

Facility Floor Elevation: 6’ NGVD

Capacity (CFS)

Pump1 = 300	Pump5 = 550
Pump2 = 300	Pump6 = 550
Pump3 = 550	Pump7 = 300
Pump4 = 550	Pump8 = 300

Click BlueText for additional pump information

AREA E-2

P.S. #3-ELMWOOD
Jefferson Parish, East Bank **SLAB EL 6.0 NGVD**

<u>FLOOD DAMAGE RISK:</u>

ELEVATION 6.6	Diesel engine lubrication pump flood.
ELEVATION 6.9	Fuel transfer pumps from the main storage tanks flood.
	100% loss of station capacity
ELEVATION 7.2	Electrical switch gear floods.
ELEVATION 7.2	277/480V, 365kW generator floods.
ELEVATION 7.6	Both diesel and electrical vacuum pumps flood.
ELEVATION 8.2	Four 300cfs vertical & four 550cfs horizontal diesel pump engines flood.

<u>WIND DAMAGE RISK:</u>

Building is concrete wall with metal truss and lightweight cement type roof.
Roof has been easily damaged in previous storms.
One unbraced rollup door at each end of the building.

SIPHON POTENTIAL: Yes

Area E-2

DUNCAN CANAL PUMP STATION JEFFERSON No 4

Looking South :
Name : Jefferson Parish #4
Parish : Jefferson
Address : 1600 Joseph Yenni Blvd.
Phone Numbers : 504-468-2828
Station Manager : Keith Lewis
Position : Latitude 30:02.310 Longitude –90:14.706
Pump From : Duncan Canal
Pump To: Lake Pontchartrain

Facility Floor Elevation: -5.3’ NGVD

Capacity (CFS)

Pump1 = 300	Pump4 =1050
Pump2 = 300	Pump5 =1050
Pump3 =1050	Pump6 =1050

Click BlueText for additional pump information

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AREA E-2

P.S. #4-DUNCAN
Jefferson Parish, East Bank

UPPER SLAB EL 3.6 NGVD
MIDDLE SLAB EL -0.5 NGVD
LOWER SLAB EL -5.3 NGVD

<u>FLOOD DAMAGE RISK:</u>

ELEVATION -4.3 Exterior rear diesel pump bearing for four1050cfs, pumps ingest water.
ELEVATION -1.8 Air intakes for the four 1050cfs pump engines flood.
88% loss of station capacity
ELEVATION -0.3 Fuel transfer pumps from the main storage tanks flood.
100% loss of station capacity
ELEVATION 0.5 Control panels for three 1050cfs, horizontal pump engines flood.
ELEVATION 0.5 Electric driven vacuum floods.
ELEVATION 0.5 Diesel engine lubrication pump flood.
ELEVATION 2.0 Diesel engine driven vacuum pump floods.
ELEVATION 4.0 Lower level of the engine seals for one 1050cfs, horizontal pump becomes submerged.
ELEVATION 4.0 Electrical distribution control panel floods.
ELEVATION 4.0 Control panels for one 1050cfs pump engine floods.
ELEVATION 5.6 4160V, 1660 kW generator operating 60Hz electrical motors for two 300cfs, horizontal pumps floods.

WIND DAMAGE RISK:

Building is concrete wall with metal truss and metal roof.
Row of windows along top of both sides of building.
One unbraced rollup door at one end.

SIPHON POTENTIAL: Yes

Area E-2

PARISH LINE PUMPING STATION
Name : Jefferson Parish #5
Parish : Jefferson
Address : 3100 Grand Lake
Phone Numbers : 504-466-6591
Station Manager :
Position : Latitude 30:00.684 Longitude –90:16.731
Pump From : 16 and 17
Pump To: Lake Pontchartrain

Facility Floor Elevation: 10.6’ NGVD

Capacity (CFS)

Pump1 = 300cfs
Pump2 = 300cfs
Pump3 = 300cfs

Click BlueText for additional pump information

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AREA E-2

P.S. #5-PARISH LINE
Jefferson Parish, East Bank **SLAB EL 10.6 NGVD**

FLOOD DAMAGE RISK:

***NOTE:** No auxiliary power available.
100% loss of station capacity when commercial power is not available.

ELEVATION 12.0 60Hz electric motors for three 300cfs pumps flood.

WIND DAMAGE RISK:

Concrete building w/ metal roof.
Row of windows along top of canal side of building.
One unbraced rollup door at one end.

SIPHON POTENTIAL: Yes

AREA E-3

ORLEANS PARISH PUMPING STATION #6

Name : Pumping Sation #6
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 29:59:12.94 Longitude 90:07:26.45
Pump From :Palmetto Canal
Pump To: 17th Street Outfall Canal

Facility Floor Elevation: 3.6’ NGVD

Capacity (CFS)

PumpA = 550	PumpI =1050
PumpB = 550	PumpCD-1 =90
PumpC =1000	PumpCD-2 =90
PumpD= 1000	Pump1=250
PumpE = 1000	Pump2 =250
PumpF =1000	Pump3 = 250
PumpG = 1000	Pump4 = 250
PumpH = 1050	

Click BlueText for additional pump information

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AREA E-2 & E-3

P.S. #6
Orleans Parish, East Bank **SLAB EL 3.6 NGVD**

<u>FLOOD DAMAGE RISK:</u>

ELEVATION 3.6 25Hz motors for two 550cfs pumps and five 1000cfs, horizontal pumps floods.

64% loss of station capacity

ELEVATION 6.6 Four 60Hz motors driving four 250cfs, vertical pumps flood.

75% loss of station capacity

ELEVATION 7.6 25Hz vacuum pump floods.

ELEVATION 7.6 Transformers and breakers flood.

100% loss of station capacity

ELEVATION 8.6 60Hz motors driving two 1100cfs, horizontal pumps flood.

<u>WIND DAMAGE RISK:</u>

Brick with metal truss roof.
Roof is planked with wood and covered with copper sheeting.
Windows are boarded.
Rollup door was braced.

SIPHON POTENTIAL: Yes

AREA E-3

ORLEANS PARISH PUMPING STATION #3

Name : Orleans Pumping Station #3
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 29:59:18.11 Longitude 90:04:04.71
Pump From : Broad Ave. and Florida Ave. Canals
Pump To:

Facility Floor Elevation: 4.1’ NGVD

Capacity (CFS)

PumpA = 550
PumpB = 550
PumpC =1000
PumpD =1000
PumpE =1000
PumpCD-2 =20
PumpCD-3 =20

Click BlueText for additional pump information

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AREA E-3

P.S. #3
Orleans Parish, East Bank

ORG SLAB EL 4.1 NGVD
NEW SLAB EL 5.6 NGVD

FLOOD DAMAGE RISK:

ELEVATION 4.7	25Hz vacuum pump floods.
ELEVATION 5.1	25Hz electric motors operating two 20cfs centrifugal pumps flood.
ELEVATION 5.1	Three DC generators flood. (DC field is required for two 550cfs, horizontal pump motor)
	28% loss of station capacity
ELEVATION 5.6	Basement containing low voltage, 25Hz transformers and switch gear floods.
ELEVATION 5.6	25Hz motors for two 1000cfs horizontal pumps flood.
	76% loss of station capacity
ELEVATION 5.6	80kW generator floods.
ELEVATION 6.6	25Hz feeders, bus ties and circuit breakers flood.
ELEVATION 6.3	25Hz vacuum pump floods.
ELEVATION 9.6	25Hz motor for flood-proof 1000cfs horizontal pump floods.
	100% loss of station capacity
ELEVATION 10.6	60Hz vacuum pump floods.
ELEVATION 15.6	Switch gear for flood-proof pump and 60 Hz vacuum pump floods.

WIND DAMAGE RISK:

Brick building with metal truss roof.
Roof is planked with wood and covered with copper sheeting.
Windows are boarded.
Rollup door was braced.
80 kW generator and switch gear for one 1000cfs pump and one vacuum pump are located adjacent to the station in a concrete building with concrete roof.

SIPHON POTENTIAL: Yes

Area E-3

ORLEANS PARISH PUMPING STATION #7

Name : OP#7
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 29.99424 Longitude –90.1010
Pump From : Kenilworth Canal and Orleans Relief Canal
Pump To: Orleans Relief Outfall

Facility Floor Elevation: 3.8’ NGVD

Capacity (CFS)

PumpA = 550
PumpC = 1000
PumpD =1000
PumpCD-2 =70
PumpCD-3 =70

Click BlueText for additional pump information

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AREA E-3

P.S. #7
Orleans Parish, East Bank

ORG SLAB EL 3.8 NGVD
NEW SLAB EL 5.6 NGVD

<u>FLOOD DAMAGE RISK:</u>

ELEVATION 3.8 25Hz motors for two 70cfs, vertical and 550cfs, horizontal pumps flood.

26% loss of station capacity

ELEVATION 4.8 DC panels and generators flood. (DC field is required for 550cfs pump)
ELEVATION 4.8 25 Hz vacuum pump floods.
ELEVATION 5.6 25 Hz motor for 1000cfs, horizontal pump floods.

63% loss of station capacity

ELEVATION 5.6 Basement containing 25 Hz transformers and switch gear floods.
ELEVATION 6.3 25 Hz feeders, bus ties and circuit breakers flood.
ELEVATION 11.6 60 Hz motor for 1000cfs, horizontal pump floods. (No auxiliary 60 Hz generator)

100% loss of station capacity

ELEVATION 11.6 60 Hz vacuum pump floods.
ELEVATION 15.8 Switch gear for the 60 Hz motor floods.

<u>WIND DAMAGE RISK:</u>

Brick with metal truss roof.
Roof is planked with wood and covered with copper sheeting.
Windows are boarded.
Rollup door was braced.

SIPHON POTENTIAL: Yes

Area E-3

ORLEANS PARISH PUMPING STATION No 19

Name : OP #19
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 29.9818 Longitude –90.02345
Pump From : Florida Ave. Canal
Pump To: Inner Harbor Navigation Canal (IHNC)

Facility Floor Elevation: 12.6’ NGVD

Capacity (CFS)

Pumps = 3770cfs

Click BlueText for additional pump information

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AREA E-3

P.S. #19
Orleans Parish, East Bank **SLAB EL 12.6 NGVD**

FLOOD DAMAGE RISK:

***NOTE:** No auxiliary power available.
100% loss of station capacity when commercial power is not available.

ELEVATION 3.6	Rear horizontal pump bearings ingest water.
ELEVATION 6.6	Water buster pumps for three 60Hz, 1050cfs, horizontal pumps flood.
ELEVATION 13.6	Vacuum pumps and electrical switch gear flood.
ELEVATION 14.1	480V, 30kW generator that operates sluice gates, and electrical control panel for the station flood.
ELEVATION 15.1	60Hz motors for two 250cfs, vertical pumps flood.

WIND DAMAGE RISK:

Brick building w/copper roof.
One unbraced rollup door.

SIPHON POTENTIAL: Yes

Area E-4A

ORLEANS PUMPING STATION No 14

Name : Jahncke
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 30.0586 Longitude –89.9667
Pump From : Morrison and Jahncke Canals
Pump To: Lake Pontchartrain

Facility Floor Elevation: 16.1’ NGVD

Capacity (CFS)

Pumps = 1200cfs

Click BlueText for additional pump information

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AREA E-4A

P.S. #14-JAHNCKE
Orleans Parish, East Bank **SLAB EL 16.1 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 17.1 2400V, 2665kW generator will flood.
100% loss of station capacity
ELEVATION 17.1 Nearly all pump equipment will flood including switch gear and four 60Hz, 300cfs vertical pump motors.

WIND DAMAGE RISK:

Pumps generator switch gear sit on top of a concrete platform supported on concrete pilings.
Control and battery room is concrete block with concrete roof. Windows are boarded.
Generator is housed in a metal factory enclosure.
Switch gear is housed in a heavy gage metal building,

SIPHON POTENTIAL: Yes

Area E-4A

ORLEANS PUMPING STATION No 16

Name : St. Charles
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 30.0381 Longitude –90.0112
Pump From : St. Charles Canal
Pump To: Lake Pontchartrain

Facility Floor Elevation: 16.1’ NGVD

Capacity (CFS)

Pumps = 1000cfs

Click BlueText for additional pump information

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AREA E-4A

P.S. #16-ST. CHARLES
Orleans Parish, East Bank

SLAB EL 16.1 NGVD

<u>FLOOD DAMAGE RISK:</u>

ELEVATION 17.1 2400V, 2665kW generator floods.

100% loss of station capacity

ELEVATION 17.1 Nearly all pump equipment flood including switch gear and four 60Hz, 250cfs, vertical pump motors.

<u>WIND DAMAGE RISK:</u>

Pumps generator switch gear sit on top of a concrete platform supported on concrete pilings.
Control room is concrete block with concrete roof. Windows are boarded.
Generator is housed in a metal factory enclosure.
Switch gear is housed in a heavy gage metal building,
Battery storage building (batteries req'd for pump motor fields) is a lightweight metal building and will probably not withstand winds over 100 mph.

SIPHON POTENTIAL: Yes

Area E-5A

FORTIFICATION PUMPING STATION #1 On Left
JEAN LAFITTE PUMPING STATION #6 On Right

Name : Fortification Canal Pumping Station #1
Parish : St. Bernard
Address : 4200 B Jean Lafitte Pkwy., Chalmette La. 70043
Phone Numbers : 504-279-3642
Station Manager : Westley Bracamontes (beeper # 504-547-4216)
Position : Latitude 29:57:58.4 Longitude –89:58:29.5
Pump From : Florida Walk Forty Arpent Canal
Pump To: Wetlands To Rear Of Station and Bayou Bienvenue

Facility Floor Elevation: 16 ft. (N.G.V.D.)

Capacity (gpm)

Center Pump = 45,000 gpm East Pump = 250,000 gpm
West Pump =250,000 gpm

Click BlueText for additional pump information

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AREA E-5A

P.S. #1-FORTIFICATION (identical to P.S. #4)

St. Bernard Parish **SLAB EL 16.0 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 14.0 Diesel fuel tank air intakes flood.

90% loss of station capacity

ELEVATION 18.0 Two 557cfs vertical engines and diesel air compressor for transfer pumps flood.

ELEVATION 18.0 60 Hz motor for 100cfs, vertical pump floods.

100% loss of station capacity (no auxiliary power)

WIND DAMAGE RISK:

Steel frame building with metal roof.
Brick control room.

SIPHON POTENTIAL: Yes

Area E-5A

GUICHARD PUMPING STATION #2

Name : Guichard Pumping Station #2
Parish : St. Bernard
Address : 4201 Jean Lafitte Pkwy., Chalmette La. 70043
Phone Numbers : None
Station Manager : Westley Bracamontes (beeper # 504-547-4216)
Position : Latitude 29:57:41.8 Longitude –89:57:52.2
Pump From : Florida Walk Forty Arpent Canal
Pump To: Wetlands To Rear Of Station and Bayou Bienvenue

Facility Floor Elevation: 0 ft. (N.G.V.D.)

Capacity (gpm)

Pump1 = 50,000 gpm
Pump2 = 100,000 gpm
Pump3 = 75,000 gpm
Pump4 = 100,000 gpm

Click BlueText for additional pump information

AREA E-5A

P.S. #2-GUICHARD
St. Bernard Parish **SLAB EL 0.0 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 1.2 Air compressor for 167cfs diesel engine floods.
24% loss of station capacity (no auxiliary power)
ELEVATION 4.0 Two 223cfs & 111cfs horizontal, diesel pump engines flood.
100% loss of station capacity
ELEVATION 5.0 Diesel fuel transfer pumps flood.

WIND DAMAGE RISK:

Steel frame building with corrugated metal siding and roof
**Will not survive a category 1 storm.

SIPHON POTENTIAL: Yes

Area E-5A

E.J. GORE PUMPING STATION   #5

Name : E. J. Gore Pumping Station #5
Parish : St. Bernard
Address: 7701 East Judge Perez Dr. Violet, La. 70085
Phone Numbers : 504-682-8235
Station Manager : Westley Bracamontes   (beeper # 504-547-4216)
Position : Latitude 29:57:41.8 Longitude –89:57:52.2
Pump From : Florida Walk Forty Arpent Canal
Pump To: Wetlands To Rear Of Station and Bayou Dupre

Facility Floor Elevation: 2' (N.G.V.D.)

Capacity (gpm)

Pump1 = 50,000 gpm
Pump2 = 50,000 gpm
Pump3 = 50,000 gpm
Pump4 = 50,000 gpm
Pump5 = 50,000 gpm
Pump6 = 50,000 gpm

AREA E-5A

P.S. # 5-E.J. GORE
St. Bernard Parish **SLAB EL 2.0 NGVD**

<u>FLOOD DAMAGE RISK</u>:

ELEVATION 3.0 240/120V, 33 kW generator-set floods.
ELEVATION 3.5 Six 111cfs, horizontal diesel pump engines flood.
100% loss of station capacity

<u>WIND DAMAGE RISK:</u>

Steel frame building with cement panel walls & metal roof.
Two unbraced rollup doors.

SIPHON POTENTIAL: Yes

Area E-5A

JEAN LAFITTE PUMPING STATION #6

Name : Jean Lafitte Pumping Station #6
Parish : St. Bernard
Address : 4200 A Jean Lafitte Pkwy., Chalmette La. 70043
Phone Numbers : 504-279-3642
Station Manager : Westley Bracamontes (beeper # 504-547-4216)
Position : Latitude 29:57:58.4 Longitude –89:58:29.5
Pump From : Florida Walk Forty Arpent Canal
Pump To: Wetlands To Rear Of Station and Bayou Bienvenue

Facility Floor Elevation: 16 ft. (N.G.V.D.)

Capacity (gpm)

Pump 1 = 150,000 gpm
Pump 2 = 150,000 gpm
Pump 3 =150,000 gpm

Click BlueText for additional pump information

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AREA E-5A

P.S. # 6-JEAN LAFITTE (identical to P.S. #7)
St. Bernard Parish SLAB EL 16.0 NGVD

FLOOD DAMAGE RISK:

ELEVATION 17.0	120/200V, 150 kW generator-set floods. (Generator needed to operate radiator fan motors and air compressor to start pump engines.) **100% loss of station capacity**
ELEVATION 17.5	Radiator fan motors flood.
ELEVATION 18.0	480V motor starters for radiator fans flood.
ELEVATION 18.0	Three 334cfs, vertical diesel pump engines flood.
ELEVATION 20.0	Diesel fuel transfer pump motors flood.

WIND DAMAGE RISK:

Steel frame building with cement panel walls & metal roof.
Two unbraced rollup doors.

SIPHON POTENTIAL: Yes

Area E-5A

ST. MARY PUMPING STATION   #8

Name : St. Mary Pumping Station #8
Parish : St. Bernard
Address 3616 Bayou Rd. Verret, La. 70085
Phone Numbers : 504-682-0591
Station Manager : Westley Bracamontes   (beeper # 504-547-4216)
Position : Latitude 29:57:41.8 Longitude –89:57:52.2
Pump From : Twenty Arpent Canal
Pump To: Wetlands To Rear Of Station and Lake Lery

Facility Floor Elevation: 16 ft. (N.G.V.D.)

Capacity (gpm)

Pump1 = 125,000 gpm
Pump2 = 125,000 gpm
Pump3 = 125,000 gpm

Click BlueText for additional pump information

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AREA E-5A

P.S. # 8-ST. MARY
St. Bernard Parish **SLAB EL 16.0 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 17.0	277/480V, 150 kW generator-set floods. (Generator needed to operate radiator fan motors and to start vacuum pump motors.) **100% loss of station capacity**
ELEVATION 17.5	Three 279cfs vertical diesel pump engines and 480V motor starters for radiator fans flood.
ELEVATION 18.0	Radiator fan motors flood.
ELEVATION 19.0	Air compressor motors flood.
ELEVATION 20.0	Diesel fuel tank air intakes & fuel transfer pumps flood.

WIND DAMAGE RISK:

Steel frame building with cement panel walls & metal roof.
Two unbraced rollup doors.

SIPHON POTENTIAL: Yes

Area W-1

BAYOU SEGNETTE PUMPING STATION

Name : Bayou Segnette
Parish : Jefferson
Address : 801 Louisiana St.
Phone Numbers : 349-5989
Station Manager : Jeffery Rivet
Position : Latitude 29:53.852 Longitude –90:09.489
Pump From : Main Canal
Pump To: Bayou Segnette

Facility Floor Elevation: 6.8' NGVD

Capacity (CFS)

Pumps = 936 cfs

Click BlueText for additional pump information

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AREA W-1

BAYOU SEGNETTE PUMP STATION
Jefferson Parish, West Bank **SLAB EL 6.8 NGVD**

FLOOD DAMAGE RISK:

***Note:** No auxiliary power available

ELEVATION 8.3 Six 156cfs, vertical diesel engines flood.
100% loss of station capacity

WIND DAMAGE RISK:

Steel frame building.
Corrugated metal walls & roof
Glass windows not protected

SIPHON POTENTIAL: Yes

Area W-2

AMES PUMPING STATION

Name : Ames
Parish : Jefferson
Address : 5100 Rodchester Dr.
Phone Numbers : 349-5997
Station Manager : Robert Bealer
Position : Latitude 29:51.321 Longitude –90:07.182
Pump From : Inner Milladoun
Pump To: Bayou Segnette

Facility Floor Elevation: 4.3’ NGVD

Capacity (CFS)

Pumps = 1930

Click BlueText for additional pump information

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AREA W-2

AMES PUMP STATION
Jefferson Parish, West Bank

LOWER SLAB EL 4.3 NGVD
UPPER SLAB EL 7.3 NGVD

<u>FLOOD DAMAGE RISK</u>:

ELEVATION 0.6	Diesel pump bearings ingests water.
ELEVATION 2.3	Fuel transfer pumps flood.
	60% loss of station capacity
ELEVATION 6.3	Vacuum pumps flood.
ELEVATION 6.8	One 1150cfs, horizontal diesel pump engine floods.
ELEVATION 8.3	Generator switch gear, 4160/480V transformer and panels for radiator motor starters flood.
ELEVATION 9.3	2400/4160V, 1600 kW diesel generator floods.
ELEVATION 11.3	60HZ electric motors for two 390cfs, vertical pumps flood.
	100% loss of station capacity
ELEVATION 11.8	156.25V, 125kW generator for radiator fan motor floods.
ELEVATION 12.8	Raw-water pumps flood.
ELEVATION 14.8	Radiator fan motor for diesel pump floods.

<u>WIND DAMAGE RISK</u>:

Steel frame building.
Corrugated metal walls & roof
Skylights on the roof
Roll-up doors without bracing

SIPHON POTENTIAL: Yes

Area W-2

COUSINS PUMPING STATION #1

Name : Cousins #1
Parish : Jefferson
Address :2466 Destrehan Ave.
Phone Numbers : 349-5991
Station Manager : Jimmy Aragon
Position : Latitude 29.87125 Longitude –90.07345
Pump From : Cousins Canal and First Ave. Canal
Pump To: Harvey Canal

Facility Floor Elevation: 4.1’ NGVD

Capacity (CFS)

Pump1 = 960cfs

Click BlueText for additional pump information

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Area W-2

COUSINS PUMPING STATION #2

Name : Cousins #2
Parish : Jefferson
Address : 2466 Destrehan Ave.
Phone Numbers : 349-5987
Station Manager : Jimmy Aragon
Position : Latitude 29.87088 Longitude –90.07348
Pump From : Cousins and First Ave. Canals
Pump To: Harvey Canal

Facility Floor Elevation: 3.6' NGVD

Capacity (CFS)

Pumps = 2300cfs

Click BlueText for additional pump information

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AREA W-2

COUSINS 1 AND 2 PUMP STATIONS
Jefferson Parish, West Bank

BLDG #1 SLAB EL 4.1 NGVD
BLDG #2 SLAB EL 3.6 NGVD

<u>FLOOD DAMAGE RISK</u>:

BLDG #1

ELEVATION 4.6	60Hz electric motor for one 60cfs vertical pump floods.
ELEVATION 5.6	Diesel engines for three 300cfs, vertical pumps flood.
	100% loss of station capacity

BLDG #2

ELEVATION 1.6	Two 1150cfs, horizontal diesel pump rear bearings ingest water.
ELEVATION 3.6	Air intakes for diesel engines flood.
	100% loss of station capacity
ELEVATION 4.6	Fuel transfer pump floods.
ELEVATION 5.6	220/480V, 420kW generator floods.
ELEVATION 6.1	One diesel and one electric vacuum pump flood.

<u>WIND DAMAGE RISK</u>:

Steel frame buildings.
Corrugated metal roofs.
Roll-up doors without bracing.
Glass windows not protected

SIPHON POTENTIAL: Yes

Area W-3A

PLANTERS PUMPING STATION

Name : Planters
Parish : Jefferson
Address : 268 By Pass Rd.
Phone Numbers : 394-6695
Station Manager : Clayton Michaud
Position : Latitude 29:53.016 Longitude –90:00.254
Pump From : Planters By Pass Canal
Pump To: Intercoastal Waterway

Facility Floor Elevation: 3.6' NGVD

Capacity (CFS)

Pumps = 2360

Click BlueText for additional pump information

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AREA W-3A

PLANTERS PUMP STATION
Jefferson Parish, West Bank **SLAB EL 3.6 NGVD**

FLOOD DAMAGE RISK:

ELEVATION -1.4	Fuel transfer pumps for four 289cfs pumps flood.
	49% loss of station capacity
ELEVATION 4.6	Switch gear and radiator fan motors for 4160V, 2350kW generator flood.
	100% loss of station capacity
ELEVATION 5.1	4160V, 2350kW and 480V, 150kW generators flood.
ELEVATION 5.6	Diesel engines for four 289cfs, vertical pumps flood.
ELEVATION 18.6	60Hz electric motors for four 288cfs, vertical pumps flood.

WIND DAMAGE RISK:

Steel frame building.
Corrugated metal walls & roof.
Skylights on the roof.
Two unbraced rollup doors.

SIPHON POTENTIAL: Yes

Area W-3A

HERO PUMPING STATION

Name : Hero
Parish : Jefferson
Address : 4644 Peters Rd.
Phone Numbers : 365-3398
Station Manager : Anthony Nuccio
Position : Latitude 29.87095Longitude –-90.05625
Pump From : Hero Outfall Canal
Pump To: Intercoastal Waterway

Facility Floor Elevation: -0.5' NGVD

Capacity (CFS)

Pumps = 3900cfs

Click BlueText for additional pump information

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AREA W-3A

HERO PUMP STATION
Jefferson/Plaquemines Parish, West Bank

LOWER SLAB EL -0.5 NGVD
MIDDLE SLAB EL 0.5 NGVD
UPPER SLAB EL 6.5 NGVD

FLOOD DAMAGE RISK:

ELEVATION -0.9	Outside fuel transfer pump floods.
ELEVATION 0.2	Fuel transfer pumps for two 1020cfs, horizontal diesel pumps flood.
	52% loss of station capacity
ELEVATION 1.6	60Hz electrical motors for three 315cfs and one 105cfs, centrifugal pump flood.
	80% loss of station capacity
ELEVATION 2.1	One vacuum pump floods.
ELEVATION 3.5	60Hz motors for four 203cfs, horizontal pumps and second vacuum pump flood.
	100% loss of station capacity
ELEVATION 6.1	4160V, 2050kW generator floods.
ELEVATION 7.6	Switch gear floods.
ELEVATION 10.5	Engine driven vacuum pump floods.
ELEVATION 12.6	Air intake for two 1020cfs pumps flood.

WIND DAMAGE RISK:

Steel frame building.
Metal roof with fiberglass panels.
Roll-up doors without bracing.
Glass windows not protected.

SIPHON POTENTIAL: Yes

Area W-3B

ORLEANS PUMPING STATION No 13

Name : OP #13
Parish : Orleans
Address :
Phone Numbers :
Station Manager :
Position : Latitude 29.89589 Longitude –89.99775
Pump From : Nolan and East Donner Canals
Pump To: Intercoastal Waterway

Facility Floor Elevation: 3.6’ NGVD

Capacity (CFS)

Pumps = 4650cfs

Click BlueText for additional pump information

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AREA W-3B

P.S. #13
Orleans Parish, West Bank

LOWER SLAB EL 3.6 NGVD
UPPER SLAB EL 7.6 NGVD

<u>FLOOD DAMAGE RISK:</u>

***NOTE:** No auxiliary power available.
57% loss of station capacity when commercial power is not available.

ELEVATION 4.6 Two vacuum pumps for two 1050cfs pumps flood.
ELEVATION 4.6 Bearings for two 1050cfs & two 1000cfs pumps ingest water.
ELEVATION 7.6 60Hz electric motors for two 250cfs vertical pumps ingest water.
ELEVATION 8.0 Fuel transfer pumps flood.
100% loss of station capacity
ELEVATION 8.0 Low voltage switch gear flood.
ELEVATION 8.0 Raw water pumps for pump seals and engines cooling flood.
ELEVATION 8.6 Horizontal pump controls flood.
ELEVATION 8.6 60Hz electric motors for 1050cfs, horizontal pumps flood.
ELEVATION 9.0 Two 480V generators flood.
ELEVATION 9.6 Motors for two motor driven vacuum pumps flood.
ELEVATION 9.6 4160/480V transformers flood.
ELEVATION 9.6 50cfs vertical pump motor floods.
ELEVATION 14.5 13800/4160V transformer floods.
ELEVATION 15.6 Raw water vertical pump motors flood.

<u>WIND DAMAGE RISK:</u>

Brick with metal truss roof.
Roof is a lightweight cement type product.
Windows are covered with translucent corrugated fiberglass panels.
One unbraced rollup door.

SIPHON POTENTIAL: Yes

Area W-4A

BELLE CHASSE PUMPING STATION No 1

Name : Belle Chasse #1
Parish : Plaquemines
Address : 206 Pump Station Road
Phone Numbers : 504-394-3290
Station Manager : Kenny Kitt
Position : Latitude 29:51:06.00 Longitude –90:01:00.00
Pump From : Barriere Canal
Pump To: Intercoastal Canal

Facility Floor Elevation: +7.6

Capacity (CFS)

Pump1 = 800 cfs
Pump2 = 800 cfs
Pump3 = 150 cfs
Pump4 = 903 cfs
Pump5 = 903 cfs

Click BlueText for additional pump information

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AREA W-4A

BELLE CHASSE P.S. #1

Plaquemines Parish, East Bank **SLAB EL 7.6 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 5.6 240/480V, 60kW engine generator-set floods.
ELEVATION 8.0 Electrical air compressor floods.
ELEVATION 9.0 Two 800cfs & two 903cfs horizontal diesel pump engines and diesel air compressor floods. (Compressor needed to start several pump engines).
100% loss of station capacity
ELEVATION 10.5 Vacuum pumps flood.
ELEVATION 11.0 Diesel fuel tank air intakes flood.

WIND DAMAGE RISK:

BLDG.#1:
Steel frame building with cement board walls & roof.
Skylights above pumps.
One unbraced rollup door.
Windows-all shuttered.
BLDG. #2
Steel frame building.
Windows-all shuttered.

SIPHON POTENTIAL: Yes

Area W-4A

BELLE CHASSE PUMPING STATION No 2

Name : Belle Chasse #2
Parish : Plaquemines
Address : Chancelor Dr., Belle Chasse
Phone Numbers : 504-394-1303
Station Manager : Mike Ragas
Position : Latitude 29:53:04.38 Longitude –89:59:51.03
Pump From : Belle Chasse Drainage Canal
Pump To: Intercoastal Canal

Facility Floor Elevation: +10’6”

Capacity (CFS)

Pump1 = 330 cfs
Pump2 = 330 cfs
Pump3 = 330 cfs

Click BlueText for additional pump information

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AREA W-4A

BELLE CHASSE P.S. #2
Plaquemines Parish, East Bank **SLAB EL 10.5 NGVD**

FLOOD DAMAGE RISK:

ELEVATION 11.5 Air compressor floods.
ELEVATION 12.5 120/208V, 50kW engine generator-set and diesel lubrication pump flood.
ELEVATION 13.5 330cfs vertical diesel engines for pumps flood.

100% loss of station capacity

WIND DAMAGE RISK:

Steel frame building with cement board walls & roof.
Skylights above pumps.
One unbraced rollup door.
Windows-all shuttered.

SIPHON POTENTIAL: Yes

APPENDIX C

DRAINAGE AFTER INNUNDATION

9. Greater Metropolitan New Orleans Area - East Bank Of the Mississippi River

A. Area E-1 East Bank St. Charles Parish

Area E-1 is not addressed in this report.

B. Area E-2 East Bank Jefferson Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 14 ft. ngvd, unless failure of a levee or floodwall occurred. Within a few days, if unattended, water levels would recede to elevation +5, the lowest elevation along the line of protection at the natural ground contours near the Mississippi River. If levees and floodwalls remained intact, water depths in low areas could be as deep as 13 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet ngvd. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the Lake drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take one or more days depending upon the width of the breach.

Appendix D Table E-2
Area E-2: Jefferson Parish East Bank
Gravity Drainage Down To Outside Stage

Breach Width (feet)	Days
100	34.6
500	6.9
1000	3.6
2650	1.3

This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet.

3) On the east bank of Jefferson Parish the land generally slopes from the river toward Lake Pontchartrain. With the exception of Hoey's Basin, most floodwater

in the parish can drain by gravity through the existing drainage culverts and canals toward the 4 pumping stations located along the lakefront. The 2 smaller pumping stations located in the lateral levees may be less functional. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as I-10, US 61and it's parallel railroad bed, US 90, and Causeway, and the filled area encompassing the N.O. International Airport can create such obstructions to flow.

4) Hoey's Basin presents a unique problem. Hoey's Basin is a separate drainage area surrounded by alluvial ridges; the area normally drains into the 17th Street Canal. Hoey's Basin is surrounded by the Mississippi River aluvial ridge to the south and Metairie ridge to the north and west. It drains toward the east via several culverts into the 17th Street Canal. From the canal this drainage is discharged into Lake Pontchartrain by Pumping Station No.6. In the event of loss of Pumping Station No.6 this area will remain flooded to a height equal to the lowest elevation of the surrounding ridges, about +3, or drain by gravity into some of the lower areas of portions of New Orleans to which it is connected by the 17th Street and Palmetto Canals. To drain this area more, all or part of Pumping Stations No. 6 will have will have to be restored into operation, or a breach will have to be made in the 17th Street Canal along the line of protection at Pumping Station No. 6.

C. Area E-3 Metro New Orleans

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 13 ft. ngvd, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 21 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet ngvd. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the Lake drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take one or more days depending upon the width of the breach.

Appendix D Table E-3 Area E-3: Orleans Parish East Bank New Orleans Metro Gravity Drainage Down To Outside Stage	
Width of Breach at +2 feet NGVD (feet)	Days to Empty
100	28.5
500	5.5
1000	3.0
2650	1.0

This would leave the interior stage at +4 to +2 depending upon the stage in the Lake or IHNC. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 2 feet. But drainage by gravity from the central part of the city is impossible because of alluvial and man-made ridges.

3) On the east bank of Orleans the land generally slopes from the river toward Lake Pontchartrain. However, the area is divided by higher ground into three low areas, which are drained by interior pumps. Sand was pumped from the Lake bottom to create a landfill between Robert E. Lee and a newly constructed seawall along the lakefront during the 1930's. This landfill prevents gravity drainage of the city into the Lake. The landfill combined with the Metairie/Gentilly ridge and the levees that surround the entire area form a low pocket in Lakeview. The Mississippi River alluvial bank, the Metairie/Gentilly ridge and another alluvial ridge along Esplanade Avenue isolate the Uptown area. A third area near Poland Avenue is formed by the levees along the IHNC, the Metairie/Gentilly ridge, and the Esplanade Ridge. The high surrounding area forces the Uptown area to drain by gravity toward several pumping stations located along the lowest points in this part of the city, Pumping Stations 1, 2 and Monticello. These pumping stations lift drainage water to another set of pumping stations, Pumping Stations 6, 7 and 3, that discharge into Lake Pontchartrain via the 17th Street, London and Orleans Outfall Canals. The Lakeview area is drained into Lake Pontchartrain by the pumping stations along the lakefront, Pump Stations 6, 12, 7, 3, and 4. The Poland Avenue area is drained by Pumping Stations 3, 17, and 19 into the London Avenue Outfall Canal, the Missssissippi River and the IHNC, respectively. A siphon is currently located underneath the IHNC connecting the canal at Pumping Station 19 with Pumping Station 5 in the lower 9th Ward. Originally this siphon allowed Pump Station 5 to drain the area currently serviced by Pumping Station 19. This siphon might be used to drain the Metro area if it is still in service at the time required.

4) If an exterior levee or floodwall were breached, interior levees and natural ridges would prevent the drainage of the city by gravity below about elevation +2. Addition relief could be achieved, if the levee along Bayou St John was breached

and the floodgate at the entrance to Bayou St. John at Lake Pontchartrain was opened. However, this floodgate is only 30 ft wide so drainage would be slow and would rely on the internal network of drainage canal for it's supply of floodwater. Many other floodgates are located within this section of this city. Most are concentrated along the IHNC corridor. A few have sills low enough to allow them to contribute to draining parts of the city; but again the gates will have to rely on the interior drainage network for supply. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Most of the area could not be drained below the normal elevation of Lake Pontchartrain, even with these efforts and would have to rely on restored pumping capacity for any addition removal of floodwaters.

D. Area E-4a New Orleans East, Citrus

1) Drainage after inundation. In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the levee areas would recede only to the elevation of the top of the levees, about + 13 ft. ngvd, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 20 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet ngvd. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the Lake drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take one or more days depending upon the width of the breach.

Appendix D Table E-4A
Area E-4A: Orleans Parish East Bank
New Orleans East (Citrus)
Gravity Drainage Down To Outside Stage

Width of Breach (feet)	Days to Empty
100	24.5
500	5.0
1000	2.5
2650	1.0

This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet.

3) The area is surrounded by hurricane protection levees along the IHNC, Lake Pontchartrain, and the MRGO/IHNC and separated from area E-4b by the Maxent Canal Levee, a small local levee about 3 ft. ngvd. The Gentilly Ridge bisects the New Orleans East Citrus area from east to west; and I-510 bisects the area from north to south. The ridge has a minimum elevation of about +1 ft. ngvd. I-510 is elevated along several reaches and at ground level along others. Below elevation +1, floodwaters will flow away from the ridge, toward Lake Pontchartrain to the north of the ridge and toward the MRGO/GIWW to the south of the ridge. But the ridge should not retard drainage of the area to normal lake stage at the time of a levee breach. Also flow from the Bayou Sauvage area, Area 4b, is possible, since the levee separating the 2 areas is only at about elevation +3 ft. ngvd. Flow toward any breach can be retarded by debris. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as I510, I-10, US 90, Old Gentilly Road, or any of the numerous railroad embankments that parallel US 90 between US 90 and the MRGO/GIWW, can create such obstructions to flow.

4) After the basin is drained by gravity, pumping stations will have to be restored to remove the remaining floodwaters. On the north side of the ridge 4 pumping stations drain the area: 3 at the Lakefront, Pump Stations 10, 14, and 16; and 1 along the IHNC, the Dwyer Pumping Station. Three pumping stations drain the area south of the ridge: Amid, Elaine and Grant stations. The Village D'Lest area is drained by the Maxent Pumping Station into the Maxent Canal. This drainage is combined with the other runoff from the area between I-510 and the Maxent Levee, with one exception, and pumped into the MRGO/GIWW by Pumping Station 15. The exception is the Michoud Complex occupied by NASA. Its drainage is handled independently of the N.O. Sewage and Water Board System. The Michoud area is pumped into the MRGO/GIWW also.

E. Area E-4b New Orleans East, Bayou Sauvage

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 13 ft. ngvd, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be 18 feet after the storm. Within 72 hours after passage of the storm water levels in Lake Pontchartrain would recede to a normal high level of +3 to +4 feet ngvd. Lake level most likely would remain above normal for another 1-2 weeks while marshes surrounding the Lake drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) In the event that breaching of the line of protection is necessary, drainage of most of the area to lake level will take one or more days depending upon the width of the breach.

Appendix D Table E-4B Area E-4B: Orleans Parish East Bank New Orleans East (Bayou Sauvage) Gravity Drainage Down To Outside Stage	
Width of Breach (feet)	Days to Empty
100	17.5
500	3.5
1000	2.0
2650	1.0

This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet.

3) The area is surrounded by hurricane protection levees along Lake Pontchartrain, the MRGO/GIWW and from South Point to the GIWW; it is separated from area E-4a by the Maxent Canal Levee, a small local levee about 3 ft. ngvd. The Gentilly Ridge along US 90 bisects the New Orleans East Bayou Sauvage area from east to west. The ridge has a minimum elevation of about +1.5 ft. ngvd. Below elevation +1.5, floodwaters will flow away from the ridge, toward Lake Pontchartrain to the north of the ridge and toward the MRGO/GIWW to the south of the ridge. But the ridge should not retard drainage of the area to normal lake stage at the time of a levee breach. Several floodgates are located in the South Point to GIWW levee north of US 90. The purpose of these structures is to provide normal tidal interchange into these areas; thus preserving them as wetlands. If these structures are operable after a storm, they can be used to assist in draining the area. Also flow from the Citrus area, Area 4a, is possible, since the levee separating the 2 areas is only at about elevation +3 ft. ngvd. It is unknown at this time if culverts connect the areas north and south of the ridge along US 90. If insufficient flow between the 2 areas exist, then additional breaching of the N.O. East Back Levee will be required to drain the area to the normal lake stage. Flow toward any breach can be retarded by debris. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. The only elevated roadbeds in the area are I-10, US 90, and the railroad embankment that parallels US 90 between the MRGO/GIWW and US 90.

4) After the basin is drained by gravity, pumping stations will have to be restored to remove the remaining floodwaters. Gated culverts connect this area to Pumping Station 15 in area E-4a via the Maxent Canal. The area south of US 90 can be drained by Pump Station 15, but most probably only after the developed

area, area E-4a, has been drained sufficiently. If drainage in the area south of US 90 is separable from the area to the north, then the area north of US 90 can be allowed to drain through the gated structures in the South Point to GIWW levee. Since this area is mostly a wildlife refuge a lengthy period of high water is not crucial.

F. Area E-5a, St. Bernard - Developed Area

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 13.5 ft. ngvd, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 18.5 feet after the storm. Within 72 hours after passage of the storm water levels in the surrounding water bodies, the IHNC, MRGO and Lake Borgne, would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while marshes surrounding Lake Pontchartrain drain their surcharge of floodwater through this area to the Gulf of Mexico. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The levee protection network in the lower 9th ward of New Orleans and St. Bernard is unique. The developed area is surrounded by the Mississippi River levee and a local back levee about 8 ft. ngvd in height. Beyond the local levee is a large sump surrounded with a federal hurricane protection levee varying in height from 17.5 ft. ngvd along the MRGO to 13 ft. ngvd in the IHNC. The hurricane protection levee along the sump turns west away from the MRGO just north of Yscloskey and returns to the Mississippi River to close the loop of protection around the developed area of St. Bernard. If inundation occurs across the entire area, the sump area would have to be drained to elevation +8, the height of the back levee, before the developed area north of the Violet Canal could be drained. The area south of the Violet Canal and south of La. Hwy 46 could be drained from a breach in the lower section of levee between Yscloskey and the Mississippi River. The area between the Violet Canal and north of La. Hwy 46 could be drained in either direction by a breach; but probably would be most efficiently drained by a breach toward the sump, because of the elevation of the highway, which is located on an alluvial ridge.

3) In the event that breaching of the line of protection is necessary, drainage of most of the area to normal outside water level will take one or more days depending upon the width of the breach and the sequence of breaching the interior and hurricane protection levees. A summary table of approximate times is given below. Note that for simplification, the table presumes that drainage of the sump

to +8 will be necessary before drainage of the developed areas can begin. As discussed above other scenarios are possible.

Appendix D Table E-5A Area E-5A: St. Bernard and Orleans Parishes Chalmette and New Orleans Lower 9TH Ward Gravity Drainage Down To Outside Stage		
Width of Breach(feet)	Days to Empty Total Area from+13 to +8	Days to Empty Developed Area from +8 to +3
100	29.0	10.0
500	6.0	4.0
1000	3.0	2.0
2650	1.0	1.0

Breaching of levees would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until exterior water levels return to normal, interior floodwater elevations for those areas that can drain freely into the surrounding water bodies will reach about 1.5 feet. Flow toward any breach can be retarded by debris. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. No significantly elevated roadbeds parallel the levee system in St. Bernard Parish. Some elevated roadbeds bisect the area, but because of the drainage pattern in the area these roadbeds are not obstructive to flow.

3) The normal drainage pattern in the developed area is from high ground along the Mississippi River toward the back levee. At the back levee drainage is captured by a man-made canal, which runs generally along the inside perimeter of the canal in the entire basin. The developed area is surrounded by local and hurricane protection levees that divide it into 3 distinct drainage basins: from the lower 9th Ward of New Orleans to the Violet Canal; from the Violet Canal to La. Hwy 46; and below La. Hwy 46 to the Hurricane Protection Levee. Seven pumping stations drain the lower 9th Ward of New Orleans and the Chalmette areas up river of the Violet Canal. The lower 9th Ward area is drained by New Orleans Sewage and Water Board Pumping Station 5. This area is divided from St. Bernard by a railroad embankment but connected by an open channel along inside of the back levee. The Chalmette area is bisected by La. Hwy 47, Paris Road, an extension of I-510 that runs from the back levee to the Mississippi River. Paris Road is only slightly elevated above the surrounding natural ground elevations. St Bernard Pumping Stations 1, 2 and 6 drain the area above Paris Road. Pumping Stations 3, 4, and 7 drain the area below Paris Road. The drainage area below the Violet Canal to La. Hwy 46 is drained by Pumping Station 5. Pumping station 8 drains the area below La. Hwy 46 to the hurricane protection levee. La. Hwy 46 is located along an old alluvial ridge of the Mississippi River; the highway varies in elevation from +9 at the Mississippi River to +4 where it crosses the hurricane protection levee.

G. Area E-5b, St. Bernard Sump Area

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 13.5 ft. ngvd, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 13 to 20 feet after the storm. Within 72 hours after passage of the storm water levels in the surrounding water bodies, the IHNC, MRGO and Lake Borgne, would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while marshes surrounding Lake Pontchartrain drain their surcharge of floodwater through this area to the Gulf of Mexico.

2) The levee protection network in the lower 9th ward of New Orleans and St. Bernard is unique. The sump area is surrounded by the Lake Pontchartrain and Vicinity Hurricane Protection Levee along the MRGO and a local back levee about 8 ft. ngvd in height. The hurricane protection levee varies in height from 17.5 ft. ngvd along the MRGO to 13 ft. ngvd in the IHNC. If inundation occurs across the entire area, the sump area would have to be drained to elevation +8, the height of the back levee, before the developed area north of the Violet Canal could be drained. The area south of the Violet Canal and south of La. Hwy 46 could be drained from a breach in the lower section of levee between Yscloskey and the Mississippi River. The area between the Violet Canal and north of La. Hwy 46 could be drained in either direction by a breach; but probably would be most efficiently drained by a breach toward the sump, because of the elevation of the highway, which is located on an alluvial ridge.

3) In the event that breaching of the line of protection is necessary, drainage of most of the area to normal outside water level will take one or more days depending upon the width of the breach and the sequence of breaching the interior and hurricane protection levees. A summary table of approximate times is given below. Note that for simplification, the table presumes that drainage of the entire area to +8 will be necessary before drainage of the other areas can begin. Drainage of the sump as an individual unit can begin after water levels recede below +8. As discussed above other scenarios are possible.

Appendix D Table E-5B Area E-5B: St. Bernard and Orleans Parishes Chalmette and New Orleans Lower 9^{TH} Ward Gravity Drainage Down To Outside Stage		
Width of Breach(feet)	Days to Empty Total Area from+13 to +8	Days to Empty Developed Area from +8 to +3
100	29.0	17.0
500	6.0	4.0
1000	3.0	2.0
2650	1.0	1.0

Breaching of levees would leave the interior stage at +4 to +1.5 depending upon the exterior stage.

3) If the breach can remain open until exterior water levels return to normal, interior floodwater elevations for those areas that can drain freely into the surrounding water bodies will reach about 1.5 feet. Flow toward any breach can be retarded by debris. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. La. Hwy 47, Paris Road, is the only elevated roadway within the sump area. Because it is significantly elevated above the surrounding marsh, it could present an obstruction to flow across the sump and may have to be breached to facilitate drainage.

4) This area is not pumped, but serves as a receiving sump for St. Bernard Pumping Station 1 through 7 and Sewage and Water Board Pumping Station 5 in the lower 9^{th} Ward of Orleans Parish. Two 56-foot wide floodgates at Bayous Bienvenue and Dupre allow the pump station discharge to flow into the MRGO and its surrounding waters. The gates also remain open allowing the ebb and flood of normal tides. The floodgates are closed when the exterior stage exceeds 2 feet or when small craft warnings associated with a hurricane are posted by the National Weather Service.

10. Greater Metropolitan New Orleans Area - West Bank Of the Mississippi River

A. Area W-1 Cataouatche - West Bank Jefferson Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 4 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 9 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, when completed, will provide levee heights surrounding the western and southern sides of the basin varying from elevation +6.5 ft. ngvd to +10.5. On the eastern side this basin is separated from the Westwego area by a series of railroad embankments at about elevation +6 ft. ngvd north of the West Bank Expressway, and a ridge south of the West Bank Expressway, at elevation +2 ft. ngvd, along Avenue A in Westwego. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water level will take one or more days depending upon the width of the breach.

Appendix D Table W-1
Area W-1: Jefferson Parish West Bank
Lake Cataouatche Basin
Gravity Drainage Down To Outside Stage

Width of Breach (feet)	Days to Empty
100	20.0
500	4.0
1000	2.0
2650	1.0

This would leave the interior stage at +4 to +1.5 depending upon the lake stage. If the breach can remain open until lake levels return to normal, interior elevations for those areas that can drain freely into the lake will reach about 1.5 feet.

3) On the west bank of Jefferson Parish in the Cataouatche Basin the land generally slopes from the river toward Lake Cataouatche. With the exception of South Avondale, most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the 4 pumping stations located along the perimeter of the basin in the hurricane protection levee. Because the South Avondale area has been pumped for many years, ground elevations are the lowest in the basin; therefore this area will have to be pumped to drain completely. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as US 90, Bridge City Avenue, the West Bank Expressway, Lapalco Blvd, and the many railroad beds, which parallel the Mississippi River between the River and US 90, can create such obstructions to flow.

4) The basin contains an interior levee of about elevation 3 to 4 feet, which separates the developed area from the undeveloped low lying area, which is used for storage of rainfall runoff, from the populated part of the basin. A complicated series of canals, gates and culverts channel drainage water from the northern reaches of the basin, Avondale and South Avondale, to the Cataouatche and Bayou Segnette Pumping Stations. On the western side of the basin a small pumping station, the Highway 90 Pumping Station, assists with drainage of the South Kenner area. Drainage canals and culverts interconnect these areas, so that any of the 4 pumping stations can drain any portion of the basin. Some of the areas north of US 90 near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, especially South Avondale, one or more of the pumping stations must be restored.

B. Area W-2 Westwego to Harvey Canal - West Bank Jefferson Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 6 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low area could be as deep as 10 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, now under construction, will provide levee heights surrounding the remainder of the basin varying from +9.5 in the northern reaches to +12 toward the southern end. On the western side the basin is separated from the Cataouatche area by a series of railroad embankments at about elevation +6 ft. ngvd north of the West Bank Expressway, and a ridge south of the West Bank Expressway, at elevation +2 ft. ngvd, along Avenue A in Westwego. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water level will take one or more days depending upon the width of the breach.

Appendix D Table W-2 Area W-2: Jefferson Parish West Bank Westwego to Harvey Canal Gravity Drainage Down To Outside Stage	
Width of Breach (feet)	Days to Empty
100	11.5
500	2.0
1000	1.5
2650	1.0

This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet.

3) On the west bank of Jefferson Parish in the Westwego to Harvey basin the land generally slopes from the river toward the Gulf. A ridge at about elevation + 5 ft. ngvd at its lowest point bisects the basin from north to south, from the Mississippi River to Ames Blvd./Barataria Blvd to La Hwy 45. This ridge separates the basin into 2 distinct gravity drainage units, although culverts and canals interconnect the two in several places. Most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the 11 pumping stations located along the perimeter of the basin in the hurricane protection levee. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as Fourth Street, the West Bank Expressway, Lapalco Blvd, the Lafitte/Larose Hwy, Hwy 45, and the many railroad beds, which parallel the Mississippi River between the River and Fourth Street, can create such obstructions to flow.

4) The basin has been divided by the parish into several forced drainage compartments: the Westwego basin is drained by Westwego Pumping Stations 1&2; Lincolnshire and the area to its north is drained by the Westmister Pumping Station; the northern areas including Marrero are drained by the Ames, Harvey

and 2 Cousins Pumping Stations; the area west of the Hwy 45 Ridge is drained by the Oak Cove and Mt. Kennedy Pumping Stations; the Woodmere/Estelle areas are drained by the 2 Estelle Pumping Stations. Rainfall runoff can be stored in the southern reaches of the basin, which is mostly undeveloped. The basin is basically divided into 2 drainage basins by the Hwy 45 ridge. Drainage canals and culverts interconnect most areas with each other on the eastern side of the ridge. The same is true on the western side of the ridge. No one pumping station can drain the entire area, because of the ridge. Some of the areas near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, several pumping stations must be restored.

C. Area W-3a Harvey Canal to Algiers Canal - West Bank Jefferson - Plaquemines Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 5 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 10 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, now under construction, will provide levee heights surrounding the entire area of +9.5 ft. ngvd. This area is separated from Orleans Parish by the Donner Levee, approximately 3 to 4 ft. in elevation. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water levels in this basin will take one or more days depending upon the width of the breach.

This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet.

Appendix D Table W-3A Area W-3A: Jefferson And Plaquemines Parishes - West Bank Harvey Canal to Algiers Canal Gravity Drainage Down To Outside Stage	
Width of Breach (feet)	Days to Empty
100	14.0
500	3.0
1000	1.5
2650	0.5

3) On the west bank of Jefferson Parish in the Harvey to Algiers basin the land generally slopes away from the Mississippi River toward the Gulf. Most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the 2 pumping stations, Hero and Planters, located along Bayou Barataria. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as Fourth Street, the West Bank Expressway, Lapalco Blvd, La. Hwy 23, and the many railroad beds, which parallel the Mississippi River between the River and Fourth Street, can create such obstructions to flow.

4) The basin is essentially one large forced drainage unit. Rainfall runoff drains by gravity through culverts into several open canals southward into Bayou Barataria where it is discharged by the Hero and the Planters Pumping Stations into the Harvey and Algiers Canals, respectively. Some of the areas near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, several pumping stations must be restored.

D. Area W-3b Harvey Canal to Algiers Canal - West Bank Orleans Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 5 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 11 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a

catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, now under construction, will provide levee heights surrounding the entire area of +9.5 ft. ngvd. This area is separated from Jefferson/Plaquemines Parishes by the Donner Levee, approximately 3 to 4 ft. in elevation. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water levels in this basin will take one or more days depending upon the width of the breach.

Appendix D Table W-3B
Area W-3B: Orleans Parish - West Bank
Harvey Canal to Algiers Canal
Gravity Drainage Down To Outside Stage

Width of Breach (feet)	Days to Empty
100	5.5
500	1.5
1000	1.0
2650	0.5

This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet.

3) On the west bank of Orleans Parish in the Harvey to Algiers basin the land generally slopes away from the Mississippi River toward the Donner and Algiers Canal Levees. Most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the only pumping station in this basin, Pump Station 13, located along the Algiers Canal. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds, such as the West Bank Expressway, General Meyer Ave., McArthur Blvd., General De Gaulle Dr., and the many railroad beds located near and parallel to the Mississippi River, can create such obstructions to flow.

4) The basin is essentially one large forced drainage unit. Runoff drains by gravity through culverts into several open canals toward the interior Algiers Canal where it is discharged by Pumping Station 13 into the Algiers Canal (the GIWW). Some of the areas near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, the pumping station must be restored; or this area must be connected to the area below the Donner Canal and drained by those pumping stations.

E. Area W-4a Algiers Canal to Hero Canal – Belle Chasse, Plaquemines Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 5 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 11 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin, and the Algiers Canal, would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, now under construction, will provide levee heights surrounding the entire area of from +9.5 ft. to +10.5 ft. ngvd. This area is separated from Orleans Parish by the Donner Levee, approximately +3 ft. in elevation. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water levels in this basin will take one or more days depending upon the width of the breach.

Appendix D Table W-4A
Area W-4A: Plaquemines Parish - West Bank
(Belle Chase)
Algiers Canal to Hero Canal
Gravity Drainage Down To Outside Stage

Width of Breach (feet)	Days to Empty
100	11.0
500	2.0
1000	1.0
2650	0.5

This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet.

3) On the west bank of Plaquemines Parish in the basin between the Algiers and Hero Canals, the land generally slopes away from the Mississippi River toward

the Algiers Canal. Most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the 2 pumping stations, Belle Chasse Stations 1 & 2, located along the Algiers Canal. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds can create such obstructions to flow. In this area the potential obstructive roadbeds are: La. Hwy 23, La. Hwy 406, Hebert Blvd., Russell Dr., Walker Rd., and several railroad beds, both operational and abandoned, which parallel the Mississippi River between the River and La. Hwy 23.

4) The basin is essentially one large forced drainage unit. Runoff drains by gravity through culverts and open canals into Bayou Barriere and Planters Canal. These 2 canals function as one; they are located near to and parallel the Algiers Canal. Collected runoff is discharged by Belle Chasse Pumping Stations 1 & 2 into the Algiers Canal. Some of the areas near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, one of the pumping stations must be restored.

F. Area W-4b Algiers Canal to Hero Canal - West Bank Orleans Parish

1) In the event of catastrophic flooding the area may experience water elevations in excess of 20 feet ngvd. Within a few hours after storm passage water levels in the leveed areas would recede only to the elevation of the top of the levees, about + 5 ft. ngvd currently, unless failure of a levee or floodwall occurred. If levees and floodwalls remained intact, water depths in low areas could be as deep as 9 feet after the storm. Within 72 hours after passage of the storm water levels in Barataria Basin, and the Algiers Canal, would recede to a normal high level of +3 to +4 feet ngvd. Water levels most likely would remain above normal for another 1-2 weeks while Barataria marshes surrounding Lakes Des Allemands, Salvador and Cataouatche drain their surcharge of flood water. Pumping stations in the aftermath of such a catastrophic event could not operate normally without extensive repairs, but might be capable of siphoning water from the interior drainage canals, if debris can be kept clear of the intakes.

2) The northern side of the basin is protected from flooding by the Mississippi River levee. The hurricane protection project, now under construction, will provide levee heights surrounding the entire area of from +9.5 to +10.5 ft. ngvd. This area is separated from Plaquemines Parish by the Donner Levee, approximately 3 ft. in elevation. In the event that breaching of the line of protection is necessary, drainage of most of the area to exterior water levels in this basin will take one or more days depending upon the width of the breach.

Appendix D Table W-4B Area W-4B: Orleans Parish - West Bank Algiers - Lower Coast Algiers Canal to Hero Canal Gravity Drainage Down To Outside Stage	
Width of Breach (feet)	Days to Empty
100	3.0
500	1.0
1000	1.0
2650	0.5

This would leave the interior stage at +4 to +1.5 depending upon the exterior stage. If the breach can remain open until water levels return to normal, interior elevations for those areas that can drain freely will reach about 1.5 feet.

3) On the west bank of Orleans Parish in the Algiers to Hero basin the land generally slopes away from the Mississippi River toward the Donner and Algiers Canal Levees. Most floodwater in the basin can drain by gravity through the existing drainage culverts and canals toward the only pumping station in this basin, Pump Station 11, located along the Algiers Canal. If debris clogs the normal flow path, removal of the obstruction or breaching of the roadway or other obstruction must be pursued. Elevated roadbeds can create such obstructions to flow. La. Hwy 406 appears to be the only elevated roadbed in the area to present any obstruction to flow. Although the English Turn Subdivision and Golf Course has been developed in this area within the last few years, the area still remains largely undeveloped.

4) The basin is essentially one large forced drainage unit. Runoff drains by gravity through culverts and open canals toward the channel at the toe of the Donner Levee where it is discharged by Pumping Station 13 into the Algiers Canal (the GIWW). Some of the areas near the Mississippi River will drain dry at elevations of between +4 and +1.5 ft ngvd, because of the natural ground elevations in those areas. But to drain the area completely after inundation, the pumping station must be restored; or this area must be connected to the area below the Donner Canal and drained by those pumping stations.

APPENDIX D

GEOTECHNICAL CONSIDERATIONS

D) Geotechnical Considerations:

1) General: The soil boring data from the eight project areas was reviewed and summarized in the form of areas where 20 feet or more clay material exists beneath the levee base, and all others. The areas that meet the 20-foot arbitrary criteria were further subdivided based upon land use. The effort was to develop some sense of areas where population density and habitation were low, and major public facilities were present as the most likely sites for breaching. Avoiding are as such as: previously/currently used as waste disposal sites, power generating facilities, fuel depots and sites which may be necessary for future restoration of life in the city such as rail roads and highways.

2) Breaching Methods: It is likely that the saturated clay of a levee will NOT be moved using explosives, it is therefore necessary to use draglines and grade -all' s to degrade the pilot channel into the levee. The soil should be cast to the flood side so that the flow through the breach will car ry it away from the breach to prevent clogging of the cut. Floodwalls may present difficult breaching problems, they may either be pulled, driven down or if sufficient depth may be developed an explosive cutting charge may function well. Caution must be exercised in all these operations as reverse heads across these levees and floodwalls will have reduced the safety factors. The added load of earth moving equipment may be sufficient to induce failure which could lead to personal injury , loss of valuable equipment and a crevasse at that location.

3) Equipment Access and Mobility: Again the levees and floodwalls were not designed to have reverse heads across them and significant danger to personnel could exist during the movement of heavy equipment or durin g breaching efforts. The most likely access points will be from the waterways, and lakes adjacent to the flood protection, on the flood side of the protection, see maps indicating the preferred breaching locations. A barge carrying the earthmover pushed by a tug could access the levees/floodwalls at the closest point, which will be at the mouths of pump station or flood control structures canals. Many of the canals will be blocked by debris and those not so blocked will be blocked by bridges, however the le vees are nearest the water at the structures.

4) Site Specific Discussion:

a) E-l East Bank Area 1- St. Charles Parish:

1) No information developed at this time-

b) E-2 East Bank Area 2- Jefferson Parish:

The major portion of the levees and floodwalls from the Bonnabel Boat Launch to

the western tip of the flood protection adjacent to Lake Pontchartrain is founded on Clay soil to at least a depth of 20 feet therefore all that length could have potential as a breach site.

1) The Area adjacent to the Old Jefferson Downs racetrack to the Treasure Chest Casino site is underutilized and may be a primary site for a breach. Equipment could be barged into the pump station site and/or the Williams Blvd. boat launch ramp.

2) The site from the intersection of Causeway Ave. and the Lake Pontchartrain levee could be breached due to the first city block being business development. The Bonnabel pump station canal or the Causeway Bridge abutment may be a potential off loading site.

3) The floodwall between the I-10 and Lake Pontchartrain may have some potential to remove the stem using explosives.

c) E-3 East Bank Area 3 - Orleans:

1) The sites with a 20-foot clay layer beneath the levee or floodwall are very difficult to identify. The buried beach sand deposits are at or very near the surface. The first and best potential site is at the Florida Ave. Bridge into the Inner Harbor Navigation Canal. Access would be from the Lake Pontchartrain side of the canal at the Bridge abutment. The flood protection is provided by walls of two types one is a composite of I-type floodwall embedded in a small levee and the second type is an inverted pile supported t-type floodwall.

2) A second site at the intersection of Canal Blvd. and the Lake a small clay zone exists.

d) E-4A East Bank Area 4 - New Orleans East Citrus:

1) On the Mississippi River Gulf Outlet (MRGO) side of the protection system a clay substratum exists from the New Orleans Public Service generating plant to about the Almonaster dock site. Although the levee appears to be founded on clay in the vicinity of Paris Road breaching at this site would not be recommended as a garbage dump exists on the West of the bridge and New Orleans Public Service Inc. power generating station exists to the East. The site of the dock facility to the West is a most likely site due to low land use. The earth moving equipment could be brought in from the MRGO to an offloading site near the dock. Borrow material may be found in the adjacent undeveloped lands to be refilled by dredging in the future. This levee has very large stability berms, which extend to very, near the adjacent waterway.

2) From the Michoud Canal to the end where the levee turns north is all founded on clay of 20 feet or greater. The most preferred sites would be adjacent to

the pump station at mid reach or at the eastern most end of the levee. In both cases the access would be from the MRGO, via barge and tug. Future borrow would be from the landside from utilized lands of the management area. This levee has very large stabil ity berms, which extend to very , near the adjacent waterway.

The entire lake front levee is constrained by having a railroad parallel and flood side of the levee. This levee is also fou nded upon a deep sand stratum.

e) E-4B East Bank Area 4 -New Orleans East Bayou Sauvage:

The levees at both these sites have large stability berms, which may require some degrading to drain water .

1) From the Michoud Canal to the end where the levee turns north is all founded on clay of 20 feet or greater. The most preferred sites would be adjacent to the pump station at mid reach or at the eastern most end of the levee. In both cases the access would be from the MRGO, via barge and tug. Future borrow would be from the landside under utilized lands.

2) A site at the eastern end of the lake front levee in the Wild life management area could be breached.

The entire lake front levee is constrained by having a railroad parallel and flood side of the levee. This levee is also founded upon a deep sand stratum.

f) E-5 East Bank Area 5 -Lake Pontchartrain and Vicinity St Bernard Parish:

1) Florida Ave. to IHNC Lock has approximately 20 feet of clay beneath the base of the levee making it a candidate area for breaching. The protection is provided by a sheetpile floodwall embe dded in a small levee section for the most part. Breaching of the wall portion could be done using explosives.

3) Sites meeting the minimum criteria exist along the Eastern most levees adjacent to the MRGO and along a segment of the levee leading away fro m the MRGO toward Verret. The site most likely for breaching is at the intersection of the levee parallel to the MRGO and the levee leading to Verret. Access for construction equipment is via barge and tug from the MRGO.

These levees have large stability berms, which may be higher than the ambient water level outside the protected areas requiring some additional degrading to drain the water .

Note: There is a local interest levee approximately parallel to the Mississippi river levee and bisecting the pari sh, which is inside the federal levee system, it runs from about Paris road to the Verret community .The safety factor used for this locally designed levee is not the minimum customarily used by the Corps and it may fail as the water contained by the federal system drains. The local system is thought to be founded upon back swamp clays and could be breached near the pump station locations or any such location with access with local approval.

g) W-l West Bank Area 1- Lake Cataouatche:

From the Lake Cataouatche pump station to the Bayou Signet pump station a 20- foot minimum clay layer exists beneath th e levee, making that area a potential for breach.

1) The most likely site is centered on the canal from the lake to the levee nearest the center of the reach. This site is based upon the land use, which seems to be more sparsely populated than the remainder of the reach. The borrow could be from underutilized land adjacent.

h) W-2 West Bank Area 2 -Westwego to Harvey Canal:

1) Along the Western side of the levees from the Westminster pump station just south of t he Westwego seaplane canal to just south of the Oak Cove pump station the soils are clayey beneath the levee. The site most conducive to breaching is near the New Westminster pump station or about midway of the Orleans Village levee near a local drainage structure.

2) On the East side of this area along the Harvey Canal from the southern most sheetpile closure to the Estelle pump station. The most suitable site is about mid way from the New Estelle pump station and the closure. The earth moving equipment could be barged into the Harvey canal and oflloaded at the levee toe.

i) W-3A West Bank Area 3- Harvey Canal to Algiers Canal including Jefferson and Plaquemines Parish West of Harvey Canal:

1) The south eastern segment of the levee system is founded upon clay a bout 20 feet below the levee toe from a location across the canal from the Plaquemines pump Station to slightly north of the Boomtown Casin o site. The most likely site for breaching is in the old construction yard site at the intersection of Harvey canal and Algiers canal. The earth moving equipment could access either canal and be oflloaded onto the levee toe or at the casino-landing site.

j) W-3B West Bank Area 3- Harvey Canal to Algiers Canal Orleans Parish:

1) The levee from approximately Algiers Lock to the New Orleans Sewage and Water Board Pump Station # 13 could likely be used as a possible breach site.

It is recommended that a site closer to the Pump Station away from the Algiers Lock site be selected to facilitate repair in the future.

k) W-4A West Bank Area 4- Algiers Canal to Hero Canal Plaquemines Parish:

This levee is directly opposite the levee in area 3 Jefferson Parish above and may be breached exactly opposite the breach for area 3.

l) W-4B West Bank Area 4- Algiers Canal to Hero Canal Orleans Parish:

The levee from approximately Algiers Lock to the approximate Parish boundary across the canal from P.S. #13 could likely be used as a possible breach site. It is recommended that a site closer to the Pump Station away from the Algiers Lock site be selected to facilitate repair in the future.

5) Closure of Breaches:

The breaches may either be caused by natural reaction to the reverse loading of the existing flood protection or by our action taken to drain ponded water down to normal outside water level. The levees cut in the effort to drain the city may be closed using sheet pile driven along the original centerline of the levee. The soil necessary to support the sheetpile may have been eroded away during the flow after breaching. The sheetpile should be expected to sustain a loading of not more than 7 feet cantilever height. Substantial soil may have to be placed to support the sheet pile through the breach zone; this should be thoroughly inspected, as it is important to the function of the wall. The tip should be driven to a minimum depth of three feet below ground surface for every one foot of exposed sheetpile, i.e. if 7 feet is exposed then 21 feet should be embedded as a minimum. Using stone along th e flood side berm toe alignment to break waves directed at the floodwall is a near necessity these rocks , may also be used as a toe dike to fill in the crevasse. A large sandbag dike along the landside may contain the fill necessary to form a base necessary to support the floodwall on the landside. A bin wall (double row of sheetpile) may also yield a satisfactory closure; it is recommended that ties between walls be added at the one- third points for internal support. The actual crevasse must be evaluated to detemiine the best means of closure. In the areas where the storm event causes damage to the flood protection such as turning the wall over disturbing the foundation a bin wall may be the best repair section.

6) Recommended Breaches In The Metropolitan New Orleans Area:

In the unlikely event that a strong hurricane causes a storm surge to overtop hurricane protection levees, floodwalls, and floodgates, the following areas have been chosen recommendation based upon:

a) Geologically acceptable areas, such that no sand layer of thickness greater than 2.0 feet can be found above elevation -20.0 NGVD, as sand is highly prone to scour.

b) Wide-open areas were chosen wherever possible, so as to minimize the impact on residential areas. Sensitive areas such as power plants and bridge pilings were also avoided.

c) Environmental concerns, so as to minimize waste flowing out of the breaches.

d) Access to all breach areas for heavy equipment.

e) Low elevations were chosen, wherever possible, but portable pumps may be also required, as the natural ground within the protected area is lower than the ambient water level outside the protection.

The area under study has been divided into the East Bank Lake Pontchartrain & Vicinity and the West Bank & Vicinity. These areas will be designated EB and WB, respectively, followed by the area number and breach number. Utilizing a GPS receiver, the end points of each breach can be found from the latitude and longitudes provided below, as streets and landmarks will be submerged under such conditions. The endpoints indicate the limits of geological acceptability, and may need to be adjusted for physical obstacles found at the sites.

7) Geologically Acceptable Sites for Breaches:

(See attached maps for Recommended Sites)

Area	Estimated Width	Location
E-1-BO	TBA St	Charles Parish -sand bags placed along the unfinished levee work
E-2-B1	6900'	Jefferson Lakefront from Jefferson Downs to Treasure Chest Casino parking lot. 30ø2'44.002" 90ø15'04.968" to 30ø02'17.527" 90ø13'59.484"

E-2-B2	5160'	Jefferson Lakefront from east side of Causeway to Bonnabel outfall canal (To be used as a last resort only) 30ø 1' 9.534" 90ø 9'14.184" to 30ø 1' 9.836" 90ø 8'25.540"
E-3-	140'	Orleans Lakefront -median of Canal Blvd. (neutral ground) (To be used as a last resort only) 30ø '34.504" 90ø 6'18.036" to 30ø 1'34.464" 90ø 6'19.584"
E-3-B2	310'	Orleans Parish -IHNC SWof Florida Ave. R.R. bridge 29ø 58'53.000" 90ø 1'23.016" to 29ø 58'49.001" 90ø 1'21.000"
E-3-B3	335'	Orleans Parish -IHNC SE of Florida Ave. R.R. bridge 29ø 58'45.998" 90ø 1'14.016" to 29ø 58'50.002" 90ø 1'14.016"
E-4a-B1	1600'	Orleans Parish -Citrus Back Levee along GIWW , just east of Read Road 30ø 0'11.016" 89ø 57'33.732" to 30ø 0' 2.466" 89ø 59' 8.772"
E-4a-B2	475'	Orleans Parish -Citrus Back Levee along GIWW, at Grant St. P .S. 30ø 0'16.308" 89ø 56'58.704" to 30ø 0'17.320" 89ø 56'53.448"
E-4b-B11	913'	Orleans Parish -Citrus Back Levee along GIWW , easternmost end of levee 30ø 2'30.408" 89ø 50' 8.880" to 30ø 2'36.960" 89ø 49'59.772"
E-4b-B12	1900'	Orleans Parish -South Point near junction of I -l0/US Hwy .11 30ø 7'46.301" 89ø 54'16.740" to 30ø 8' 3.214" 89ø 5' 5.544"
E-4b-BI3	886'	Orleans Parish -South Point near junction of I-10/US Hwy.11 30ø 8'11.245" 89ø 53'56.832" to 30ø 8' 2.836" 89ø 53'26.304"

E-5-B2	3600'	St. Bernard Parish -Chalmette Extension, easternmost end along the MRGO 29ø 53'39.4401' 89ø 46126.328" to 29ø 53'23.172" 89ø 45'49.752"
W-1-B1	1000'	Jefferson Parish -Cataouatche East-West segment 29ø 52'14.858" 90ø 12' 1.332" to 29ø 52'14.275" 90ø 10'30.288"
W-2-B1	3000'	Jefferson Parish -Westwego to Harvey-East-West segment just east of south end of old Westwego Airport. (To be used as a last resort only) 29ø 52115.758" 90ø 8'16.908" to 29ø 52'14.761" 90ø 7'42.276"
W-2-B2	1440'	Jefferson Parish -Westwego to Harvey-North-South segment just south of Coubra Drive 29ø 51'44.762" 90ø 6'54.072" to 29ø 51 '29.999" 90ø 6'53.676"
W-2-B4	TBA	Jefferson Parish -Hero Cutoff, entire length of north side and westward to Estelle P .S.
W-3a-B1	TBA	Jefferson/Plaquemines Parishes - Algiers Alternate Canal - SW of Plaquemines Pumping Station and back to Engineers Road intersection
W-3b-B1	TBA	Orleans Parish -Plaquemines Parish section of Algiers Alternate Canal SW of Plaquemines Pumping Station
W-4a-B1	TBA	Orleans Parish -Plaquemines Parish section of Algiers Alternate Canal SW of Plaquemines Pumping Station
W-4b-B1	TBA	Plaquemines Parish - Algiers Alternate Canal - SW of Plaquemines Pumping St ation

APPENDIX E

AFTER ACTION REPORT

HURRICANE BETSY

AFTER ACTION REPORT

HURRICANE BETSY

8-11 SEPTEMBER 1965

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA

JULY 1966

HURRICANE BETSY

8-11 SEPTEMBER 1965

AFTER-ACTION REPORT

DEPARTMENT OF THE ARMY
NEW ORLEANS DISTRICT, CORPS OF ENGINEERS
NEW ORLEANS, LOUISIANA
JULY 1966

AFTER-ACTION REPORT
ON
HURRICANE BETSY
8-11 SEPTEMBER 1965

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Betsy left her mark on historic Canal Street in New Orleans

(Photo by Times-Picayune Pub. Co.)

FOREWORD

"This nation grieves for its neighbors in Louisiana; but this State will build its way out of its sorrow. And the national government will be at Louisiana's side to help every step of the way."

President Lyndon B. Johnson
New Orleans, Louisiana
10 September 1965

Figure 1. Aerial view of the vast flooded area of New Orleans east of the Inner Harbor Navigation Canal

HURRICANE BETSY - 8-11 SEPTEMBER 1965

AFTER-ACTION REPORT

SECTION I - INTRODUCTION

1. AUTHORITY

This report on the activities of the Corps of Engineers during and after Hurricane Betsy is authorized by letter, file ENGCW-OE, dated 16 December 1965, and is prepared in accordance with instructions contained in EM 500-1-1.

2. PURPOSE AND SCOPE

This report summarizes those emergency activities accomplished under Public Laws 875/81 and 99/84, as well as those under the various Corps of Engineers statutory authorities. It is intended to describe the program of relief and rehabilitation operations undertaken by the New Orleans District. In addition to recording the emergency operations, it is anticipated that the report may be of value as a reference for organization and administration of similar operations in the event of a future disaster.

3. THE STORM

a. On Friday morning, 27 August 1965, reconnaissance aircraft located a tropical depression with winds estimated at 44 miles per hour in the Atlantic Ocean about 350 miles east-southeast of Barbados in the Windward Islands, West Indies. This tropical storm was soon to grow into Hurricane Betsy, the most destructive on record to hit the Louisiana coast. For 4 days, Betsy moved slowly across the Atlantic Ocean in a generally northwesterly direction. It then made a gradual loop about 275 miles north of Puerto Rico and on 1 September became a full-fledged hurricane with winds estimated at 80 miles per hour. Resuming its generally northwesterly movement, the storm gained in size and intensity until it reached a point about 430 miles south of Cape Hatteras, North Carolina. There it performed another loop and began an unusual southward course. On 6 and 7 September, it pounded

Nassau with violent winds and high tides. Betsy then followed a westerly course, passing over the Florida Keys on 8 September and lashing the Miami area with 105-mile-per-hour winds.

b. Moving across the Gulf of Mexico, Betsy increased her forward speed and became a definite threat to the Louisiana and Texas coasts. Hurricane warnings were issued at 6 a.m., 9 September, from the mouth of the Mississippi River to Galveston, Texas, and at 1 p.m. were extended east to Mobile, Alabama. At 10 p.m., the eye of the storm passed to the west of Grand Isle, Louisiana, preceded by winds in excess of 160 miles per hour and a tide of 8.8 feet above mean sea level. At 11 p.m. Betsy was about 35 miles southwest of New Orelans, lashing that city with winds of 125 miles per hour. By 4 a.m., the storm was just west of Baton Rouge, Louisiana, with winds of about 100 m.p.h. near the center.

c. Losing strength as she moved inland, Betsy was downgraded to a tropical storm at 10 a.m., 10 September. She had left in her wake a path of devastation unparalleled by any other storm in the recorded

Figure 2. Flooding in New Orleans east of the Industrial Canal

Figure 3. New Orleans where the water rose to heights of 9 feet

Figure 4. Flooding in New Orleans downstream from the Inner Harbor Navigation Canal

Figure 5. Storm-tossed debris in Lafourche Parish

history of Louisiana. (The path of Hurricane Betsy is shown on plate 1 while a detail of its route through Louisiana is shown on plate 2.)

d. The eye of the hurricane was 40 miles in diameter and the highest winds were estimated to have been in excess of 160 miles per hour, in gusts. Hurricane winds extended outward 90 miles from the hurricane eye, while gale winds extended 250 miles in all directions. The tidal surge which accompanied the hurricane ranged from about 8 feet above mean sea level at Grand Isle to better than 16 feet mean sea level east of the Mississippi River below New Orleans, Louisiana. At Pointe-a-la-Hache, Louisiana, a community on the east bank of the Mississippi River about 50 river miles below New Orleans, floodwaters rose to a maximum elevation of 14.3 feet. Betsy inundated over 5,000 square miles in Louisiana, including highly populated urban areas in Orleans and St. Bernard Parishes. Fortunately, Betsy was a relatively dry hurricane. As she passed inland over south Louisiana, rainfalls of from 1/2 inch to 1 inch per hour were recorded. On Friday and

Figure 6. Oyster house and seafood plant in Lafourche Parish destroyed by the hurricane winds

Figure 7. Only the foundations remain in this portion of Grand Isle, La.

Saturday, 10 and 11 September, the remnants of Betsy deposited from 4 to 7 inches of rain over the lower Mississippi and lower Ohio River Valleys.

e. In her trip through Louisiana, Betsy left 81 dead, over 17,600 injured, and caused the evacuation of 250,000 persons to storm shelters. The total damages in Louisiana from Betsy's winds and tides are estimated at about $2 billion (figures 1 thru 12). Detailed economic data on the damages within the inundated areas caused by the hurricane are contained in the report "Hurricane Betsy - September 8-11, 1965" prepared by the U. S. Army Engineer District, New Orleans, in November 1965. The report also contains detailed engineering, hydrologic, and meteorologic data on the storm.

Figure 8. Flooding in Plaquemines Parish below Port Sulphur, La.

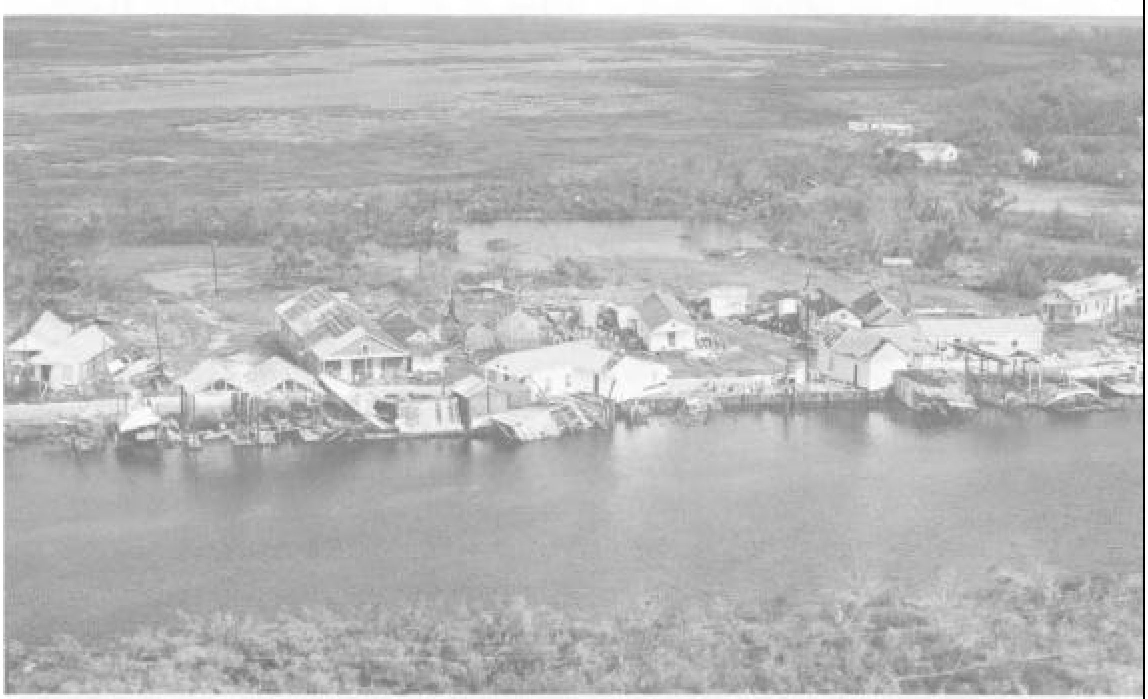
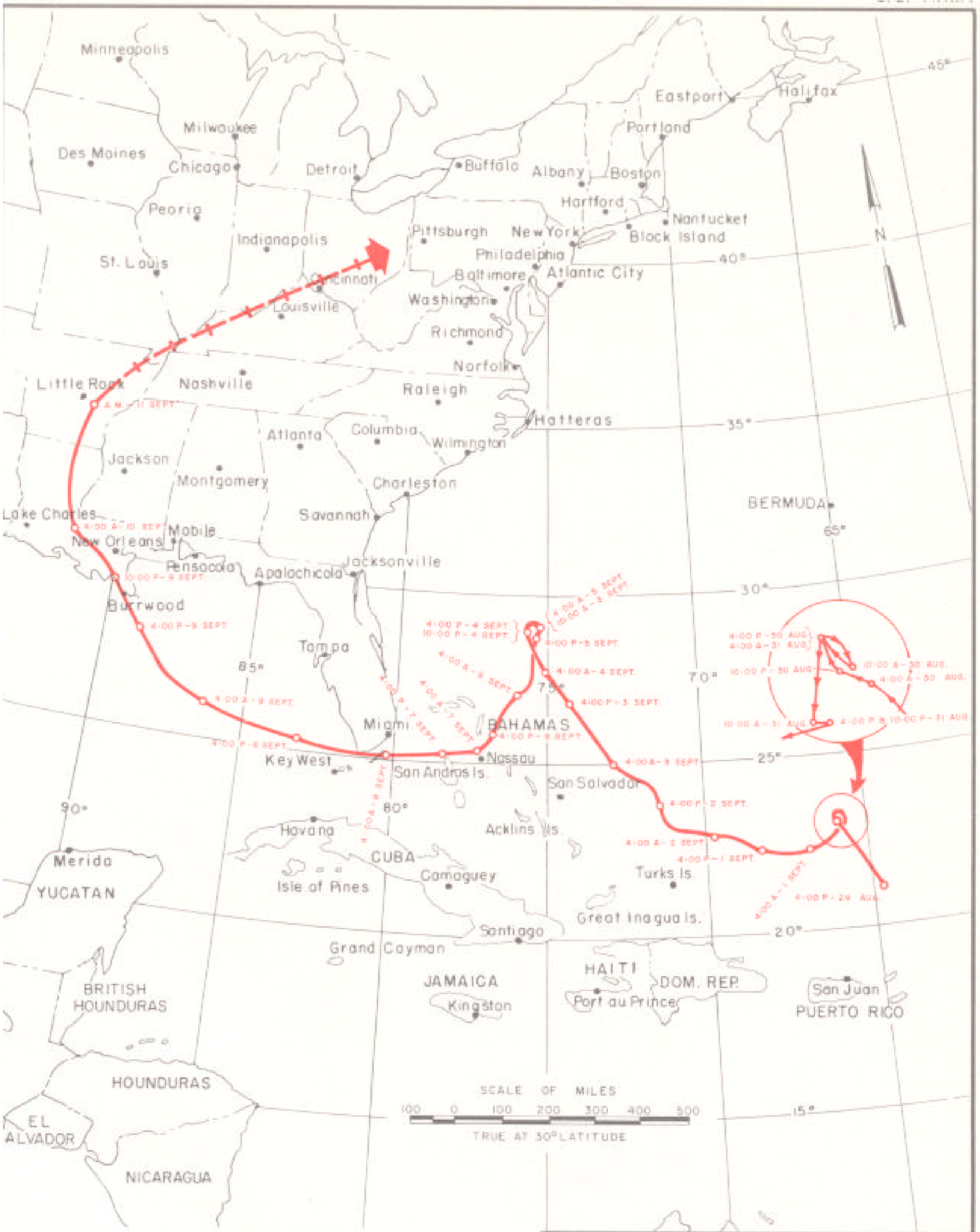


Figure 9. Wind damage along Bayou Terre aux Boeufs in St. Bernard Parish



LEGEND

HURRICANE STAGE (75 MILES AND HIGHER)

EXTRATROPICAL STAGE *

* A COMPLEX WEATHER PHENOMENON THAT CANNOT BE DESCRIBED IN TERMS OF WIND VELOCITIES.

HURRICANE BETSY 8-11 SEPT., 1965

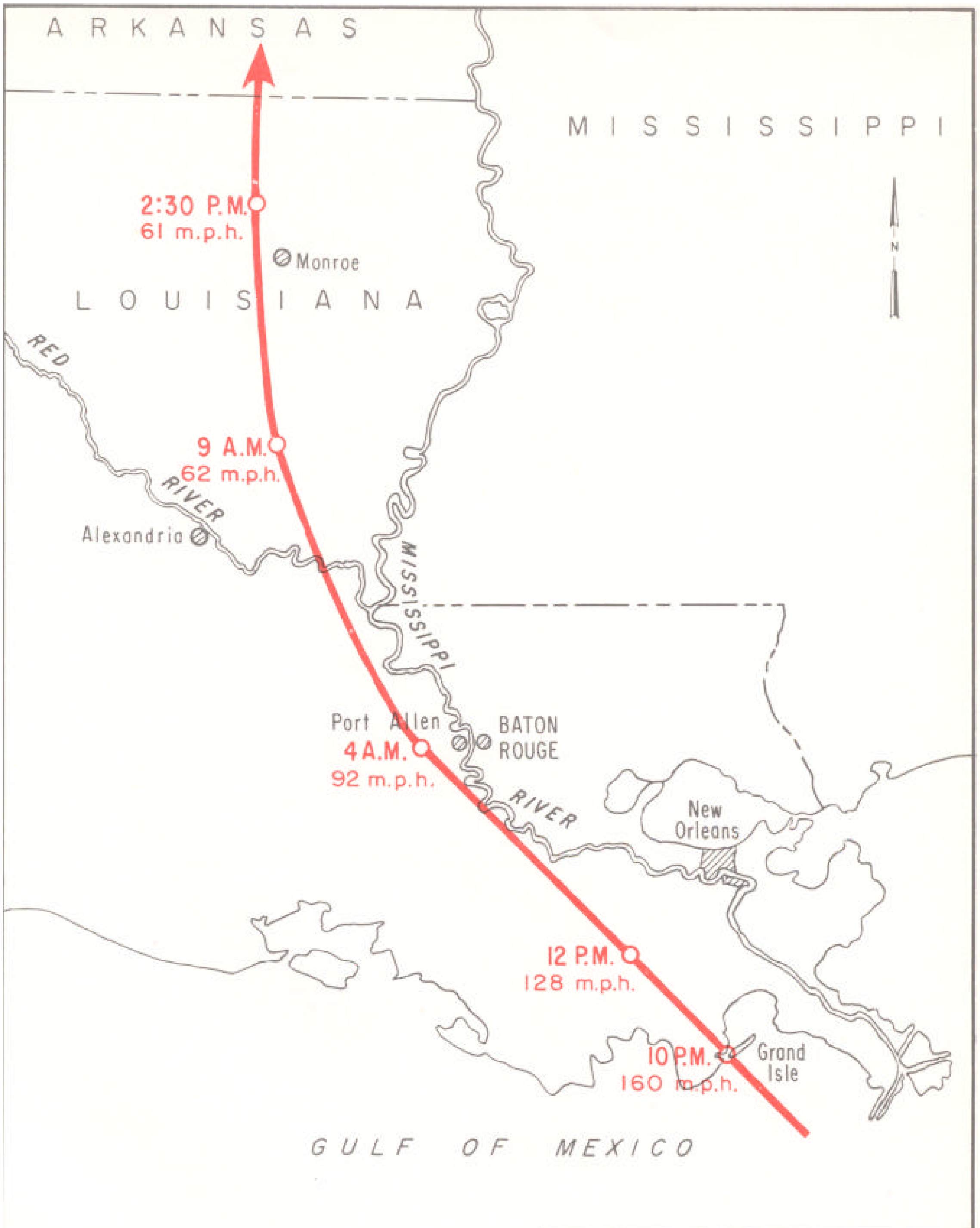
PATH OF HURRICANE "BETSY"

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.

TO ACCOMPANY AFTER ACTION REPORT ON HURRICANE BETSY DATED: JULY 1966

FILE NO. H-2-23890

PLATE 1



HURRICANE BETSY 8-11 SEPT., 1965

PATH OF HURRICANE "BETSY" IN LOUISIANA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
To accompany AFTER ACTION REPORT ON HURRICANE BETSY DATED: JULY 1966
File No. H-2-23890

PLATE 2

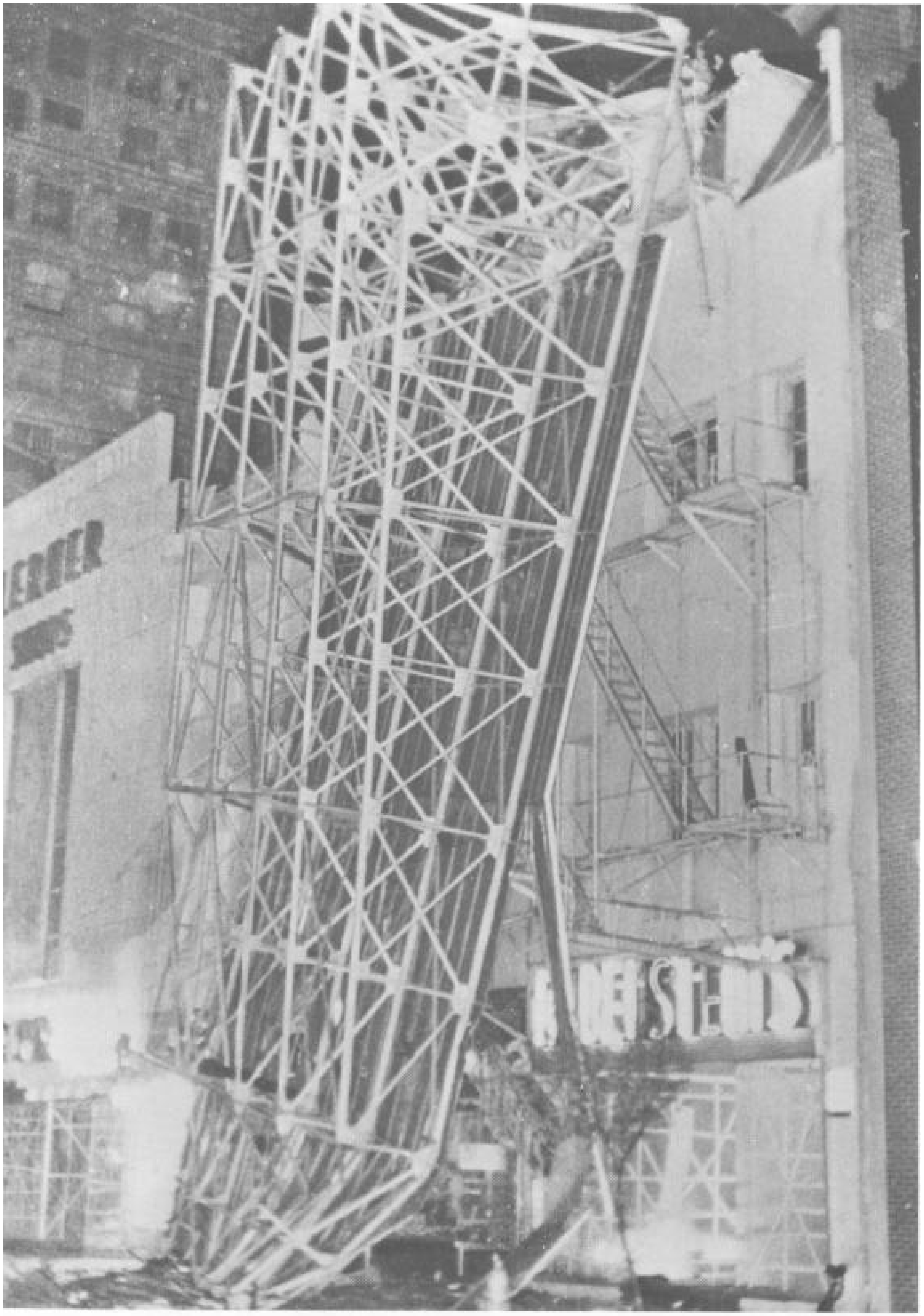


Figure 10. Sign collapsed by Betsy's 100+ miles per hour winds

(Photo by Times-Picayune Pub. Co.)

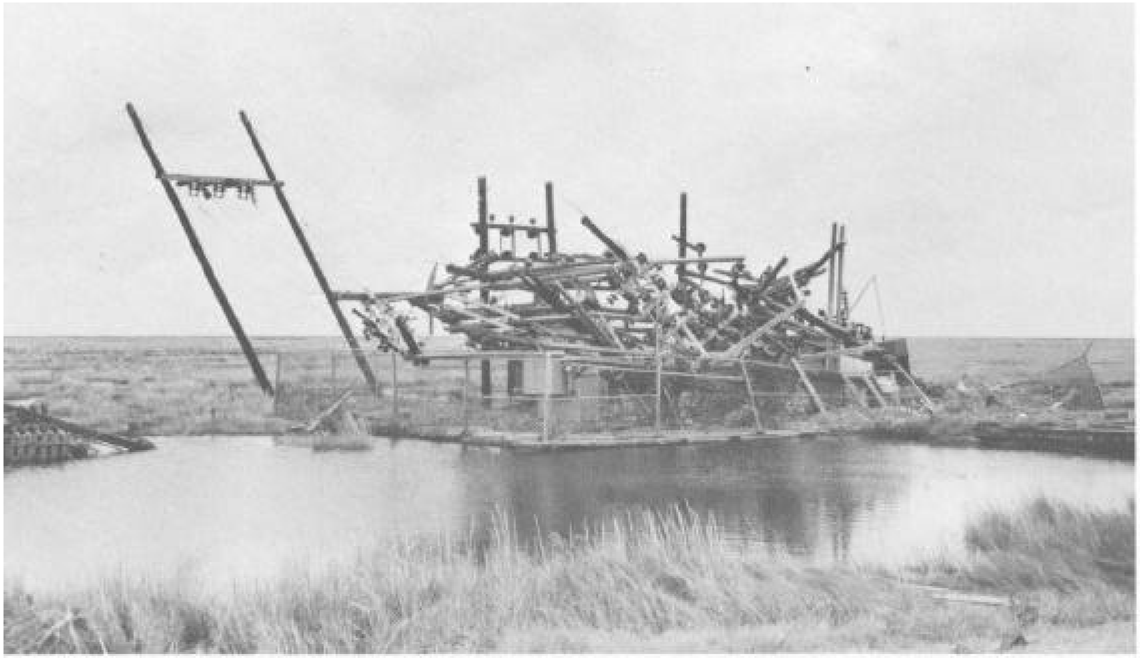


Figure 11. Electrical substation in Lafourche Parish

Figure 12. Brick wall collapses during hurricane, New Orleans, La.

SECTION II - EMERGENCY OPERATIONS

4. PRESTORM ACTIVITIES

a. When it became apparent that the hurricane would move inland somewhere along the Louisiana coast, precautionary measures were put into effect by the District Engineer to protect government property and personnel. A preplanned emergency operations center was activated in the New Orleans District office during the morning of 9 September on a 24-hour basis. The unusually high forward speed and erratic path of the storm limited the time available for prestorm activities to hours rather than days. Nevertheless, by Thursday night, 9 September, all possible precautionary measures had been taken. By 6 p.m., when Betsy roared inland over Grand Isle, the Corps of Engineers was ready.

b. In anticipation of losing commercial power as a result of the storm, emergency generators were placed at critical locations on the District reservation. At the same time, an around-the-clock radio watch was instituted which continued to function throughout the emergency. Commercial power failed at 8:50 p.m., Thursday, 9 September, and for the next 5 days, the District reservation operated on emergency power. While radio communication was maintained at the New Orleans District office, most of the field units in southeastern Louisiana could not be reached because of equipment failure due to loss of power or flooding. However, from 4 p.m., Thursday, until communications were lost, field units reported hourly on weather conditions at their locations. Such data as tidal gage heights, barometric pressures, wind direction and velocity, plus rainfall were furnished and forwarded to all District elements involved for record and evaluation. Simultaneously, liaison with local officials and Civil Defense agencies was established and continued throughout the emergency period.

c. The field installations wasted no time in securing their physical plant and completing preparations to ride out the storm. This necessitated either securing or moving the floating plant to safe harbors. The fleet at the District reservation--consisting of 20 boats ranging from 35 to 100 feet in length, plus six 500-ton barges--was moved to the boat pen on the Harvey Canal. The hopper dredge LANGFITT, which was working on the Calcasieu River, was moved to a safe harbor at Lake Charles.

d. All possible precautions had been completed by nightfall Thursday, and a small crew of men remained on duty at the District reservation to make emergency repairs. During the storm, three members of the crew were sent to the Industrial Canal to assist in sandbagging a leak that had developed in the levee system. This group continued operations until the wind made it impractical to continue. As the storm abated during the following morning (10 September), the initial phase of operation--that of protecting government property and personnel from the elements--was successfully concluded. Corps personnel on duty at the time suffered no deaths or injuries and storm damage to government property had been kept to a minimum. Only two pieces of floating plant--the surveyboat GILES and an office barge--suffered major damage.

e. The hurricane left devastation in its path through the southeastern Louisiana coast. Eighteen parishes were flooded by the tidal surge that accompanied Hurricane Betsy (figure 13 and plate 3). The surge had overtopped both the Federal and non-Federal levees protecting the areas and was trapped between the levees leaving water over large areas of land in Orleans, Plaquemines, and St. Bernard Parishes. (The maximum depth of water was in Plaquemines Parish where it was up to 11.6 feet deep.) Twenty-seven other parishes suffered major wind damages. Federal, state and local governmental agencies, businesses, and individuals were faced with the enormous job of restoring the devastated area to normalcy. The Corps of Engineers played a major role in these recovery operations, performing a variety of tasks ranging from rescuing flood victims to removing debris. Activities accomplished under Public Law 875/81 as well as under each of the Corps statutory authorities (P.L. 99/84 and Operation and Maintenance (General)) are detailed in subsequent paragraphs.

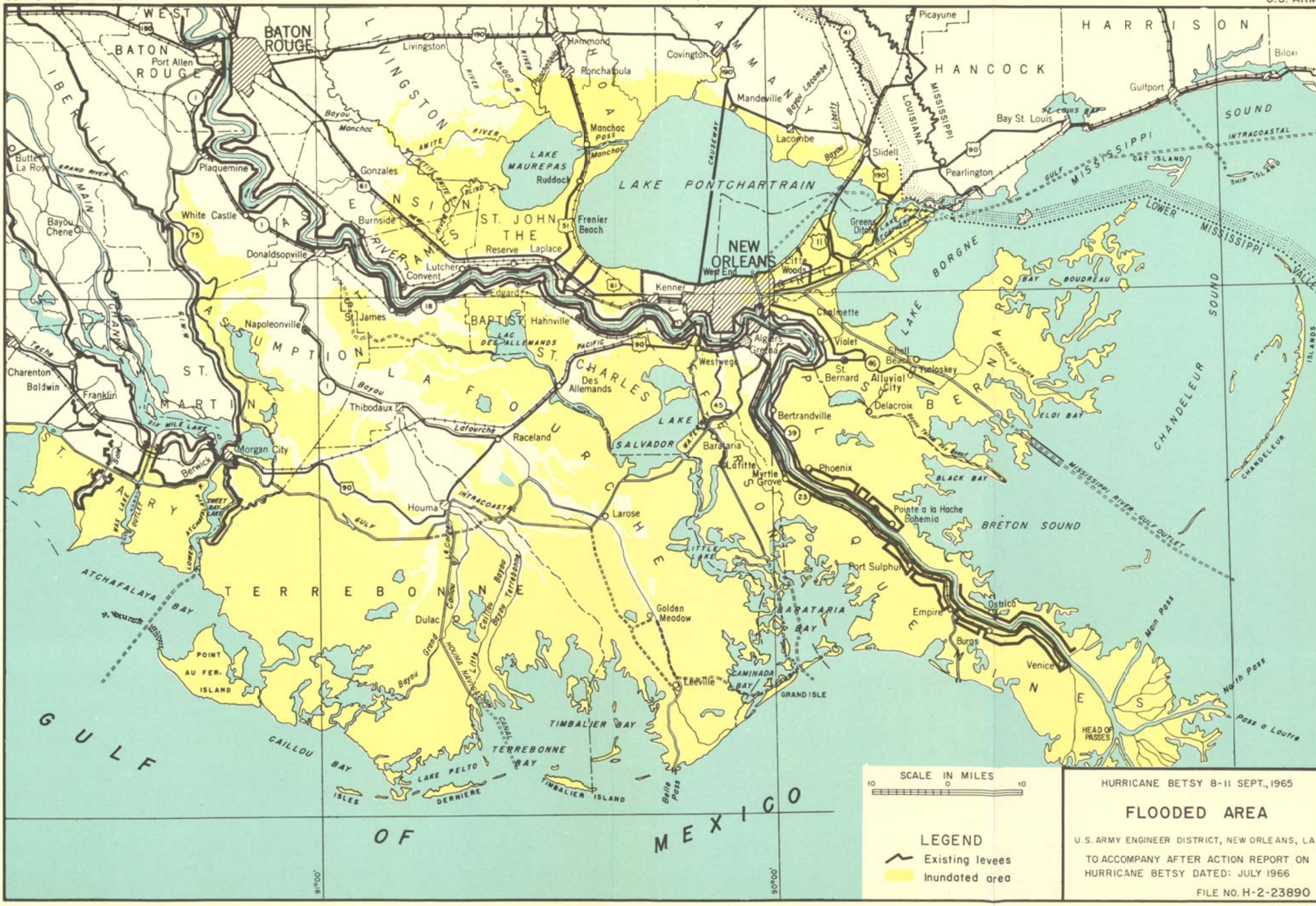

HURRICANE BETSY 8-11 SEPT., 1965
FLOODED AREA
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
TO ACCOMPANY AFTER ACTION REPORT ON
HURRICANE BETSY DATED: JULY 1966
FILE NO. H-2-23890
LEGEND
Existing levees
Inundated area
SCALE IN MILES
10
0
10
BATON ROUGE
NEW ORLEANS
LAKE PONTCHARTRAIN
LAKE MAUREPAS
LAKE BORGNE
BRETON SOUND
CHANDELEUR SOUND
MISSISSIPPI SOUND
BARATARIA BAY
TIMBALIER BAY
TERREBONNE BAY
CAILLOU BAY
ATCHAFALAYA BAY
GULF OF MEXICO
HARRISON
HANCOCK
LOUISIANA
MISSISSIPPI
WEST BATON ROUGE
IBERVILLE
LIVINGSTON
TANGIPAHOA
ST. TAMMANY
ASCENSION
ST. JAMES
ST. JOHN THE BAPTIST
ST. CHARLES
ASSUMPTION
LAFOURCHE
TERREBONNE
JEFFERSON
ORLEANS
ST. BERNARD
PLAQUEMINES
ST. MARTIN
ST. MARY
Picayune
Biloxi
Gulfport
Bay St. Louis
Pearlington
Slidell
Lacombe
Mandeville
Covington
Hammond
Ponchatoula
Livingston
Port Allen
Plaquemine
Gonzales
Burnside
White Castle
Donaldsonville
Lutcher
Convent
Reserve
Laplace
Edgard
Hahnville
St. James
Napoleonville
Thibodaux
Raceland
Des Allemands
Kenner
West End
Algiers
Gretna
Westwego
Chalmette
Violet
St. Bernard
Alluvial City
Shell Beach
Ycloskey
Delacroix
Bertrandville
Phoenix
Pointe a la Hache
Bohemia
Port Sulphur
Empire
Ostrica
Buras
Venice
HEAD OF PASSES
Barataria
Lafitte
Myrtle Grove
Golden Meadow
Leeville
GRAND ISLE
Larose
Houma
Dulac
Morgan City
Berwick
Franklin
Charenton
Baldwin
Butte La Rose
Bayou Chene
Ruddock
Frenier Beach
Manchac Pass
Little Woods
Green Ditch
LAKE SALVADOR
LITTLE LAKE
SIX MILE LAKE
LAC DES ALLEMANDS
CAT ISLAND
SHIP ISLAND
CHANDELEUR ISLANDS
POINT AU FER ISLAND
ISLES DERNIERE
TIMBALIER ISLAND
LAKE PELTO
Belle Pass
Main Pass
North Pass
Pass a Loutre
MISSISSIPPI RIVER-GULF OUTLET
GULF INTRACOASTAL
HOUMA NAVIGATION CANAL
BLACK BAY
ELOI BAY
BAY BOUDREAU
CAMINADA BAY
CAUSEWAY
90°00'
91°00'

Figure 13. Flooding of Carolyn Park in St. Bernard Parish

Figure 14. President Lyndon B. Johnson with members of Louisiana congressional delegation in New Orleans, La.

Figure 15. President Johnson with New Orleans Mayor Schiro

Figure 16. President Johnson speaking with one of Betsy's refugees

(Photos by Times-Picayune Pub. Co.)

SECTION III - DISASTER RECOVERY ACTIVITIES P.L. 875/81

5. ORGANIZATION

a. Many Corps employees suffered severe personal losses the night of the storm. Despite these losses, they came through streets filled with water, debris, and fallen electrical lines to report for emergency duty on Friday morning, 10 September. A preplanned Disaster Recovery Center was activated at the New Orleans District Headquarters to coordinate the poststorm activities of the Corps. This unit was staffed with competent, well-trained people experienced in similar operations both within and outside of the New Orleans District. Thirty-two assistance teams, each led by an engineer, were organized and dispatched to the parishes affected by the storm. These teams were instructed to estimate damages and render all possible assistance to the local officials. A list of field offices established by these assistance teams is attached as exhibit 5-1.

b. Approximately 500 New Orleans District personnel were assigned to disaster recovery operations. However, it soon became evident that additional personnel would be required. A call for assistance was sent to all Corps offices throughout the country resulting in an effective and rapid response. In a short period of time, 250 people arrived from all parts of the country. Engineers, construction superintendents, inspectors, auditors, and others came ready, willing, and able to work. Every Corps division in the continental United States sent top people in their respective fields to assist the New Orleans District. These personnel as well as New Orleans District personnel assigned gained valuable experience in postdisaster operations. A listing of these personnel is attached as exhibit 5-2. An organization chart for the disaster recovery operation is attached as exhibit 5-3.

c. On the evening of 10 September, the President of the United States, accompanied by Members of the Louisiana Congressional delegation and other Federal officials, flew to New Orleans to survey the hurricane damages (figures 14 thru 16). The President promptly declared that a major disaster had occurred in Louisiana and pledged the full cooperation of the Federal government in rehabilitating the area.

The Office of Emergency Planning (OEP) was given the responsibility for coordinating the emergency operations of all Federal agencies. The Louisiana parishes listed below were determined by OEP to be eligible for Federal assistance under the provisions of Public Law 875/81. The determination by OEP is published in the Federal Register of 21 September 1965.

Acadia	Lafayette	St. James
Ascension	Lafourche	St. John the Baptist
Assumption	Livingston	St. Landry
Avoyelles	Orleans	St. Martin
Caldwell	Ouachita	St. Mary
Catahoula	Plaquemines	St. Tammany
East Baton Rouge	Pointe Coupee	Tangipahoa
East Feliciana	Rapides	Terrebonne
Franklin	Richland	Washington
Iberia	St. Bernard	West Baton Rouge
Iberville	St. Charles	West Feliciana
Jefferson	St. Helena	

In addition, Concordia, Evangeline, and Tensas Parishes were declared eligible on 13 October 1965.

6. MISSION ASSIGNMENTS BY OEP

a. During his tour of the ravaged area, the President made it clear that immediate Federal action was necessary and that "red tape" would be cut to a minimum. Therefore, in anticipation of a request from OEP for assistance, the Corps went to work. Corps representatives were already in the field working with local governments, explaining the Federal assistance programs available, and making damage estimates when the first formal request from OEP for technical assistance was received on 17 September. The text of the request and letters transmitting the request to the Lower Mississippi Valley Division and the New Orleans District are attached as exhibit 6-1, and are summarized below:

(1) Make initial inspections and document work eligible under P.L.875/81 in connection with debris clearance, protection of life and property, repairs of dikes and levees, and reestablishment of drainage facilities.

(2) Repair eligible damages when requested by local officials.

(3) Provide technical and administrative assistance and reimbursement to local governments doing work eligible for assistance under P.L.875/81.

b. The reimbursement agreement in item (3) above is a departure from the normal method of OEP operations. This arrangement allows the Corps to make payments directly to local governments and is in line with the President's direction to cut the red tape. This method applied not only to the functions normally performed by the Corps (debris removal, restoration of flood control works, drainage, etc.) but also to all categories of work assigned to other Federal agencies. The result of this procedure is that communities, financially distressed by the hurricane, were reimbursed for their expenditures in a fraction of the time usually required.

c. The Office of Emergency Planning issued four "Natural Disaster Memoranda" to define the policies and procedures to be followed in assisting local governmental agencies. While four memoranda were issued, only the two pertinent ones are attached as exhibit 6-2. Three procedures for emergency repair or temporary replacement of public facilities damaged by the hurricane are given in the memoranda and summarized below:

(1) Federally-operated Contract. When this procedure is selected, the applicant submits a resolution describing the emergency work to be performed. Representatives from appropriate Federal and state agencies make an inspection to determine the eligibility of the work and to estimate its cost. This estimate serves as the basis on which a Federally-operated contract is undertaken.

(2) Applicant-operated Contract. If the applicant desires to perform emergency repairs or replacement, he submits a project application, including plans and specifications for the work, to the Corps of Engineers representative in his area. Upon approval of the application, the applicant lets a contract for the work and receives partial payments for the work as it progresses.

(3) Applicant-force Account and/or Temporary Employees. If the applicant desires to perform repairs or replacement with his own forces and/or temporary employees, an initial inspection is made by appropriate Federal and state agencies to recommend the amount of funds required for eligible emergency work. The applicant is reimbursed periodically by the Corps of Engineers as the work progresses.

d. The following categories of work were defined by OEP:

A. Debris clearance.

B. Protective, health and sanitation measures.

C. Streets, roads, and bridges.

D. Dikes, levees, and drainage facilities.

E. Public buildings and related equipment.

F. Public utilities.

e. A typical example of the sequence of operations whereby a local governmental agency obtains Federal emergency assistance is as follows:

(1) The Corps of Engineers representative in the area contacts the local officials and explains the Federal emergency assistance programs available to them. He then assists them in preparing and submitting the necessary documents to obtain Federal assistance.

(2) The applicant prepares a "Letter of Intent" and submits it to OEP through the Corps. In this letter, the applicant states which

Figure 17. One of thousands of trees in New Orleans blown down by the hurricane
(Photo by Times-Picayune Pub. Co.)

procedure will be followed to accomplish eligible work.

(3) An inspection and an initial damage estimate is made by representatives of the applicant and the appropriate Federal and state agencies.

(4) The applicant submits a "Project Application" to request Federal assistance. If a Federal agency is requested to perform the work, a "Resolution" is also submitted.

(5) The work is then accomplished under one of the procedures outlined in Par. 6c. above. Regardless of the procedure chosen, the Corps exercises supervision of the work and issues partial payments as the job progresses.

Figure 18. Famous New Orleans architecture marred by debris

(Photo by Times-Picayune Pub. Co.)

(6) When the work is complete, a final inspection is made by representatives of the Corps and the applicant. Upon acceptance of the work by both agencies, the necessary financial audits are made and the final payment transmitted.

7. MISSION ACCOMPLISHMENT

a. Category A - Debris Removal.

(1) The activity of the Corps which required the most time and effort was debris removal. Though an unglamorous task, it is, nevertheless, one of the most essential to safeguarding public health and restoring vital transportation arteries. The storm felled an inestimable number of trees and littered the area with every type of debris imaginable (figures 17 thru 20). The removal of damaged furniture, building materials, vehicles, trees, and other types of debris considered a potential hazard to public health or safety, necessitated swift and efficient action by the Corps. The Corps of Engineers

alerted the construction industry for mobilization of all possible equipment that could be used for debris removal and other disaster work. Much of the equipment in the immediate area was either damaged or immobilized by the storm. However, efforts by local contractors and others from as far away as Texas and Florida enabled the Corps to assemble, within a few days, a formidable array of dump trucks, loaders, dozers, cranes, and related equipment for removing debris. Within 48 hours, contracts were signed and work had begun on what was to become the largest operation of its kind in the history of the Corps.

(2) The flooded areas of Orleans, Plaquemines, and St. Bernard Parishes posed a particularly difficult debris removal problem. Initial operations in these parishes removed trees, roofing, and other materials strewn about by Betsy's winds. As residents moved back into the area, the character of the debris changed. Water-soaked furniture and household goods of every description, as well as floor and wall covering, were discarded (figures 21 and 22). A seemingly endless line of trucks hauled the debris to dumps for burning (figures 23 and 24).

Figure 19. Corps of Engineers' contractor removing debris from New Orleans streets

An official of the City of New Orleans estimated that it would take a year to clean up the city. The Corps accomplished the initial cleanup in 2 months. (For a detail of the inundated area in New Orleans, see plate 4.)

(3) In all, 53 contracts were let by the Corps of Engineers for debris removal in 15 Louisiana parishes. The method of payment employed for this work resulted in excellent Corps of Engineers-Contractor relationships. At the close of each day's operations, the Corps and contractors' representatives prepared and certified a delivery ticket for the work done that day. These tickets were hand-carried to the Disaster Recovery Center and used to substantiate weekly payments to the contractors. Using this method, all contractors received their final payment on the day following termination of the contracts. Over a quarter of a million truckloads of debris, enough to stretch bumper to bumper from New Orleans to St. Louis, were removed by Corps contractors. In addition, 36 parishes did all or part of their own debris clearance under Corps supervision. In these instances, the Corps of Engineers furnished technical and administrative assistance, made inspections, and issued payments (figures 25 thru 28 show the results of Corps cleanup operations).

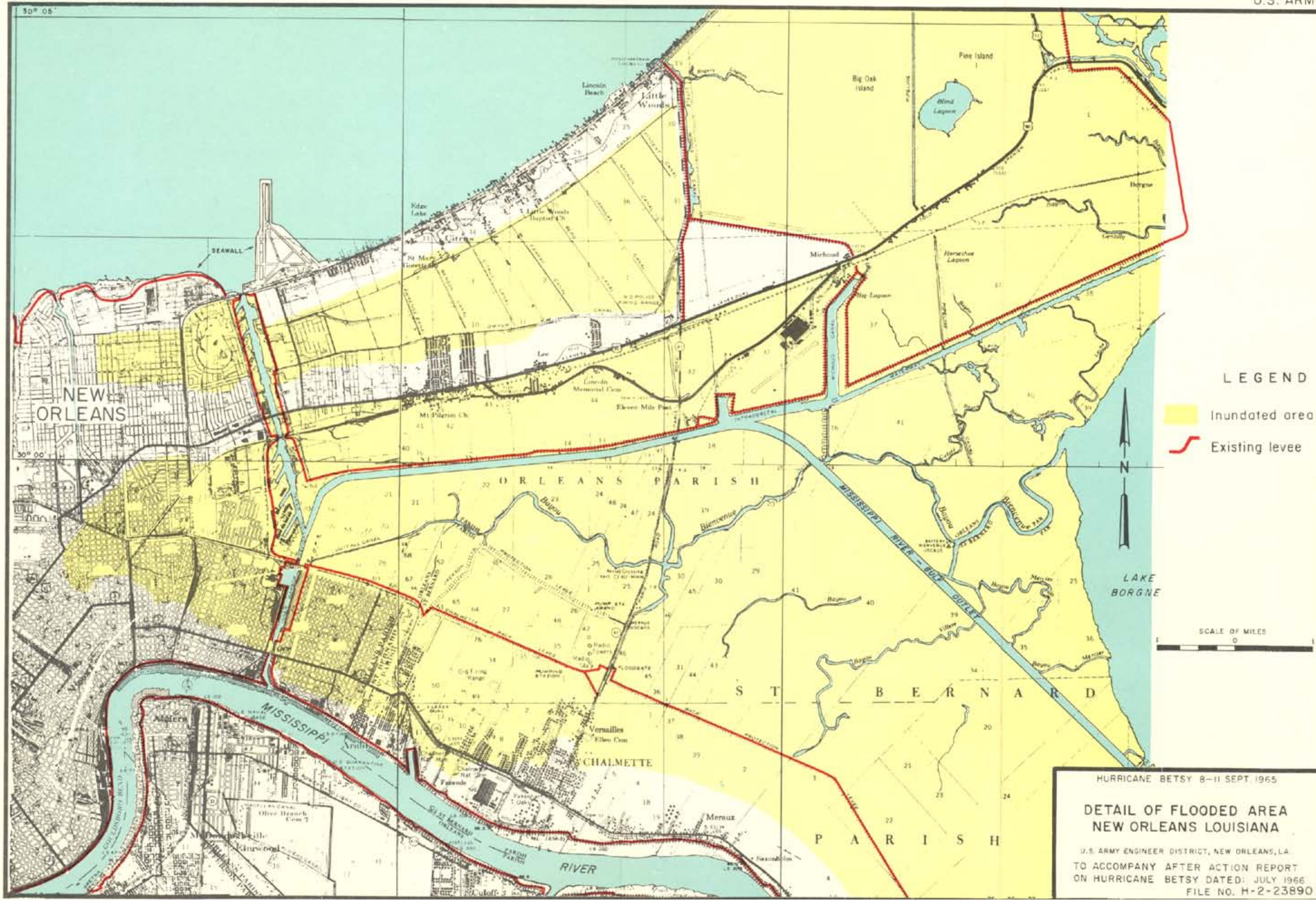
Figure 20. Typical of the some half-million tons of debris removed by the Corps of Engineers

Figure 21. Typical debris in the flooded area

Figure 22. Household furnishings ruined by Hurricane Betsy

CORPS OF ENGINEERS

U.S. ARMY



HURRICANE BETSY 8–11 SEPT. 1965

DETAIL OF FLOODED AREA
NEW ORLEANS LOUISIANA

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.

TO ACCOMPANY AFTER ACTION REPORT
ON HURRICANE BETSY DATED: JULY 1966
FILE NO. H-2-23890

Figure 23. Emergency dumping area provided by the city of New Orleans

Figure 24. Various types of trucks used to haul debris to dump

Figure 25. Before Corps of Engineers cleanup, St. Bernard Parish

Figure 26. After Corps of Engineers cleanup of location shown in Figure 25

Figure 27. Before Corps of Engineers cleanup, Orleans Parish

Figure 28. After Corps of Engineers cleanup, Orleans Parish

(4) As Betsy's winds and tidal surge rolled inland, entire buildings were swept from their foundations and floated as far as 10 miles away. Many came to rest against levees and across highways. Those blocking the highways required immediate action so that vital transportation arteries could be opened to emergency traffic. These were declared hazards by the responsible local government officials and were moved by Corps contractors as well as local contractors. For those structures not posing an immediate threat to public health or safety, permits were obtained from the owners before removal work began. In the four parishes (Jefferson, Orleans, Plaquemines, and St. Bernard) where this work was done, 10 Corps contractors moved 228 buildings (figures 29 thru 31).

Figure 29. Waterborne debris on road, St. Bernard Parish

Figure 30. Church blown across road near Reggio, La.

Figure 31. House blocking road near Shell Beach on Lake Borgne

(5) Many other buildings were left in a structurally unsound condition by the storm and posed a threat to public safety. With the owners' permission, the Corps let demolition contractors for those structures found to be beyond repair. These included commercial buildings, houses, and a church. A total of 7 contracts was let for the demolition of 12 such structures.

(6) The amount of Federal funds expended in each parish for work done under OEP category A is given in exhibit 7-1.

b. <u>Category B - Protective, Health and Sanitation Measures.</u>

(1) In the immediate aftermath of the storm, the primary mission of all agencies, Federal, state, and local, was to relieve human suffering and damages to the maximum possible extent. Betsy had left vast areas of Orleans, Plaquemines, and St. Bernard Parishes flooded to depths up to 11.6 feet. Fortunately, advance warning by the U. S. Weather Bureau had enabled hundreds of thousands of residents to flee their homes before the storm struck. Many others, however, were not so fortunate. Rapidly rising water trapped them in their homes, on roofs, on tops of cars, in trees, and anything else that stood above the water. Evacuation by boat was their only salvation. Early on Friday morning, 10 September, Corps personnel and boats were sent into the flooded area near the Industrial Canal in New Orleans to assist in the rescue operations. These were the first personnel from any Federal agency to begin rescue operations in the area and, by nightfall, the Corps had evacuated over 1,200 persons to safe ground (figure 32).

(2) A critical need for electric power developed immediately after the storm. Emergency power was desperately needed to operate equipment essential to public health and safety. To help supply this need, the Corps arranged for the loan of 26 electrical generator sets from the Fourth U. S. Army. These generator sets were flown into New Orleans on Air Force cargo planes and were accompanied by one officer with 42 enlisted men from Fort Sam Houston and Fort Hood, Texas, to operate and maintain them. The value of these generators to the people of the stricken areas cannot be overemphasized.

(3) Betsy left numerous towns in south Louisiana with no means of communication. Until communications could be restored, very little

Figure 32. This Corps of Engineers crew, together with other Corps units, rescued over 1,200 flood victims

(Photo by Times-Picayune Pub. Co.)

Figure 33. All clear as barge MTC-602 is towed to the unloading point

emergency work could be done. The Corps furnished and installed emergency base radio stations at Buras, Chalmette, Grand Isle, Pointe-a-la-Hache, and Thibodaux. These sets were operated by local people and for many days carried all emergency radio traffic into and out of the area.

(4) One of the casualties of Hurricane Betsy was barge MTC-602 en route from Lake Charles, Louisiana, to Calvert City, Kentucky. This barge, loaded with 600 tons of chlorine, arrived in the Mississippi River at Baton Rouge on the morning of 7 September and disappeared from its mooring place along the east bank of the river during the hurricane. After a search of the area by boats and helicopters on 10-11 September, the barge was presumed sunk. An underwater search was initiated early on 12 September by personnel of the Army, Navy, and Coast Guard under coordination of the Corps of Engineers. The barge was located under a group of floating barges late on 16 September, while using a Honeywell Precision Profiling Sonar System furnished by the Tennessee Gas Pipeline Company. Divers determined the barge to be in an upright position in about 60 feet of water. A cost-plus-a-fixed-fee salvage contract was negotiated with J. Ray McDermott, Inc. The proximity of the barge and its hazardous cargo to the large population in the Baton Rouge area and the Louisiana State University, in particular, made safety of the general public a paramount

consideration. Coordination with state, local, and civilian agencies responsible for safety of personnel other than at the work site was accomplished through the Governor of Louisiana and his designated representatives. The barge was lifted without incident on 12 November using an 800-ton floating, twin stiffleg derrick and a lifting frame attached to each of the four chlorine tanks by cable slings. The cargo was found to be in a safe condition and the barge suitable, after minor repairs, for towing to the unloading point (figure 33). Details of the search and salvage operations are contained in appendix A.

(5) Betsy left thousands homeless in south Louisiana. Returning refugees often found only a pile of debris where their homes had stood just days before. The Federal government responded to the plight of these homeless citizens by providing mobile homes for their temporary use. Trailers were purchased and distributed by the General Services Administration. In a very short period of time, a Corps contractor prepared a trailer site, furnished by local interests, at Grand Isle, Louisiana, complete with potable water and sanitary facilities for 72

Figure 34. A trailer site, prepared by the Corps at Grand Isle, for temporary housing of refugees

trailers. Trailer sites in other sections of the disaster area were prepared by local interests to receive the GSA furnished trailers (figure 34).

(6) After the floodwaters had been drained, public buildings in the area were still not fit to be used. They were covered inside and out with a foul smelling, germ-laden layer of scum. A contract was let by the Corps for cleaning and sanitizing these buildings. The cleaning work consisted of removing trash and thoroughly washing down walls, floors, and equipment inside the buildings. After they were cleaned, the interior of the buildings was sanitized by spraying with a germicidal, deodorizing compound (figure 35).

(7) In 20 parishes, the local governing bodies chose either to do the work in this category with their own forces or to let contracts for it themselves. Initial inspections and damage estimates for this work were made by the Department of Health, Education, and Welfare along

Figure 35. Corps of Engineers contractor cleaning school furnishings in New Orleans

with the Louisiana State Board of Health. These estimates were submitted to OEP for review and approval and turned over to the Corps of Engineers who made final inspections when the work was completed and reimbursed the parishes for their expenditures.

(8) Federal expenditures in each parish for work in OEP category B are shown in exhibit 7-1.

c. Category C - Streets, Roads, and Bridges.

(1) Major damage was done to roads in Jefferson, Orleans, Plaquemines, St. Charles, and Terrebonne Parishes. In addition, 10 other parishes suffered lesser damages to public roads. In all of these parishes the local agencies chose to do the repair work themselves. Initial inspections and estimates were made by the Louisiana Department of Highways and the Bureau of Public Roads. After OEP approval of these estimates, the Corps of Engineers inspected the completed work, made detailed payment estimates, and issued payments to each parish as the work progressed. (See exhibit 7-1 for the amount reimbursed to each parish.)

(2) Publicly-owned ferries at Belle Chasse, Luling, New Orleans, and Pointe-a-la-Hache were casualties of Betsy's winds and tidal surge that raised the level of the Mississippi River by as much as 13 feet. Those at Pointe-a-la-Hache and New Orleans were sunk while those at Belle Chasse and Luling were tossed up onto the bank (figure 36). As the water receded, these last two were left stranded high and dry. They were successfully refloated by a contractor employed and supervised by the Corps of Engineers. The ferry at Pointe-a-la-Hache was refloated by the local government. The ferry sunk at New Orleans was a standby ferry and, as such, was ineligible for Federal assistance under Public Law 875/81.

(3) The landings for the Jackson Avenue-Gretna Ferry in New Orleans were almost completely destroyed when rammed by rampaging ships propelled by Betsy's fury. Only the vehicular loading ramps remained undamaged after the storm. Repairs, reimbursable by OEP, are estimated at over a quarter of a million dollars. These include replacing two landing pontoons, numerous pile clusters, and the pedestrian loading ramps.

d. Category D - Dikes, Levee, and Drainage Facilities.

(1) Extensive flooding was caused by overtopping and breaching of existing protection levees in Orleans, Plaquemines, and St. Bernard Parishes. Because of the low elevation of the flooded lands, it was necessary to pump out the floodwaters. Power failures immobilized local pumping plants compounding the problem. The Corps leased six hydraulic dredges and one pump barge to aid in flood relief (figures 37 and 38). One dredge operated at Venice, Louisiana, while five dredges operated at New Orleans; the pump barge operated at both locations. The combined daily capacity of these dredges is about 350 million gallons per day (enough to satisfy the entire municipal water needs of a city the size of New Orleans for a period of 3 days). The dredges worked continuously until the area was essentially dry. The Corps also furnished and installed pumps at various locations in the flooded area. The largest installation was at the Citrus Canal Pumping Station in New Orleans, where five large capacity pumps were used to

Figure 36. Grounded ferry at Belle Chasse being refloated

Figure 37. Corps of Engineers leased dredges pumping out floodwaters in New Orleans

Figure 38. Corps of Engineers leased dredge in the Inner Harbor Navigation Canal, New Orleans, La.

help drain a highly developed area in the eastern portion of the city (figure 39). Three of the five pumps were installed on a rapidly constructed pile-supported platform. The Corps also installed temporary portable pumps at Venice and Braithwaite, Louisiana. Draglines, bulldozers, marsh cranes, and other construction equipment were rented and used to restore drainage to flooded areas (figure 40).

(2) Dike Restoration at Grand Isle. A rock dike at the eastern end of the island suffered heavy damage from Betsy. The dike is used for the purpose of trapping sand which is used to replenish dunes along the southern shore of the island. Twenty-three hundred feet of the dike was rebuilt under a Corps of Engineers contract. The storm also washed away the dunes that protect the island from tidal flooding. The Corps prepared the plans for restoration of the sand dunes and arranged for the State of Louisiana, Department of Public Works, to accomplish the work by contract. The Department of Public Works has let a contract for the work($279,000) which is progressing

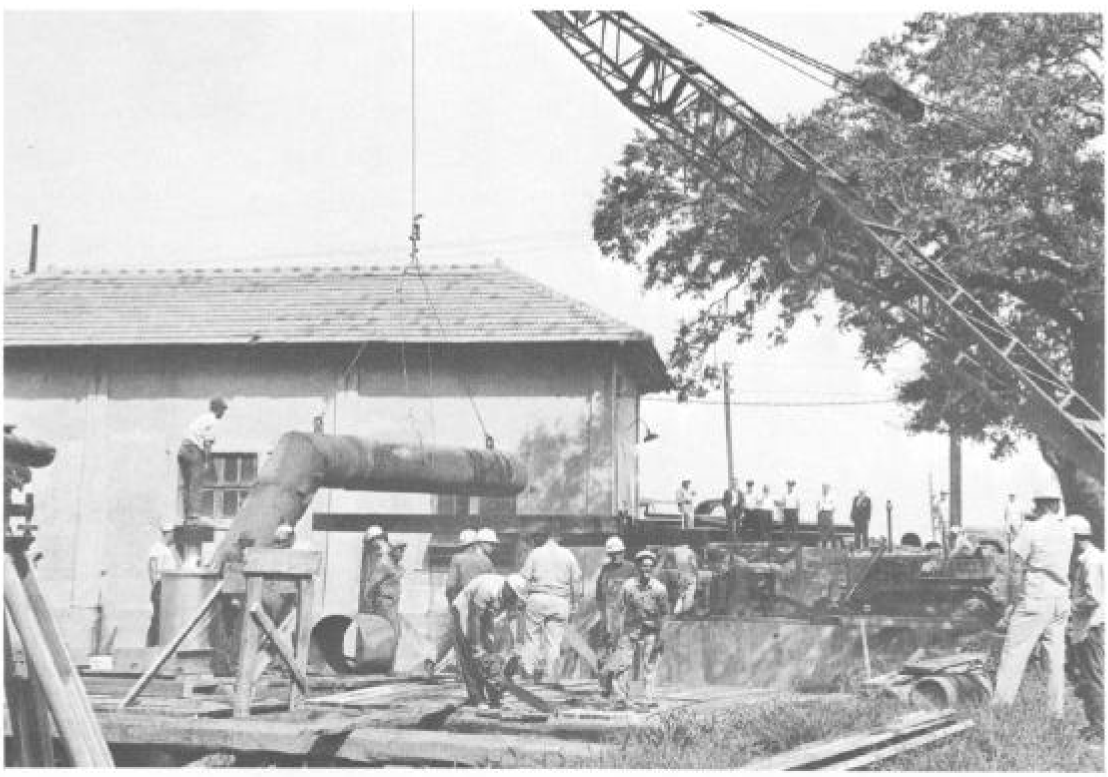


Figure 39. Emergency operations at the Citrus Canal Pumping Station, New Orleans, La.

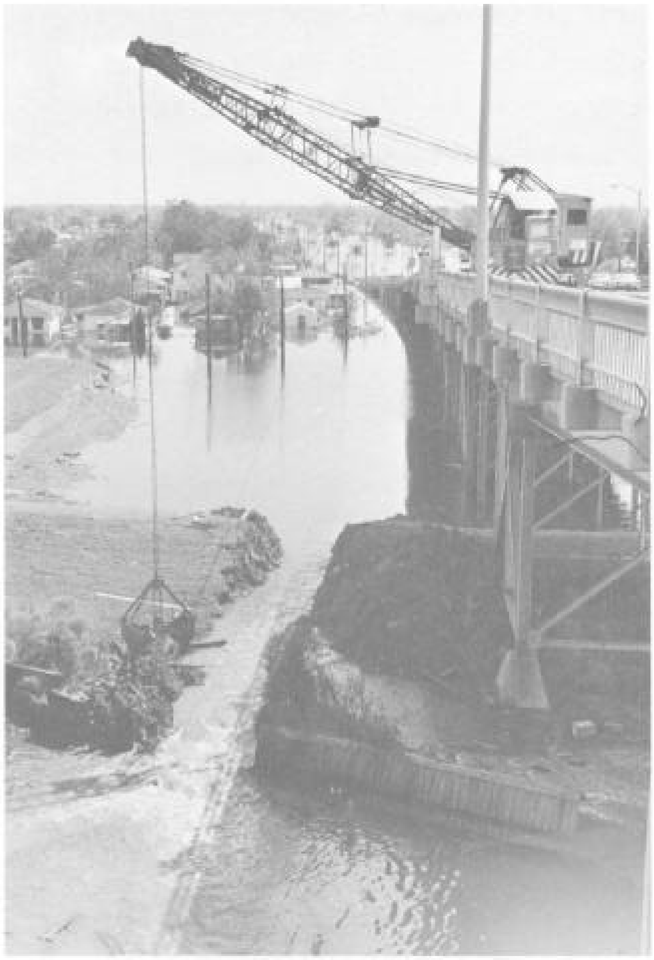


Figure 40. Clamshell breaching the levee to drain floodwaters

as this report is written. Upon completion and acceptance of the work, the Department of Public Works will be reimbursed by OEP through the Corps of Engineers.

(3) In 18 Louisiana parishes, local drainage facilities were damaged by the storm. Pumping plants were flooded, drainage canals were blocked by debris, and local protection levees were damaged or destroyed. Local government agencies in all these parishes elected to do the work themselves under Corps supervision. Representatives of the Corps of Engineers made inspections and estimates and furnished administrative and technical assistance to the local agencies in each parish. Reimbursements for all eligible expenses were made to the parishes by the Corps.

(4) Exhibit 7-1 contains a listing of the amount of Federal funds expended in each parish for work under OEP category D.

e. Category E - Public Buildings and Related Equipment.

(1) Betsy inflicted damages estimated at over $35 million to publicly-owned buildings. A high percentage of these damages was covered by insurance. Public Law 875/81 authorizes the Federal government to reimburse local governments for their eligible repairs not covered by insurance. Twenty-five parishes suffered uninsured damages to public buildings of about $8 million. Losses varied from very minor to very

Figure 41. School buildings suffered heavily from Betsy's fury

(Photo by Times-Picayune Pub. Co.)

severe; from a few broken windowpanes to complete destruction. School buildings in particular suffered extensive wind and water damages (figures 41 thru 43).

(2) Each of the 23 parishes chose to do all or part of their own repair work. The Department of Housing and Urban Development, formerly called the Housing and Home Finance Agency, together with the State of Louisiana, Department of Public Works, made initial inspections and damage estimates. These reports were submitted to OEP for approval and forwarded to the Corps for action. Many of the buildings were damaged beyond repair and required complete rebuilding. For these structures it was necessary that the Corps review the plans and specifications, inspect the construction work, and recommend amounts to be paid as the work progressed. Reimbursement to local agencies for all eligible work in this category was made by the Corps after receiving OEP approval.

(3) In accordance with arrangements established between national offices, Department of Health, Education, and Welfare, and Office of Emergency Planning, financial assistance to school boards for emergency work resulting from Hurricane Betsy was provided by OEP under P.L. 875/81 for public elementary and secondary schools in the following 13 parishes in Louisiana included in the disaster area:

Figure 42. Lawless High School in New Orleans

Ascension	Jefferson	Orleans	St. James
Assumption	Lafayette	Pointe Coupee	St. John the Baptist
Iberville	Lafourche	St. Bernard	St. Landry
			West Baton Rouge

Claims for financial assistance submitted by the following parish school boards for public elementary and secondary schools were handled by the Office of Education, Department of Health, Education, and Welfare under provisions of P.L. 874/81 and P.L. 875/81 as amended by P.L. 313/89:

East Baton Rouge	St. Tammany	Terrebonne
Livingston	St. Charles	St. Mary

The following 11 parishes submitted claims to the Department of Health, Education, and Welfare for supplemental financial assistance to cover expenditures exceeding those considered eligible under P.L. 875/81:

Ascension	Jefferson	St. Bernard	St. Landry
Assumption	Lafayette	St. James	West Baton Rouge
Iberville	Orleans	St. John the Baptist	

The Office of Emergency Planning provided assistance under P.L. 875/81 for universities, colleges, trade schools, and other eligible public school facilities in the disaster area that are not considered eligible for assistance under P.L. 313/89.

Figure 43. Tons of textbooks were ruined by the floodwaters

(4) Due to the scope of the parish school board project, a special school board section of the Disaster Recovery Center was established by the Corps of Engineers to provide OEP the necessary technical assistance required for processing the parish school board claims under P.L. 875/81. Nine consultant engineers were employed by the Corps of Engineers on a contract basis to perform the inspections and prepare the cost estimates required by OEP.

(5) The storm severely damaged the Desire Street and Florida Avenue public housing projects in New Orleans. The area in which these buildings are located was flooded to a depth of over 7 feet. Walls, floors, windows, doors, electrical wiring, and appliances (refrigerators, ranges, and heaters furnished by the New Orleans Housing Authority in each apartment) were ruined by Betsy's floodwaters. The New Orleans Housing Authority performed some work with their own forces and let a contract to replace all electrical wiring, switches, receptacles, and fixtures damaged by the floodwaters. When it became apparent that the task for complete rehabilitation of the damaged apartments was beyond the capabilities of the Housing Authority, the Corps of Engineers was called on for assistance. The Corps prepared plans and specifications, advertised for bids, and let a contract for repairing and/or replacing walls, floors, doors, windows, and screens in all damaged apartments. In addition, the New Orleans Housing Authority replaced damaged appliances and performed miscellaneous repairs to the damaged plumbing. All of the aforementioned items of work are reimbursable under P.L. 875/81 and total cost will approach $1 million.

(6) Facilities of the Port of New Orleans were severely damaged by the storm. Hundreds of vessels were pulled from the docks and swept along by 125-mile-per-hour winds. Traveling upstream and back and forth across the river, they crashed into docks, wharves, and other ships, inflicting major damages. Not one wharf building in the 9-mile-long port was untouched. Roofs, skylights, rolling doors, and electrical equipment were particularly hard hit. Three grain loaders at the Public Grain Elevator and four banana unloaders were completely destroyed. Flooding at the Public Bulk Terminal on the Mississippi River-Gulf Outlet ruined diesel engines and the terminal's radio system. The Board of Commissioners

of the Port of New Orleans is having the work done and is being reimbursed by OEP through the Corps of Engineers. Expenditures for work in category E are shown in exhibit 7-1.

f. Category F - Public Utilities.

(1) The public utility systems in 20 parishes were damaged by Betsy (figure 44). Electrical distribution lines were the hardest hit; however, some natural gas distribution systems also were damaged. The most severe losses occurred in Jefferson (Grand Isle) and Lafourche Parishes. All 20 parishes elected to do their own repair work. Initial inspections and damage estimates made jointly by the Department of Housing and Urban Development and the State of Louisiana, Department of Public Works, were furnished the Corps of Engineers after being approved by OEP. The Corps provided administrative assistance, inspected the work, made final estimates, and reimbursed all the parishes for the work eligible under P.L. 875/81. Exhibit 7-1 shows the amount paid to each parish for work under this category.

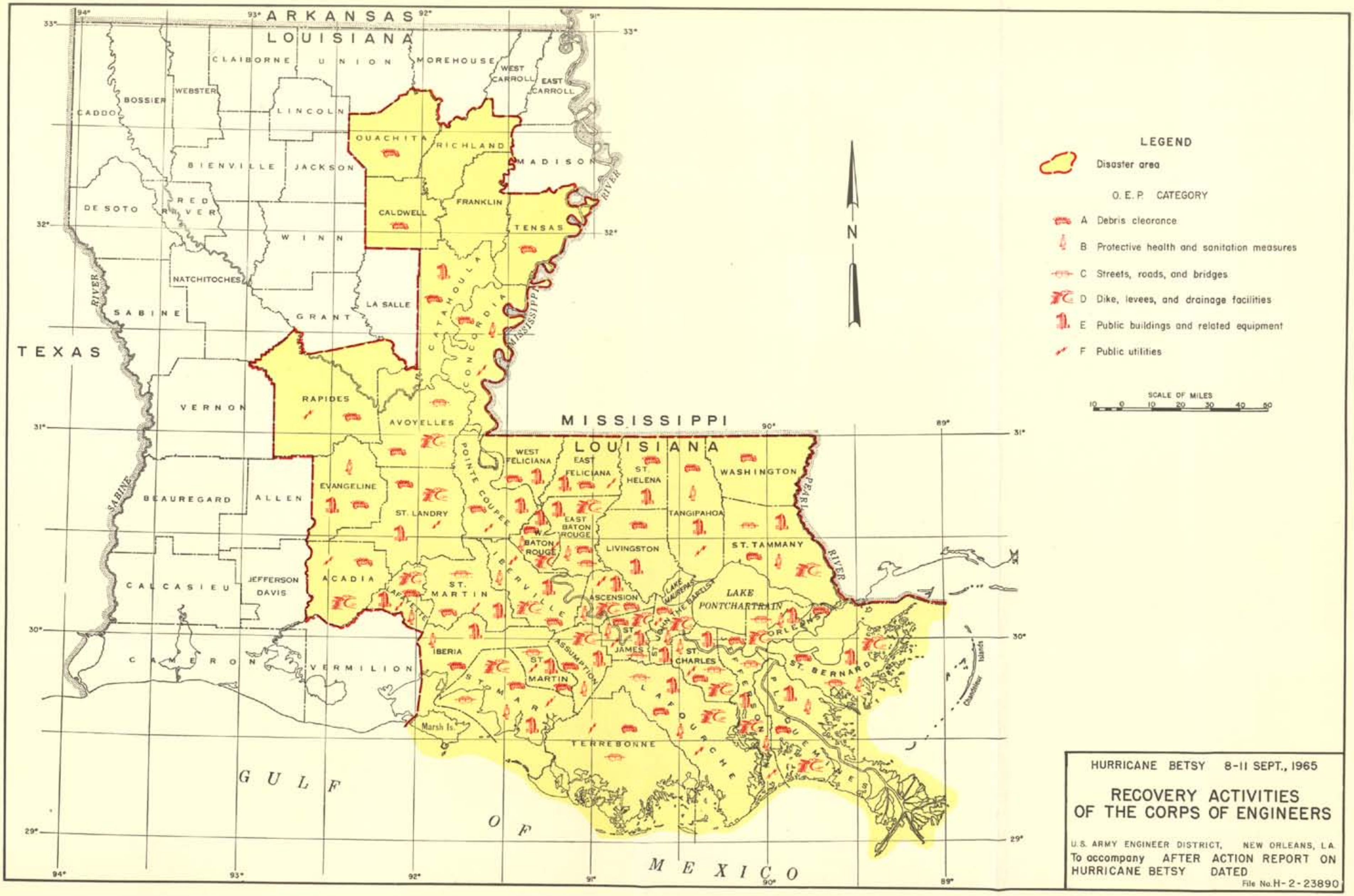
Figure 44. Power lines in some 20 parishes were blown down by the hurricane winds

g. Summary. At its peak, the relief and rehabilitation activities of the Corps of Engineers employed over 8,000 people and 1,500 pieces of equipment. Total expenditures under P.L. 875/81 are expected to exceed $37 million. The total mission of the Corps of Engineers under P.L. 875/81 is about 80 percent complete as of 30 June 1966. Exhibit 7-1 contains a listing of expenditures under P.L. 875/81 by parish and by category of work. Plate 5 shows parishes in which the various categories of work under P.L. 875/81 were performed. Exhibit 7-2 summarizes expenditures in each reimbursable category. The cutoff date established by the Office of Emergency Planning for assistance under P.L. 875/81 is 9 September 1966, 1 year from the date of the Presidential declaration of a disaster area. The New Orleans District will be heavily involved in this effort for several months after the cutoff date in order to make the final inspections and prepare final payments for work performed through 9 September 1966.

8. EQUIPMENT UTILIZATION

a. Debris removal operations of the scale accomplished following Betsy had never before been attempted in the District. The scope of these activities placed a severe burden on personnel to determine proper equipment for each job. This problem was successfully solved by utilizing equipment available throughout the southern states and by on-the-spot improvisation by Corps and contractor personnel. Maximum mechanization and minimum labor were the basic requirement of the large scale cleanup operation.

b. The selection of equipment was determined by the type of debris to be removed. In the recovery operations, experience was gained in both inundated and dry areas. In the dry areas, the debris consisted mainly of tree limbs, trunks, and stumps. Also included was a significant amount of materials blown from various structures. Initially, the New Orleans District mobilized contractors having tandem dump trucks (12- to 14-cubic yard capacities). Each truck was assigned five laborers, and five trucks comprised one work unit under a foreman. Based on past experience in Hurricane Hilda (1965), mechanical loading devices (sugarcane loaders or winch trucks) were assigned to two dump truck units. A power saw gang consisting of three power saw operators, two laborers, and a foreman were



LEGEND
Disaster area
O. E. P. CATEGORY
A Debris clearance
B Protective health and sanitation measures
C Streets, roads, and bridges
D Dike, levees, and drainage facilities
E Public buildings and related equipment
F Public utilities
SCALE OF MILES
10 0 10 20 30 40 50
N
HURRICANE BETSY 8-11 SEPT., 1965
RECOVERY ACTIVITIES
OF THE CORPS OF ENGINEERS
U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.
To accompany AFTER ACTION REPORT ON
HURRICANE BETSY DATED
File No. H-2-23890
ARKANSAS
LOUISIANA
MISSISSIPPI
TEXAS
GULF OF MEXICO
CLAIBORNE
UNION
MOREHOUSE
WEST CARROLL
EAST CARROLL
BOSSIER
WEBSTER
CADDO
LINCOLN
OUACHITA
RICHLAND
MADISON
BIENVILLE
JACKSON
RED RIVER
DE SOTO
CALDWELL
FRANKLIN
TENSAS
WINN
NATCHITOCHES
LA SALLE
GRANT
SABINE
CATAHOULA
CONCORDIA
RAPIDES
VERNON
AVOYELLES
WEST FELICIANA
EAST FELICIANA
ST. HELENA
WASHINGTON
EVANGELINE
BEAUREGARD
ALLEN
ST. LANDRY
POINTE COUPEE
EAST BATON ROUGE
W. BATON ROUGE
TANGIPAHOA
LIVINGSTON
ST. TAMMANY
JEFFERSON DAVIS
CALCASIEU
ACADIA
LAFAYETTE
ST. MARTIN
IBERVILLE
ASCENSION
LAKE MAUREPAS
ST. JOHN THE BAPTIST
LAKE PONTCHARTRAIN
ORLEANS
ST. JAMES
ST. CHARLES
ST. BERNARD
CAMERON
VERMILION
IBERIA
ASSUMPTION
ST. MARTIN
ST. MARY
LAFOURCHE
JEFFERSON
PLAQUEMINES
TERREBONNE
Marsh Is.
Chandeleur Islands
MISSISSIPPI RIVER
SABINE RIVER
PEARL RIVER

PLATE 5

also assigned to the dump truck units. The demand on power saws soon exceeded the supply.

c. Of significant note, a single-pronged "claw" was developed and adapted to a rubber-tired backhoe (figures 45 and 46). This claw worked exceptionally well in picking up single limbs of relatively large diameter or large groups of limbs which had been previously gathered. The claw could tear such a limb from a fallen tree, thereby reducing the work time of the power saws. Cane loaders performed exceptionally well on light brush. For optimum loading, limbs having a butt diameter of approximately 4 inches or larger were trimmed from tree trunks or from larger limbs before loading. The limbs were loaded into the trucks with the butts forward. The capacity of the trucks used was dictated by the physical limitations of the streets and roadways.

d. In the areas which had been inundated, five generations of debris were experienced:

(1) Wind and waterborne debris (trees, marsh grass, and building construction materials);

(2) Household appliances and stuffed furniture (refrigerators, washing machines, sofas, mattresses, etc.);

(3) Building construction materials (floors, sheetrock walls, and insulation);

(4) Other types of furniture (tables, chairs, etc.) and interior doors;

(5) Shrubbery, ornamental bushes, and combinations of the above.

Each of these debris generations presented its unique loading problems.

(a) Wind and waterborne debris. This operation was similar to that previously described for dry areas with the exception that small (D-2 or equal) angle blade bulldozers were used, where justified, to move large amounts of waterborne debris to the roads for loading. The ground was saturated and only light crawler equipment could be used. For locations where a light tractor could not be used, a rake was developed for use on a dragline in place of a bucket. By such methods the debris was brought to the road and then loaded into dump trucks with a conventional clamshell bucket and crane (figures 47 thru 49).


Figure 45. The "Claw" developed by the Corps for the truckloading of large tree limbs


Figure 46. A close-up of the "Claw"

Figure 47. Crane with clamshell bucket loading waterborne debris

Figure 48. "Rake" developed by Corps personnel for collecting waterborne debris

(b) Household appliances and stuffed furniture. Modified cane loaders, front end loaders, and hand labor were used to load this debris. The cane loading buckets were modified to increase the opened jaw distance to enable them to grasp the larger appliances (figure 50).

(c) Building construction materials. The bulk of this material consisted of oak block flooring and larger quantities of gypsum wallboard and roofing material. This operation was most effectively handled by a combination of truck-mounted cranes with extremely short booms and 3/8- to 1/2-cubic yard clamshell buckets, without teeth, and front end loaders having four-in-one buckets. The truck-mounted cranes had an operating limitation due to the presence of overhead power and communication lines. During this phase, a contractor was requested to obtain a "pulpwood" loader. This is the most universal type of equipment for debris removal because of the many accessory buckets and the articulated movement of the loading arm. The pulpwood

Figure 49. Small bulldozer gathering debris for pickup by crane

loader was secured and proved to be as good as anticipated. A well-balanced work unit consisted of a four-in-one front end loader working the side of the street under the powerlines and a pulpwood loader or truck-mounted crane working the other side (figure 51). Hand labor was used to keep the relatively small pieces of debris in piles and the streets clear of nails.

(d) Other types of furniture and interior doors. For this relatively light-weight material, large clamshell buckets on motor cranes, pulpwood buckets on the pulpwood loaders, and four-in-one buckets on the front end loaders were the most efficient mechanical handling devices. The dump trucks had the tailgates suspended but were only loaded to the end of the truck bed. This allowed the width of the tailgate for load movement from the point of loading to the dump.

(e) Shrubbery, ornamental bushes, and combinations of the above. The four-in-one bucket mounted on a front end loader and

Figure 50. Cane loaders were used for loading of bulky items

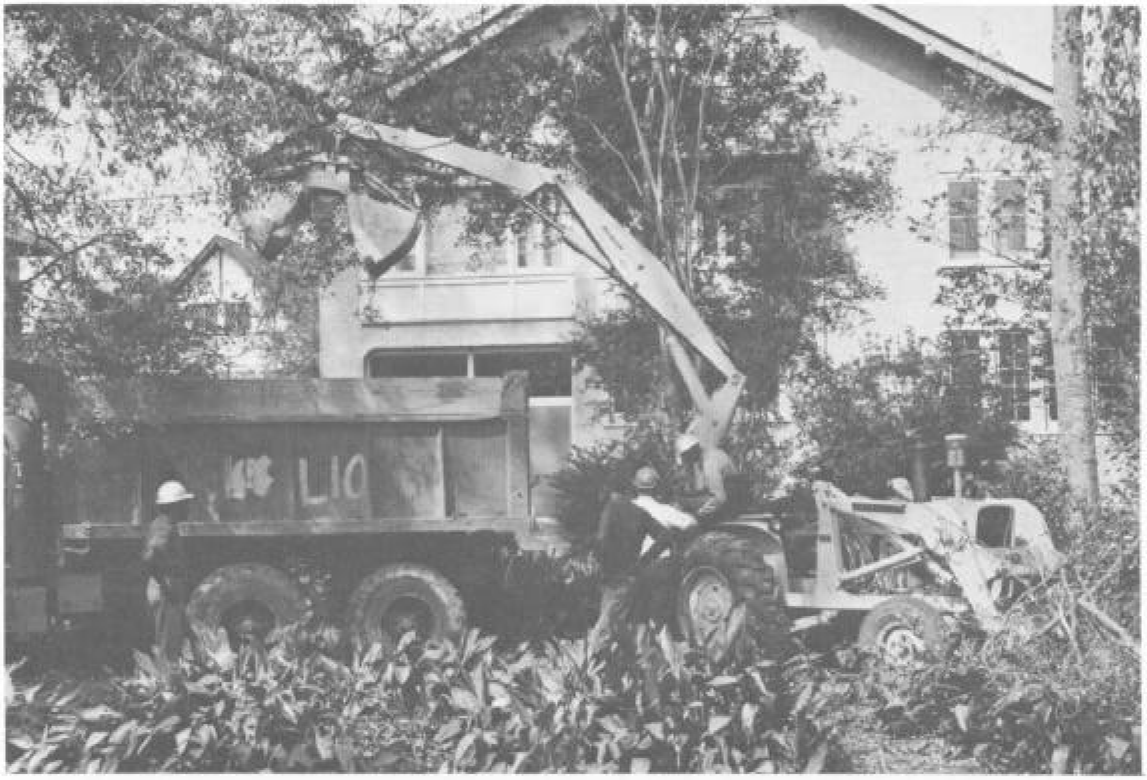


Figure 51. Pulpwood loaders were easily adapted for debris loading

the small clamshell buckets on pulpwood loaders were found to be most effective for handling this type of debris.

SECTION IV - DISASTER RECOVERY ACTIVITIES P.L. 99/84

9. GENERAL

Public Law 99 of the 84th Congress authorizes the Chief of Engineers to expend funds for flood emergency preparation, flood fighting and rescue operations, and for the repair or restoration of any flood control work threatened or destroyed by flood. Emergency work accomplished under this authority included levee and revetment restoration and repair, removal of wrecks and debris from levees and battures, and repairs to the Bonnet Carre Spillway.

10. REPAIRS AND RESTORATION

a. Levee Repairs.

(1) As soon as was practicable following the storm, personnel of the Corps of Engineers were dispatched to survey the damages to the Mississippi River levee system below Baton Rouge. Severe damages to both the mainline and back protection levees were found from New Orleans to Venice. Damages to the mainline levees were caused by vessels and debris striking the levee embankments and by overtopping from the tidal surge in the river. The damages to the back protection levees were caused mostly from overtopping by wind-driven waters crossing the marshes (figure 52). Resolutions were received from local interests in Jefferson, Plaquemines, St. Bernard, and St. Tammany Parishes granting the necessary assurances and requesting the Corps to repair the levees. The Corps then made cost estimates for the repairs and requested authority and funds from the Chief of Engineers. Funds were promptly made available, and plans and specifications were prepared and contracts let for the work.

(2) The damaged areas were divided into reaches of work, the lengths of which were based on the severity of damages and the amount of time required for repairs. Generally, the most critical damages were assigned to government hired labor forces and plant and these units began work almost immediately. The remaining areas to be repaired were assigned to numerous contractors who were required to take steps to insure that they would have all of the necessary plant, material, equipment, and labor to complete repair and restoration of the riverside levee slopes prior to high water, which could be expected to occur as

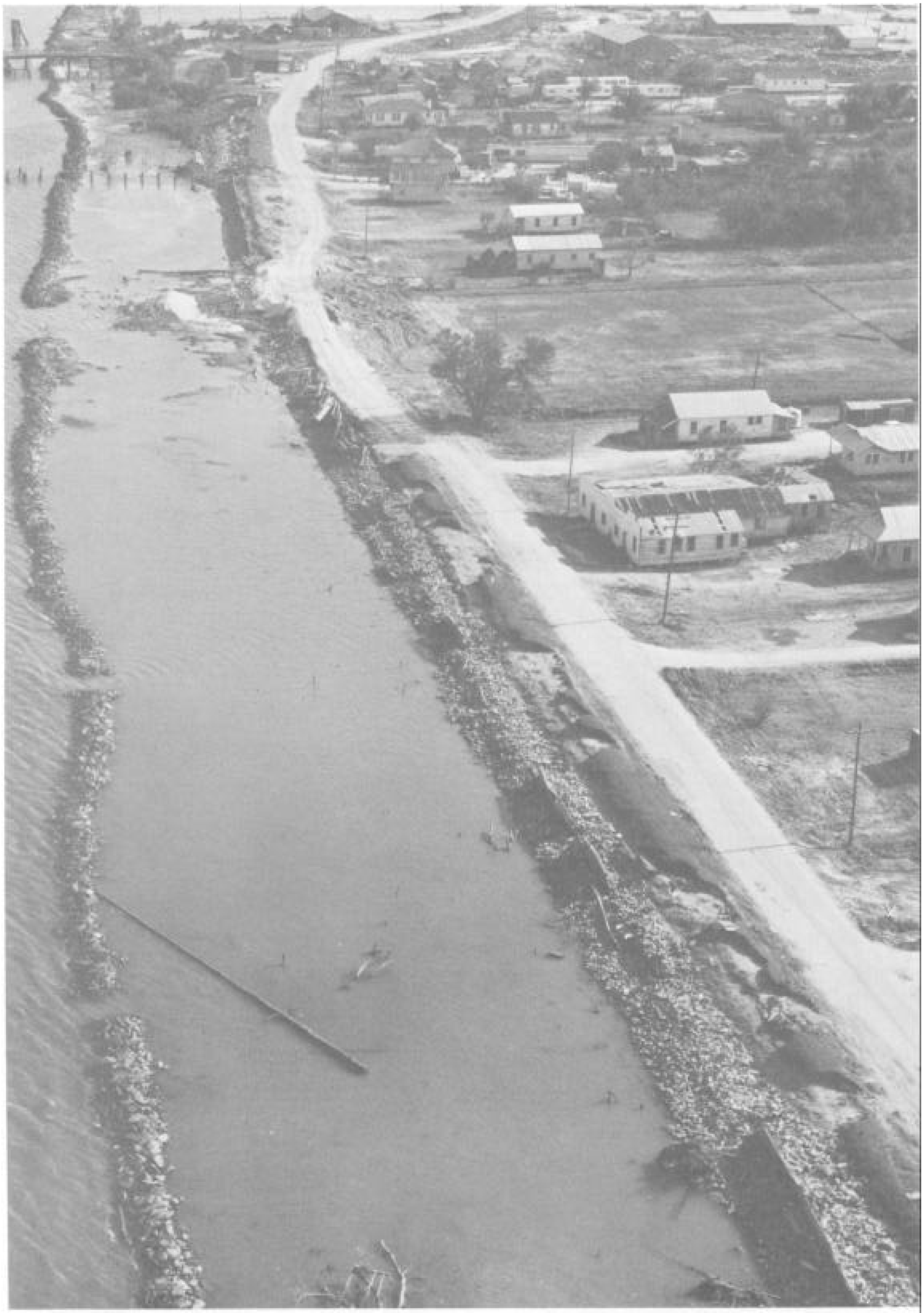


Figure 52. Erosion of Mississippi River levee at Venice, La.

Figure 53. Repair of main line Mississippi River levee on the west bank in Plaquemines Parish

early as 15 December 1965. Contracts for normal levee maintenance repairs, which were under way at the time of the storm, were modified to allow the contractors to repair hurricane damages in the areas in which they were working. The order of work consisted of clearing operations to provide access for construction equipment, restoration of the riverside slopes and levee crown, placement of concrete or riprap pavements on the levee riverside slopes, restoration of landside slopes, and finish dressing and seeding of the embankments (figures 53 and 54).

(3) A particularly critical situation developed on the Chalmette Back Levee in St. Bernard Parish. This levee is adjacent to the highly developed residential subdivision Carolyn Park. About 700 feet of the levee had been washed out by Betsy, flooding the subdivision up to 8 feet deep. Tropical storm Debbie was holding Gulf of Mexico tides at a high level and threatening even more flooding. Three Corps contract marsh cranes were sent in to construct an

Figure 54. Repairs being made on a main line levee

emergency closure. These repairs were made in time to prevent further damage. After the emergency closure, Corps of Engineers hired labor units restored the levee to its prestorm condition (figure 55).

(4) The Westwego Back Levee along the Mayronne Canal in Jefferson Parish was endangered by Betsy's tides. Corps of Engineers crews sandbagged the levee to provide interim protection and constructed a 420-foot levee setback opposite the damaged area.

(5) The areas where levee repairs and restoration were accomplished by new contracts, modified contracts, and Corps of Engineers hired labor units are shown on plate 3.

b. Revetment Repairs. Prior to the advent of Hurricane Betsy, the Corps of Engineers had under contract an estimated $185,000 of annual maintenance repairs to the Mississippi River bank revetments. This revetment consists of an intermittent series of articulated concrete mattresses and riprap placed along certain bends and reaches of the river to stabilize its banks in areas where levee setbacks are impractical due to industrial or high residential development. The Mississippi River revetments in the New Orleans District extend from the Palmetto Point revetment (mile 324 above Head of Passes (AHP)) to the New River Bend revetment (mile 183 AHP) and from the Reserve revetment (mile 140 AHP) to the Third District Reach revetment (mile 90 AHP) in New Orleans. After the storm, the Corps of Engineers field personnel inspected the revetments throughout the District and found that the upper bank paving had been damaged considerably from being struck by vessels that had broken their moorings and were set adrift in the river (figure 56). The existing contracts for annual maintenance work were modified to incorporate repair of the storm-caused damages at a cost of about $200,000. These repairs consisted of placing riprap in the breaks in the upper bank paving. In addition to the actual revetment repairs, about $41,000 worth of revetment anchorage warning signs located in the New Orleans area were repaired or replaced.

c. Wreck Removal. Losses to shipping interests due to Betsy are the highest ever recorded for a single natural disaster. Estimates place the damages at about $1 billion. On the Mississippi River between

Figure 55. Repair of Chalmette Back Levee (Carolyn Park)

Figure 56. Damage to Mississippi River levee upper bank paving

Baton Rouge and the Gulf of Mexico 176 vessels were left wrecked or stranded against the levees and along the batture (figure 57). These craft were located by aerial surveys and photographs and on-the-ground inspections. The owners were notified of the location of their vessels and requested to remove them. The Corps of Engineers prepared and distributed to the owners a plan (exhibit 10-1) limiting excavation near the levees. Aggressive follow-up insured that the owners removed or satisfactorily disposed of the vessels. Continuing checks were made during removal operations to safeguard the levees, revetments, dikes, and foreshore protective works.

d. Bonnet Carre Spillway Repairs. This structure is located just upriver of the New Orleans metropolitan area and is used to divert floodwaters from the Mississippi River to Lake Pontchartrain. Flow through the structure is controlled by 7,000 timber needles. Betsy's 100-plus miles per hour wind blew out all of these needles. Trees were blown onto fences and all the signs at the spillway were destroyed. All restoration work was done by Corps of Engineers hired labor forces.

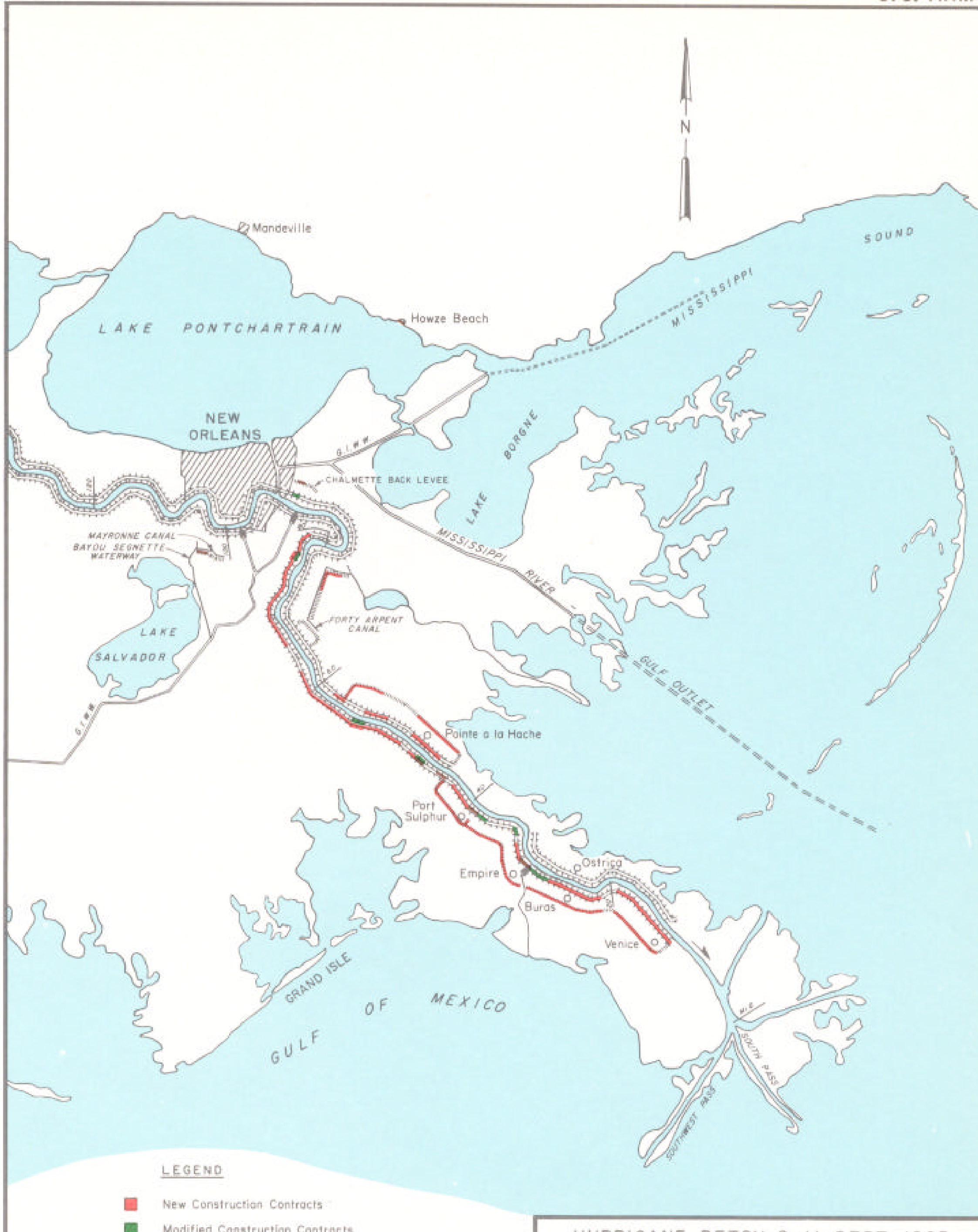
Figure 57. Vessels washed ashore by Hurricane Betsy in the New Orleans area

e. Summary. Costs to 30 June 1966 for work done under P.L. 99/84 are shown on table 10-1. It is estimated that about $1,900,000 will be required to complete hurricane repairs to levees and facilities under this authorization.

TABLE 10-1

PUBLIC LAW 99/81st CONGRESS

Location	Type of work	Cost
Avoyelles Parish	Minor repairs to upper bank paving	$ 600
E. Baton Rouge Parish	Repairs to Mississippi River revetment and warning signs	57,700
Jefferson Parish	Repairs to Westwego Back Levee and Mississippi River revetment	76,000
New Orleans District	Postflood reports	110,200
Orleans Parish	Repairs to Mississippi River revetment and warning signs	57,700
Plaquemines Parish	Repairs to mainline Mississippi River levees and back protection levees	2,405,800
St. Bernard Parish	Repairs to back protection levees	129,100
St. Charles Parish	Repairs to Bonnet Carre Spillway	27,500
St. Tammany Parish	Repairs to Howze Beach levee	30,380
W. Baton Rouge Parish	Repairs to Mississippi River revetment and warning signs	57,700
	TOTAL	$2,952,680



HURRICANE BETSY 8-11 SEPT., 1965

LEVEE REPAIRS - PL 99/84

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS, LA.

To accompany AFTER ACTION REPORT ON HURRICANE BETSY DATED: JULY 1966

File No. H-2-23890

SECTION V - RESTORATION OF FEDERAL PROJECTS
UNDER
OPERATION AND MAINTENANCE - GENERAL APPROPRIATIONS

11. PROJECT RESTORATION

a. Work under this authorization consisted of restoring Federal project streams and structures to prestorm conditions. Betsy damaged all project streams in southeast Louisiana to some degree. Heaviest damage was on the Mississippi River below Baton Rouge. As Betsy moved up the river, ships and barges of every description were torn loose from their moorings and tossed about like toys. She pushed ocean-going ships up the river bouncing them from bank to bank. These uncontrolled vessels crashed into other ships, wharves, and docks, inflicting severe damages. In addition to vessels beached on the riverbanks and levees, there were 90 vessels sunk by the hurricane. These vessels ranged from small barges to ocean-going ships over 500 feet long.

b. Since navigation is the lifeblood of much of south Louisiana, no efforts were spared by the Corps of Engineers, the Board of Commissioners of the Port of New Orleans, other public agencies, and private industry and individuals to reopen the channels and the Port of New Orleans. The fact that shipping was restored between the Port of New Orleans and the Gulf of Mexico in less than 2 days after the storm is a testimony to the knowledge, skill, and dedication of these agencies and individuals.

c. Corps of Engineers activities under this authorization were many and varied. Condition surveys were made of all project streams affected by the storm. These surveys indicated Betsy-induced shoaling at numerous locations, as well as structural damage to jetties and groins and sunken vessels obstructing navigation channels. Corrective action was started immediately. Shoals were removed, structures repaired, and owners notified of sunken vessels. Many of these vessels were abandoned to the Federal government by their owners. Three of these vessels constituted particular hazards to navigation in the New Orleans harbor area and were removed by a contractor working under direction of the U. S. Navy, the cost being reimbursed by the Corps of Engineers.

d. A listing of the work done and its cost, by project, under the Operation and Maintenance, General, authorization, is shown in table 11-1.

TABLE 11-1

OPERATION AND MAINTENANCE, GENERAL

Project	Type of work	Cost
Atchafalaya River, Morgan City to the Gulf of Mexico	Condition survey, removal of shoals	$ 78,100
Barataria Bay Waterway	Condition survey, removal of shoals	25,600
Bayou Lafourche and Lafourche Jump Waterway	Condition survey, jetty and groin repairs	48,900*
Calcasieu River and Pass	Condition survey by Galveston District	1,000
Gulf Intracoastal Waterway	Condition survey, removal of shoals, lock repairs	104,900
Mississippi River-Baton Rouge to the Gulf of Mexico	Condition survey, aerial reconnaissance, shoal removal, repair of Southwest Pass jetties, pile dikes, and Venice suboffice	1,915,000
Mississippi River-Gulf Outlet	Condition survey, repair of survey tower	22,500*
Bayou Teche	Condition survey	200
Removing the Water Hyacinth	Condition survey	200
**Removal of sunken vessels	One in Bayou Lafourche; three in Mississippi River	231,900*
General regulation functions	Issuance of temporary permits	3,200
Project condition surveys	Streams entering Lake Pontchartrain	100
Bayou Bonfouca	Clearing and snagging	49,800*

TABLE 11-1 (cont'd)

Project	Type of work		Cost
Bayou Lacombe	Shoal removal, clearing and snagging		$ 37,600*
Tangipahoa River	Clearing and snagging		33,500
Tickfaw, Natalbany, Ponchatoula, and Blood Rivers	Clearing and snagging		43,500
		TOTAL	$2,596,000*

*Estimated. Work in progress.
**Several major wrecks remain in navigable waters pending decision on final disposition.

SECTION VI - OTHER ACTIVITIES OF DISTRICT ELEMENTS

12. COMMUNICATIONS AND TRANSPORTATION

a. Rapid communications were essential for the effective dissemination and collection of information and the effective use of personnel and equipment. To achieve this effectiveness, communications by means of personal contact, telephone (commercial and leased lines), radio, teletype, and correspondence were employed. Telephone communications between the New Orleans District office and the Division office in Vicksburg were usually by means of the leased line. The Wide Area Telephone Service (WATS) line was generally employed for within-the-State calls, with rush and/or overload long distance calls being handled by means of toll calls. One TWX interchange channel from Vicksburg to New Orleans was installed and in use from 13 September 1965 to the end of November 1965. The PBX was staffed and operated on a 24-hour, 7-days per week basis from 9 September 1965 through 1 October 1965 and from 6 a.m. to 8 p.m. daily thereafter until 12 November 1965, when the normal 7:30 a.m. to 5 p.m. operations were resumed. During the emergency, five additional employees were assigned to the District communications section to assist the normal operating staff.

b. The New Orleans District had an extensive radio communications system prior to Betsy. The extent of recovery operations, coupled with the additional demands of "Operation 602," required far more in men and equipment than was initially available. The New Orleans headquarters station, WUG 4, began 24-hour a day operations on 9 September and continued these operations 7 days a week into November. Clerical personnel from other organizations were diverted to radio operating and four additional repairmen from other Districts came to assist. Additional equipment consisting of mobile units, base stations, and handi-talkie units, was procured on an emergency basis. Other Corps Districts loaned New Orleans District additional communications equipment. Five additional base stations were established to facilitate recovery operations. These stations initially provided the only communications available to certain areas. There was never any time during or after the hurricane that WUG 4 was inoperative except momentarily.

c. Two modifications in radio communications have been adopted based on experience due to Betsy. One is to maintain a stock of various radios available specifically for such emergencies. The other is to provide channels which may be used to communicate directly with all adjacent Districts by radio.

d. Transportation and travel services were provided to both District personnel and personnel on loan from other offices by the Travel Section, Office of Administrative Services. The government vehicle fleet on the District reservation was supplemented by vehicles brought in by personnel from other Corps Districts. In addition, the General Services Administration purchased approximately 150 vehicles (automobiles and pickup trucks) for use by the Corps. GSA procured these vehicles from as far away as Tulsa, Oklahoma, and Cape Kennedy, Florida. As the scope of emergency operations decreased, the vehicles were returned to the General Services Administration.

13. SUPPLY

a. The first negotiations undertaken by the New Orleans District were with dredging companies already operating under contract with the government to convert their operations from dredging to pumping out the floodwaters from the area below the Inner Harbor Navigation Canal (Industrial Canal). In addition to the change of operations under existing contracts, other dredges were put to work on this most important assignment. These negotiations were accomplished by Supply Division personnel, working under the technical requirements set forth by the Chief of the Engineering Division. Contracts were negotiated with sources of supply for pumping equipment. The lack of electricity and communications made the job difficult, but not impossible. The equipment and supplies were there and on time so that personnel in the field had what they needed when they needed it. Pumps were repaired or replaced and lives were saved and property damage held to a minimum.

b. Immediately after the storm all sorts of debris hindered and, in some cases, prevented movement from one point to another, even on short distances and for urgent and imperative reasons. Two types of contracts were utilized for removal of debris and dangerously damaged structures. For the removal of ordinary debris, such as fallen trees, contracts were negotiated for the rental of equipment, fully operated (trucks, lowboys, winch trucks, tractors, front-end loaders, cherry-pickers, power saws, and other equipment). For the demolishing and removal of structures that were left in dangerous condition, contracts were negotiated using the Armed Services Procurement Regulations approved form of contract for demolition and removal of dangerous public improvements and obstacles to navigation. Many houses had been blown or floated from their foundations and were blocking roads and rights-of-way. Contracts for removal of these structures were negotiated, using service-type contracts. This opened the way for transportation and communication.

c. Supply Division furnished personnel to assist the District Engineer and Chief of the Operations Division in the negotiation of a cost-plus-a-fixed-fee type contract to bring the chlorine barge MTC-602 to the surface of the Mississippi River in the vicinity of Baton Rouge, Louisiana. Upon completion of negotiations, Supply Division finalized the contract and supervised the signing ceremony. Previous to this, Supply Division had negotiated with several firms to furnish services and equipment to locate the sunken barge. It was also necessary, after the barge had been raised, for Supply Division personnel to negotiate for the storage and disposition of the chlorine. Supply Division accomplished this by a negotiated service contract with a chemical company to store the chlorine, and a negotiated contract for the transfer of the government's salvor rights to an industrial firm. This contract was negotiated by Supply Division personnel and the contract documents drafted by the Office of Counsel.

Supply Division was reorganized during the emergency with a separate office established to handle Betsy operations. Assistance by the highest grade personnel from other Engineer Districts throughout the United States made it possible for the Supply Division to meet the demands of the hurricane recovery activities.

14. REPORTS

a. To keep all agencies and personnel informed of the situation at all times, reports were furnished in accordance with instructions issued by OCE, Division Engineer, and the District Engineer, and contained in EM 500-1-1. Logs were maintained of all telephone and radiophone communication in order to document the basis for any action taken. Poststorm or recovery phase reports were submitted to OCE direct in accordance with paragraph 173.40 of EM 500-1-1, part 1. These were initially daily teletype situation reports beginning 10 September 1965 (information copies to Division Engineer and Commanding General, Fourth U. S. Army). The report period covered 24 hours (from 12:01 a.m. to midnight) of each day and was due in OCE at 8 a.m. the following day.

b. Because of the sunken chlorine barge, two situation reports were furnished to OCE initially--one covering Betsy general disaster recovery activities, the other covering only the chlorine barge activities. On 13 September 1965, the two reports were combined into a single situation report. These teletype reports were continued until 4 October 1965 at which time the Division Engineer requested a change for the general disaster recovery report from a daily to a weekly report commencing at 8 p.m. on 10 October 1965, and extending through 8 p.m. on Sunday of each week. The chlorine barge report continued as a daily teletype report until 15 November 1965 after the barge MTC-602 was raised and its cargo secured. On 15 November 1965 the Division Engineer authorized the sending of the weekly report by mail rather than by teletype. Authorization was received on 19 November 1965 to discontinue the weekly report and to submit subject report on a semimonthly basis. This was done until 25 January 1966 when authorization from OCE was received to submit this report on a monthly basis beginning 31 January 1966 and to be dispatched to OCE not later than the fifth working day following. It is anticipated that the report will continue to be submitted monthly until recovery operations are complete.

c. These reports contain up-to-date cost information compiled from daily records of all operations furnished the Disaster Recovery Center by Corps engineers in the field. At the close of each day's operations, the Corps and contractors' representatives prepared and certified a delivery ticket, either on the contractor's billhead or a regular inspector's report form used for normal Corps construction operations. These tickets were hand-carried to the Disaster Recovery Center daily and were used to substantiate weekly payments to contractors. Using this method, all contractors received their final payment on the day following termination of contracts.

15. COORDINATION WITH OTHER AGENCIES

a. The New Orleans District established liaison with interested local agencies some 12 hours before Hurricane Betsy passed over the Louisiana gulf coast by sending Corps representatives to six major towns in southern Louisiana. These personnel contacted the local officials including civil defense and sheriffs' offices to assist them with any disaster problems that might arise during the storm.

b. After the hurricane had passed inland, an underwater survey along the Mississippi River revealed three sunken objects in the New Orleans area which were deemed hazardous to navigation. These locations were marked with black wreck buoys by the United States Coast Guard. The U. S. Navy, Eighth Naval District, was then contacted and a request was submitted authorizing them to undertake the salvage of the three submerged vessels. This was accomplished by a contract with a private salvage operator.

c. Close liaison was maintained with the Office of Emergency Planning through their representative assigned to this office. An OEP project office established on the New Orleans District reservation definitely expedited emergency procedures within the District. At the same time, normal liaison was maintained with the Regional Director of OEP (Region 5) and between the Chief of Engineers and the OEP Director. Close coordination also was maintained, in all phases of operations necessary to complete the P.L. 875/81 emergency work, through the daily contact of Corps representatives with officials in each parish within the disaster area. These agencies made joint initial inspections and damage estimates and submitted them to OEP. These estimates, after review and approval by OEP, were furnished to the Corps of Engineers. The Corps executed completion of the repairs and maintained direct liaison with each of the agencies.

d. OEP assigned preparation of engineering estimates for the repairs of damages suffered by public entities to the following Federal and state agencies:

Category	Federal agency	State agency
A - Debris clearance	USA Corps of Engrs. New Orleans District New Orleans, La.	La. Dept. of Pub. Wks. Baton Rouge, La.
B - Protective health and sanitation measures	Dept. of Health, Education, and Welfare Dallas, Texas	La. Dept. of Health New Orleans, La.
C - Streets, roads, and bridges	Bureau of Pub. Roads Baton Rouge, La.	La. Dept. of Highways Baton Rouge, La.
D - Dikes, levees, and drainage facilities	USA Corps of Engrs. New Orleans District New Orleans, La.	La. Dept. of Pub. Wks. Baton Rouge, La.
E - Public buildings and related equipment	Housing & Home Finance Agency* Fort Worth, Texas	La. Dept. of Pub. Wks. Baton Rouge, La.
F - Public utilities	Housing & Home Finance Agency* Fort Worth, Texas	La. Pub. Svc. Comm. Baton Rouge, La.

*Now the Department of Housing and Urban Development

e. During the search in the Baton Rouge Harbor for the chlorine barge MTC-602, operations of the U. S. Navy, U. S. Coast Guard, the Corps of Engineers, and other Federal, state and local agencies were coordinated by the Corps of Engineers Project Officer through meetings held each night. After locating the barge, close coordination was maintained with state agencies responsible for the safety of the public to assure that timely and adequate plans were ready for execution in the event of a chlorine leak. The U. S. Public Health Service and the U. S. Coast Guard provided a doctor and two hospital corpsmen, respectively, to man a medical station at the salvage operation site. The U. S. Coast Guard provided assistance in the direction and control of waterway traffic. The Chlorine Institute provided specialists in the handling of chlorine to furnish technical assistance during the planning and lifting operations.

f. In the pursuit of the repair and replacement of flood control structures damaged by the hurricane (Public Law 99), a close liaison was maintained with the State of Louisiana, Department of Public Works, state levee boards, and parish levee district officials. All agencies were very cooperative and the early initiation of this emergency work was due to the timely submission of the necessary assurances and construction rights-of-way.

16. TECHNICAL LIAISON

a. Following Hurricane Betsy, there was a great deal of confusion in the minds of the public as to what was being done to relieve the flooding and clear the streets of debris to make them passable. Also, a tropical storm was forming off the coast, keeping the tides up in the flooded areas and injecting an additional fear in the minds of the residents as to restoration of Betsy-damaged levees.

b. Local, as well as national, representatives of news media and wire services were personally contacted by the TLO and advised of the many Corps of Engineers operations (dredges, pumping, installation of pumps, dispatch of engineer assistance and levee restoration teams, etc.) then under way and those contemplated to assist in restoration of the disaster area. By direct contact and through news and photo releases, this close liaison was maintained throughout the duration of the emergency operations.

c. Photo assignments were given to the Chief of the Photographic Section, outling specific activities to be covered. The photographic coverage, both under this guidance and through the personal initiative of the Photo Lab Chief, was the widest obtained by any known source and was extremely useful in portraying the Corps' role in restoring the 38 devastated parishes in the disaster area. Photo stories, along with feature stories, of the Corps' work were developed and disseminated to all news media and dispatched to Washington for national release. A great demand was later made (and continued for many months) for copies of the District's photographs for use in Corps, OEP, Small Business, and Federal, state, and city Civil Defense Betsy reports.

d. To accomplish the quickest dissemination of spot news activities of the Corps, the TLO made and distributed tape recordings for broadcast over local radio station.

e. As the local populace returned to a semblance of normalcy and the Corps' extensive role in the restoration became well known (through publicity), requests were received for presentations on the hurricane.

Well-illustrated speeches were prepared, and the District Engineer, TLO, and other members of the staff presented talks to civic groups and interested public bodies. The Corps' role in disaster relief was fully explained, as well as the various hurricane protection plans that the District had prepared and which had been approved and were in the process of being acted upon by the Congress when Betsy struck.

f. In order to reduce the possibility of unfavorable incidents arising from statements and actions of "non-Corps" restoration workmen, items of equipment used in Corps activities (trucks, etc.) were clearly marked as such from the inception of the work. These signs are prepared and stocked for use in any future emergency situation.

g. Exhibit 16-1 contains selected articles from publications in the disaster area concerning Corps of Engineers activities.

17. REAL ESTATE

a. On 14 September 1965, Real Estate Division received an oral request from Engineering Division to obtain right of entry to the Mississippi River levees and batture from all of the levee districts located along the Mississippi River in the New Orleans District. Right of entry was necessary to effect repairs to the levees caused by Hurricane Betsy. By 28 September 1965, all rights of entry were obtained and made available to Engineering Division.

b. During the recovery period after the hurricane, Real Estate Division prepared and furnished to the Corps Disaster Recovery Center temporary permits required for removal of houses from highway right-of-way. Permits were also prepared and furnished for removal of debris by Government contractors from private property. Personnel of Real Estate Division were actively engaged in coordinating the efforts of local agencies in obtaining permits in Orleans, Plaquemines, and St. Bernard Parishes.

c. Real Estate Division procured assurances, resolutions of appropriation and rights of entry required by Public Law 99 for the following items of work:

Repairs and restoration of the back levee system in Plaquemines Parish consisting of:

Stations 25+00 to 315+50
Empire to Buras
Fort Jackson to Venice
Scarsdale to Joe Brown Canal
Belair drainage back levee
Buras to Triumph

Repairs and restoration of the main line Mississippi River levees:

Mile 57.7 to mile 58.8
Station 100 to 110 (office for trailer--lifting chlorine barge)
Boothville to Fort Jackson (borrow material)
Port Sulphur to Fort Jackson
Empire Waterways Reservoir

Westwego, Louisiana, back levee system, Jefferson Parish

St. Tammany Parish lakeshore levee

18. SAFETY

a. The inability to secure personal protective equipment and trained employees, and the emergency nature of the work made it necessary for the District Engineer to waive compliance with nine safety requirements pertinent to the work at hand. This action focused attention on the weak areas in the accident prevention program, and within approximately 10 days all waivers or exceptions were either revoked or modified so that the intent of the requirement was met. A single sheet of 14 "Minimum Safety Requirements for Debris Clearance" (exhibit 18-1) was reproduced and distributed to all government inspection personnel, contractors' supervisors and workers.

b. Safety Office tested water supplies for free chlorine content and sanitation where government and contractor employees were living in devastated areas. Contractors in these areas utilized the services of professional caterers. This dramatically reduced the possibility of food contamination and food poisoning due to improper refrigeration or cooking. Typhoid and tetanus toxoid inoculations were given by the U. S. Public Health Service, the Louisiana State Board of Health, and the First Aid Station at the New Orleans District headquarters. Chem-Wipes (moistened antibacterial wipes sealed in foil) and Neko (an antibacterial soap) were issued to government personnel working in devastated areas.

c. Large numbers of snakes had been driven to high ground by flooding, so snake-bite kits were issued to all field personnel. However, no instances of snake bite were reported. Bands of dogs, driven to wildness by lack of food and care, presented a hazard in several flooded areas. Foul weather gear and rubber boots were issued to government employees working in certain locations. Safety hats were secured and issued to all government employees working in the field who did not already have one.

d. On 58 of the 120 contracts that were let, 1,263,998 manhours were received. It is realized that a number of these contracts were for rental of pumps, etc., not involving personnel and there is little doubt that the manhours and accident experience were not reported on a number of contracts. Five lost-time accidents were reported with a total of 38 days' lost time. This gives a frequency rate of 3.96 and a severity rate of 0.03.

e. A safety plan was prepared for "Operation 602." This plan set forth procedures for safeguarding personnel and for an adequate warning system. Appendix A contains a detailed description of the plan.

SECTION VII - CONCLUSION

19. GENERAL

a. Hurricane Betsy gave the New Orleans Office, Corps of Engineers, some practical experience in what could be expected when a severe storm strikes a major metropolitan center. This experience, gained from the preparatory activities prior to the approach of the hurricane and the disaster recovery activities after the hurricane had passed, has enabled Federal, State and local agencies to evaluate and revise their emergency plans. These revisions will provide a more effective and efficient utilization of resources available to each agency for the accomplishment of their respective missions.

b. The mission of the Corps of Engineers, resulting from Hurricane Betsy's devastation, was accomplished under three authorities and are as follows: Public Law 875/81, Public Law 99/84, and the Operation and Maintenance, General. The latter two authorities, which are Corps of Engineers statutory authorities, provided authorization for the Corps to protect and restore both Federal and non-Federal flood control projects. It was found that this work was handled very efficiently by the District elements having normal operation and maintenance responsibilities. The work required under Public Law 875/81 was performed by a temporary organization designed to provide the Office of Emergency Planning the necessary technical and administrative assistance required to fulfill their performance of the Federal financial assistance provided under the natural disaster act.

c. The organization established for disaster recovery activities proved to be very effective in implementing preconceived plans. (See the Organization Chart - Exhibit 5-3.) A definite advantage resulted from the establishment of sector assistance teams in each parish to coordinate Corps activities. Each team consisted of an engineer (Area or Sector Commander) in charge, together with the number of inspectors and administrative personnel necessary to perform assigned duties. These teams were staffed with New Orleans District personnel experienced in similar work and supplemented with personnel from outside the District. In critical areas having a particularly heavy workload, it was found to be advantageous to assign one or two Deputy Commanders to provide a continuity of direction over a full 24-hour period. This decentralization of control not only saved time in processing the paper work but also enabled the restoration work to move ahead at an accelerated pace.

d. The result of the advanced training in disaster recovery activities received by the Corps personnel was very evident right from the beginning for it enabled the disaster recovery activities to progress without delay. Also, the on-the-job training and experience received by all personnel working on this program will be invaluable and lend tremendously to any future disaster in which the Corps will be involved. It is believed that written instructions covering exact duties of each member of the emergency organization and the eligibility of work under the various authorities should be prepared jointly by the OEP District Coordinator and the District Emergency Planner to further improve the emergency restoration program. Such an organization could be mobilized any time it was deemed necessary by the District Engineer. The Sector Assistance Teams could then establish liaison with local officials of their respective areas and keep the District office cognizant of area conditions. At the same time, the teams could be of assistance to local officials in preparing requests to OEP for the performance of work under Public Law 875/81. The Sector Teams could then prepare initial engineering estimates, supervise the recovery work, make final inspections, and submit requests for final payment.

e. It is hoped that the above observations will be of some value to other Corps of Engineers districts in preparing for future emergencies resulting from hurricanes, tornadoes, floods, or other natural disasters.

SECTION VIII - ESTIMATED COST SUMMARY

20. COST SUMMARY

A summary of estimated total costs for Corps of Engineers expenditures for Hurricane Betsy recovery activities is given below:

P.L. 875/81	$37,639,429
P.L. 99/84	4,852,680
O&M General	2,596,000
Total Corps expenditures	$45,088,109

EXHIBIT 5-1

CORPS OF ENGINEERS FIELD OFFICES

Parish Served	Location
Arcadia Evangeline St. Landry	Courthouse, Opelousas, Louisiana
Ascension	609 Railroad Avenue, Donaldsonville, Louisiana
Assumption	Police Jury Office, Napoleonville, Louisiana.
Avoyelles	Police Jury Office, Marksville, Louisiana.
Caldwell Richland	Police Jury Office, Columbia, Louisiana.
Catahoula Concordia Franklin Tensas	Police Jury Office, Winnsboro, Louisiana.
East Baton Rouge	Municipal Building, Baton Rouge, Louisiana.
East Feliciana St. Helena	Town Hall, Clinton, Louisiana.
Iberia Lafayette	Lafayette Area Office, Lafayette, Louisiana.
Iberville	Courthouse, Plaquemine, Louisiana.
Jefferson	Courthouse, Gretna, Louisiana.
Lafourche	Police Jury Office, Thibodaux, Louisiana.
Livingston	Police Jury Office, Livingston, Louisiana.
Orleans	City Hall, New Orleans, Louisiana.
Ouachita	Parish Engineer's Office, Monroe, Louisiana.

CORPS OF ENGINEERS FIELD OFFICES (Cont'd.)

Parish Served	Location
Plaquemines	Buras High School, Buras, Louisiana.
Pointe Coupee West Feliciana	Police Jury Office, New Roads, Louisiana.
Rapides	Police Jury Office, Alexandria, Louisiana.
St. Bernard	Courthouse Annex, Chalmette, Louisiana.
St. Charles	Courthouse, Hahnville, Louisiana.
St. James	Gonzales Motel, Vacherie, Louisiana.
St. John the Baptist	Police Jury Office, Edgard, Louisiana.
St. Martin	Courthouse, St. Martinville, Louisiana.
St. Mary	Police Jury Office, Franklin, Louisiana.
St. Tammany	Police Jury Office, Covington, Louisiana.
Tangipahoa Washington	Police Jury Office, Amite, Louisiana.
Terrebonne	Pettigrew Hotel, Houma, Louisiana
West Baton Rouge	Police Jury Office, Port Allen, Louisiana

TEMPORARY DUTY PERSONNEL

Name	Designation & grade	Reporting date	Release date
ALBUQUERQUE DISTRICT			
Butler, Raymond E.	Auditor, GS-9	3/8	6/3
BALTIMORE DISTRICT			
Hogen, Francis J.	Clerk, GS-7	10/4	11/12
McGuchen, Patrick F.	Attorney, GS-11	10/4	10/29
CANAVERAL DISTRICT			
Ahrano, Frederick W.	Const Mgt Engr, GS-12	9/20	10/22
Brown, Joseph A.	Civ Engr, GS-11	9/20	10/6
Cairns, David P.	Architect, GS-11	9/20	10/22
Durham, Pleasant B.	Const Inspector, GS-7	9/20	10/29
Tyner, James B.	Const Engr, GS-13	9/20	10/30
CHARLESTON DISTRICT			
Lively, Oran W.	Civ Engr, GS-12	9/21	10/30
Sands, Samuel E.	Civ Engr, GS-11	9/21	11/13
CHICAGO DISTRICT			
Kuehn, William F.	Auditor, GS-11	10/28	2/16
FORT SAM HOUSTON			
Hansen, Ted	Dep Ch Staff for Log	9/25	10/30
FORT WORTH DISTRICT			
Colvin, Thomas L.	Auditor, GS-11	11/1	12/18
Deck, F. C., Jr.	Auditor, GS-12	9/26	10/27
Johnson, McO.	Civ Engr, GS-11	9/21	9/30
Kilpatrick, John K.	Civ Engr, GS-7	9/27	11/12
Lee, John A.	Civ Engr, GS-11	9/21	9/30
Norton, William M.	Civ Engr, GS-7	9/27	11/20
GALVESTON DISTRICT			
Boswell, Herman E.	Auditor, GS-11	2/28	3/19
Chatlain, Donald J.	Civ Engr, GS-11	9/18	10/21
Dousman, Donald J.	Civ Engr, GS-9	9/17	10/18
Hughart, Herbert C.	Elec Tech, GS-7	9/17	10/4
Maurer, Herbie A.	Civ Engr, GS-7	9/27	11/2
Peltier, Leroy	Civ Engr, GS-9	9/17	9/27

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
GALVESTON DISTRICT (cont'd)			
Ravenstein, William L.	Supv Civ Engr, GS-12	9/17	10/28
Roche, Thomas R.	Auditor, GS-9	1/24	2/26
Senasac, Raymond L.	Civ Engr, GS-11	9/20	10/21
Tanner, Napoleon B. III	Civ Engr, GS-5	9/26	11/7
Warren, James E.	Civ Engr Tech, GS-9	9/20	10/21
HUNTINGTON DISTRICT			
McIlwain, David L.	Civ Engr, GS-7	9/26	11/12
Straub, John K.	Auditor, GS-11	9/30	10/12
JACKSONVILLE DISTRICT			
Cogswell, Clark	Civ Engr, GS-11	9/20	10/12
Costas, Pericles	Civ Engr, GS-5	9/22	10/28
Hartman, Richard J.	Civ Engr, GS-9	9/20	10/5
Upchurch, James A.	Civ Engr, GS-5	9/23	11/13
KANSAS CITY DISTRICT			
Dearinger, Murl	Const Foreman, S-7	9/21	11/12
Hahne, Arthur L.	Const Foreman, S-7	9/21	10/16
Uffelman, Wilburn	Ship Fitter, W-10	9/21	9/23
LITTLE ROCK DISTRICT			
Alexander, Ken G.	Elec Tech, GS-5	9/21	10/5
Austin, Alvin C.	Civ Engr, GS-12	9/21	10/21
Disbrow, Harry C.	Civ Engr, GS-9	9/27	11/12
Fraley, Morris A., Jr.	Civ Engr, GS-7	9/27	11/12
Hogue, Larry D.	Civ Engr, GS-7	9/27	10/22
McGrew, James K.	Struct Engr, GS-11	9/21	10/1
Mikelson, Lyal O.	Const Insp, GS-7	9/22	11/4
Patton, Joseph C.	Const Repr, GS-11	9/22	11/13
Richards, Brainard W.	Auditor, GS-9	1/24	3/22
LOS ANGELES DISTRICT			
Hentges, Robert G.	Auditor, GS-10	10/28	12/18
LOUISVILLE DISTRICT			
Christman, William F.	Civ Engr, GS-7	9/27	10/26
Knosp, Charles M.	Procurement Off, GS-12	9/27	10/22
Tyler, Neill B.	Civ Engr, GS-7	9/27	10/12

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
LOWER MISSISSIPPI VALLEY DIVISION			
Crosby, Charles L.	Mgt Analyst, GS-12	9/26	12/18
Cunningham, Alex W.	Auditor, GS-13	9/26	2/26
MEMPHIS DISTRICT			
Alderman, Clifton W.	Brick Layer, W-11	9/20	11/16
Arnold, Charles J.	Diesel Mech, W-10	9/20	11/17
Bourne, John R.	Crane Opr, W-12	9/20	10/30
Bragg, Frank T.	Const Supv, GS-11	9/20	10/18
Brandon, Luscius A.	Supt Const Insp (Gen)GS-9	2/13	4/8
Brewer, John N.	Mech Engr, GS-12	9/20	10/31
Brown, Clarence A.	Marine Carpenter, W-10	9/20	10/30
Bufford, Parker W.	Acctg Tech, GS-5	9/22	10/20
Camp, Lehman K.	Const Insp, GS-7	9/14	10/18
Cash, William T.	Acctg Tech, GS-4	9/22	11/5
Childers, Jimmy L.	Const Engr, GS-12	10/3	10/12
Conditt, James H.	Civ Engr, GS-7	9/14	10/16
Culp, Clyde S.	Crane Opr, W-12	9/20	11/8
Davis, Arthur G.	Const Engr, GS-11	9/13	10/18
Deason, Roy B.	Civ Engr, GS-12	9/13	10/15
Ditto, David M.	Metal Worker, W-11	9/20	10/11
Fairley, John G.	Civ Engr, GS-11	10/8	10/30
Forney, Guy W.	Civ Engr, GS-11	9/13	11/24
Gafford, Thomas G.	Civ Engr, GS-11	9/20	10/1
Gray, Billy D.	Civ Engr (Gen), GS-11	4/17	5/20
Grisham, Cecil W.	Civ Engr, GS-9	9/13	11/5
Jernigan, Mervin B.	Const Insp, GS-8	9/14	10/30
Johnson, James A.	Crane Opr, W-12	9/21	10/24
Johnson, Noah	Mech Engr, GS-12	9/21	10/8
Koch, Joe L.	Civ Engr Tech, GS-9	9/14	10/12
Laird, W. M.	Auditor, GS-11	9/26	11/21
Lloyd, Vivian L.	Metal Worker, W-11	9/20	11/13
McCracken, Walter L.	Marine Carpenter, W-10	9/20	10/12
Martin, Henry S.	Supt Const Mgt Engr, GS-11	1/23	3/4
Madsen, Terence O.	Radio Repairer, WL-12	11/2	11/13
Mosher, Hall E.	Mech Engr, GS-11	9/20	10/31
Parkinson, Oliver N.	Civ Engr, GS-11	9/20	10/1
Patey, James W.	Crane Opr, W-09	9/20	11/13
Pendergrast, Leonard	Const Insp, GS-8	9/14	10/31
Person, Fred E.	Metal Worker, W-11	9/20	10/30
Pickett, Terry G.	Const Insp, GS-7	9/14	10/31
Pitts, David R.	Civ Engr, GS-11	4/9	5/20
Pollock, Joseph M.	Engr, GS-11	11/28	1/22
Rabalais, Lawrence A.	Civ Engr, GS-7	9/14	10/21

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
MEMPHIS DISTRICT (cont'd)			
Sawyers, Fred T.	Civ Engr, GS-9	5/21	7/1
Smith, Lonnie M.	Marine Carpenter, W-10	9/21	10/30
Stewart, John M.	Const Insp, GS-8	9/14	10/15
Tucker, Wade J.	Rigger, W-08	9/20	10/23
Wargo, Steve D.	Civ Engr Tech, GS-6	9/20	10/8
Wilkerson, Audley L.	Const Insp, GS-8	9/14	11/6
Williams, Bobby G.	Supt Const Engr, GS-9	3/6	4/15
MOBILE DISTRICT			
Blake, Edwin E.	Clerk-Typist	10/2	10/16
Brewton, William J.	Const Insp, GS-5	9/18	9/26
Bruce, Charles J.	Civ Engr, GS-7	9/22	10/30
Cruz, David R.	Trainee, GS-2	9/18	9/26
Durant, Clarence W.	Civ Engr Tech, GS-6	9/18	9/26
Gardner, Harold A.	Clerk, GS-6	10/4	11/6
Huffman, Dan M.	Civ Engr Tech, GS-7	9/18	9/26
Hawkins, William T.	Auditor, GS-11	1/12	3/11
Lee, Henry J.	Civ Engr, GS-7	9/22	11/12
Lombard, Carlton E.	Survey Tech, GS-5	9/17	9/26
Love, Teddy G.	Civ Engr, GS-5	9/22	11/13
McLeod, James A., Jr.	Survey Tech, GS-5	9/18	9/26
Mellgren, Harold A.	Auditor, GS-11	10/25	12/18
Merritt, Allen F.	Admin Asst, GS-10	9/19	10/16
Murphy, Edward B.	Mech Engr, GS-12	9/19	10/8
Rawson, James W.	Civ Engr Tech, GS-11	9/17	9/26
Roberts, Thomas H.	Engr Tech, GS-7	9/19	10/16
Ross, Raymond E.	Survey Tech, GS-6	9/18	9/26
Santa Cruz, James J.	Surveyboat Opr, S-5	9/18	9/26
Smith, Ebb C.	Survey Aid, GS-4	9/18	9/26
Strickland, Howard E.	Const Insp, GS-7	9/18	9/26
Tillman, Joseph G.	Deckhand, W-6	9/18	9/26
Waggener, Green T.	Civ Engr, GS-12	10/1	11/8
Wiggs, Willard R.	Survey Tech, GS-7	9/18	9/26
NEW ENGLAND DIVISION			
Cutcher, Bernard J.	Const Rep, GS-11	10/4	11/9
deNevers, Bertrand	Admin Clerk, GS-5	10/4	11/2
Keefe, Joseph T.	Auditor, GS-11	5/22	Present
NORTH ATLANTIC DIVISION			
Carter, William I.	Auditor, GS-12	5/18	Present

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
NORTH PACIFIC DIVISION			
Bentley, Earl W.	Auditor, GS-13	1/24	4/22
OMAHA DISTRICT			
Bogle, Julius	R&H Foreman, S-6	9/22	10/21
Brokow, Anthony	Maint Foreman, S-6	9/22	11/22
Denman, Edwin M.	Auditor, GS-11	1/5	2/24
Holland, Raymond	2d Mate, P.L.Dredge, S-7	9/22	11/22
Kingan, Richard	Clerk, GS-4	9/23	11/13
Paden, Walter L.	Clerk, GS-5	9/24	11/9
PITTSBURGH DISTRICT			
Bilotta, John J.	Civ Engr, GS-7	9/28	10/30
Fry, Richard A.	Civ Engr, GS-5	9/28	10/30
Goodboy, Stanley L.	Civ Engr, GS-7	9/28	10/30
Rogalla, Albert H.	Civ Engr, GS-7	9/28	10/30
ROCK ISLAND DISTRICT			
Wymore, Don L.	Auditor, GS-9	10/11	3/9
ST. LOUIS DISTRICT			
Bell, William	Auditor, GS-9	9/13	9/27
Blodgett, David C.,Jr.	Auditor, GS-11	9/26	12/3
Burnett, Ferrell E.,Jr.	Const Engr, GS-9	9/13	10/22
Butery, James L.	Civ Engr, GS-7	9/24	11/9
Clymore, Marion C.	Auditor, GS-9	10/25	6/30
Feld, Walter C.	Civ Engr, GS-7	9/24	11/22
Gaal, John A.	Civ Engr, GS-7	9/24	10/23
Hoffman, Davis V.	Engr, GS-11	9/13	10/27
Holcomb, Wilbur	Lead Foreman, S-4	10/1	11/10
Joyce, Joe B.	Const Rep, GS-9	9/13	10/12
Keaton, Charles A.	Struct Engr, GS-11	11/27	1/22
Komas, John N.	Const Mgt Engr, GS-11	11/8	12/18
Knepper, Erwin J.	Const Rep, GS-7	9/13	9/24
Lill, Loren W.	Radio Rpr, W-10	9/17	10/7
Lutz, George O.	Const Insp, GS-7	9/13	10/12
Martin, Clyde F.	Const Engr Tech, GS-10	9/13	10/12
Modde, Dale E.	Civ Engr, GS-11	9/13	10/14
Mudd, Thomas J.	Struct Engr, GS-11	9/18	10/19
Parker, O. Newell	Elect Engr, GS-11	3/6	4/15
Porter, William C.	Civ Engr, GS-11	9/18	11/24
Robinson, Lee R.	Mech Engr, GS-11	1/24	3/5

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Releas date
ST. LOUIS DISTRICT (cont'd)			
Rudert, Albert C.	Const Insp, GS-7	9/18	10/18
Sherbine, Dee B.	Const Rep, GS-9	9/24	11/20
Simpson, Reese W.	Supt Const Mgt Engr, GS-12	1/3	1/28
Taphorn, William J.	Civ Engr Tech, GS-9	9/13	10/30
Tribaut, Charles H.	Civ Engr, GS-9	4/18	5/27
Turina, Bob W.	Civ Engr, GS-11	9/13	10/25
Wich, Robert F.	Civ Engr, GS-9	3/6	4/15
Wilkey, Ralph W.	Supt Civ Engr, GS-11	1/30	3/11
" " "	" " " "	5/30	7/1
SAN FRANCISCO DISTRICT			
Hoffman, Edwin B.	Mech Equip Insp, GS-11	10/4	11/30
SAVANNAH DISTRICT			
Best, Cecil H.	Const Engr, GS-11	9/21	10/22
Cole, John A.	Civ Engr, GS-12	9/28	10/20
Crapnell, Scott M.	Const Rep, GS-9	9/20	11/12
Durden, Dawson D.	Const Insp, GS-7	9/20	11/17
Lewis, William F.	Civ Engr, GS-13	10/5	10/30
McKeever, Shelton R.	Hydraulic Engr, GS-12	9/28	10/16
Miller, Randall C.	Civ Engr, GS-7	9/22	11/20
Willett, Harold E.	Civ Engr, GS-7	9/22	11/20
Williams, Bennie G.	Elect Engr, GS-7	9/22	11/20
SEATTLE DISTRICT			
Martin, Paul R.	Civ Engr, GS-12	10/4	10/30
Meyers, Wallace K.	Civ Engr, GS-12	10/4	11/12
SOUTH ATLANTIC DIVISION			
Finch, Nathaniel J.	Auditor, GS-11	9/26	11/18
Giles, Robert	Press Opr Offset, W-7	10/21	11/3
Moore, Jimmy D.	Leader Press Opr, L-7	9/27	10/8
Sloan, Murray D.	Auditor, GS-13	9/26	11/18
TULSA DISTRICT			
Becker, Robert E.	Civ Engr, GS-7	9/27	11/2
Cochran, Charles M.	Civ Engr, GS-7	9/27	11/24
Haag, Lawrence D.	Engr Tech, GS-11	9/21	10/19
Moore, John A.	Auditor, GS-11	9/30	11/18
" " "	" "	1/18	4/5

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
VICKSBURG DISTRICT			
Agnostinelli, Victor M.	Civ Engr, GS-7	9/26	10/28
Balconi, Joseph A.	Civ Engr, GS-12	9/13	10/12
Bridges, Bert E.	Civ Engr, GS-11	9/13	10/16
Bower, Robert I.	Struct Engr, GS-11	9/13	10/16
Buffington, Donald J.	Chief, Contracts, GS-11	9/13	9/17
Carrol, Roland S.	Procurement Off, GS-12	9/13	10/3
Cesare, John G.	Auditor, GS-10	9/26	12/18
" " "	" "	1/3	1/29
" " "	" "	3/20	4/16
Chaffin, Phillip R.	Civ Engr, GS-5	9/27	10/31
Chisholm, William W.	Insp Gen, GS-9	9/13	10/12
Craig, Andrew H.	Civ Engr, GS-11	9/20	10/19
Crocker, Alex B.	Const Supt, GS-11	4/11	5/13
Cummings, Robert H.	Res Ranger, GS-6	9/13	10/15
Farrior, Edward V.	Voucher Exam, GS-5	10/3	11/24
Fite, Joe T.	Foreman, S-4	9/13	9/27
Gibson, Paul D.	Const Foreman, S-4	9/20	11/5
Graham, James L.	Civ Engr, GS-7	9/26	10/12
Gray, William H.	Const Insp, GS-9	9/13	9/27
Hansen, James B.	Clerk, GS-5	9/27	11/21
Harding, Willard E.	Elect Engr, GS-11	5/15	7/1
Harper, Herbert C.	Civ Engr, GS-11	9/13	10/20
Hernandez, Samuel O.	Supt Civ Engr, GS-11	1/3	3/3
Herren, R. D., Jr.	Auditor, GS-11	1/31	3/19
" " " "	" "	6/13	Present
Hobelman, Charles G.	Struct Engr, GS-11	11/8	12/18
Jenkins, Thomas H.	2d Mate, WS-7	9/13	10/29
Joiner, Tommie L.	Foreman, S-4	9/13	10/10
Jones, Buford R.	Const Insp, GS-7	9/13	10/10
Knight, Marion C.	Const Supv, GS-9	9/13	10/17
Moorhead, Mary Jo	Clerk-Steno, GS-4	9/18	10/8
Morgan, James	Lead Foreman, S-4	9/13	10/9
Newton, Luther B.	Struct Engr, GS-11	9/13	10/17
O'Neal, Dan R.	Civ Engr, GS-7	5/15	7/1
Patton, Vernon L.	Civ Engr, GS-9	9/13	10/2
Pierce, Paul W. III	Civ Engr, GS-7	9/27	10/30
Richardson, Jasper	Res Ranger, GS-7	9/13	10/15
Shelton, Thomas F.	Civ Engr Tech, GS-10	9/13	10/22
Smith, Charles E.	Acctg Tech, GS-6	9/21	11/22
Stockton, David L.	Civ Engr, GS-5	9/27	10/14
Stowers, Eugene V.	Supt Civ Engr Tech, GS-9	3/7	4/8
Stuart, Richard E.	Civ Engr, GS-7	9/27	11/3
Weaver, Samuel N.	Auditor, GS-9	4/17	6/12
Wilson, Sam J.	Civ Engr, GS-9	9/13	9/26
Wimbish, John W.	Clerk, GS-6	10/3	11/3
Woods, William R.	Const Supt (R&H), GS-9	1/3	3/4

TEMPORARY DUTY PERSONNEL (cont'd)

Name	Designation & grade	Reporting date	Release date
VICKSBURG DISTRICT (cont'd)			
Allen, Ben		9/14	11/14
Anderson, John		9/14	11/13
Bowen, John		9/15	9/26
Cain, A. D.		9/16	9/26
Dunn, Horace E.		9/16	9/26
Geter, Marvin L.		9/18	11/14
Harding, Willard E., Jr.		9/18	11/13
Secrest, Leon A.		9/18	11/14
Secrest, Paul E.		9/16	9/26
Shackleford, Henry A.		9/15	11/14
Stainbrook, Keith C.		9/12	11/14
Wilson, Harry C.		9/16	9/26
WATERWAYS EXPERIMENT STATION			
Ball, Robert	Photographer, GS-7	10/20	10/29
Beacham, Earnest P., Jr.		9/15	11/14
Bragg, George H.	Civ Engr, GS-11	9/18	11/12
Evans, John M.	Equip Foreman, S-7	9/18	10/23
Fenwick, William B.	Civ Engr, GS-12	9/18	11/5
Green, Hugh L.	Civ Engr, GS-11	9/18	11/5
Hamilton, Clifton	Photographer, GS-7	9/24	10/8
Hebler, John N.	Pipefitting Foreman, S-7	9/18	10/17
Hilderbrand, Jack	Accountant, GS-7	9/21	9/23
Leggett, Robert N.	Const Supt, GS-11	9/18	10/23
Mobley, Bob	Supv Phy Security, GS-7	9/18	10/24
Nettles, Eugene H.	Civ Engr, GS-12	9/21	10/22
Newman, George W.	Photographer, GS-4	9/18	9/20
Rudd, Ryland M.	Photographer, GS-9	9/18	9/28
Sullivan, Aubrey L., Sr.	Civ Engr Tech, GS-12	9/18	10/23
Teeter, Earl H.	Const Spec, GS-12	9/18	10/15
Wilson, James K.	Lead Foreman, S-7	9/18	10/28
WILMINGTON DISTRICT			
Costakis, James L.	Civ Engr, GS-11	9/22	11/12
Jacobs, Edwin J.	Civ Engr, GS-11	9/20	11/5
Swart, Robert S.	Civ Engr, GS-7	9/22	11/2
Tickner, Wilford E.	Civ Engr, GS-7	9/22	11/23
Whidden, Howard B.	Const Rep, GS-9	9/20	10/23

NEW ORLEANS DISTRICT EMPLOYEES
ASSIGNED TO DISASTER RECOVERY OPERATIONS
HURRICANE BETSY

DISASTER RECOVERY CENTER

Adams, J. W., Oprns.
Fenerty, M. L., Oprns.
Parker, R. J., Oprns.
Louque, N., Oprns.
Hackney, Z., Oprns.
Magee, M., Oprns.
Alexander, J., Oprns.
Hemple, H. H., Oprns.
Matherne, W. D., Oprns.
Bonano, U., Oprns.
Freeman, W. I., Engrg.
Bracey, H. L., Engrg.
Widlitze, N. W., Engrg.
Jones, M. L., Engrg. (nights and weekends)
Allen, V. D., Engrg. (one week)
Harvey, M. C., Lafayette A/O
Whitaker, H. G., Real Estate
McHugh, W. C., Supply
Gogreve, L., Supply
Russell, S. L., Supply
Ripple, S., Personnel
Walter, E., Personnel
Heinold, Personnel
Troy, T., Personnel

EMPLOYEES WORKING IN FIELD WITH VARIOUS PARISHES
ASSIGNED TO DISASTER RECOVERY CENTER

Robinson, O., Oprns.
LeBlanc, N. M., Oprns.
Milano, L., Oprns.
Wunderlich, W. Oprns.
Manson, L., Oprns.
Broussard, R. D., Engrg. (later assigned to DRC office)
Barton, E. E., Engrg.
Jesclard, G. P., Engrg.
Langlois, N., Engrg.
O'Bannon, W. L., Engrg.
Lipari, F., Engrg.
Dretke, G. R., Engrg.
Roberson, B. J., Engrg.
Bearss, A. J., Engrg.
Montgomery, R. L., Engrg.
Decker, C. W., Engrg.
Johnston, T. E., Engrg.
Stokes, S. J., Engrg.

EMPLOYEES WORKING IN FIELD WITH VARIOUS PARISHES
ASSIGNED TO DISASTER RECOVERY CENTER (cont'd)

Lamana, A. J., New Orleans A/O (2 weeks)
Brauwn, E. A., New Orleans A/O
Fabre, A. L., New Orleans A/O
Trew, F. B., New Orleans A/O
Fortenberry, J., New Orleans A/O
McIntyre, M., New Orleans A/O
Klar, H., New Orleans A/O
Briggs, E. J., Personnel
Seher, L. M., Real Estate
Hull, D. F., Shreveport A/O
Wommack, R. L., Calcasieu Salt Water Project
Langston, J. H., Const.
Bruck, J. C., Const.

EMERGENCY OPERATION CENTER

Landry, V. A., Oprns. (later assigned to DRC office)
Nettles, C. J., Oprns.
Dunn, C. R., Oprns.
Viso, S. B., Oprns.
Blaize, S. C., Oprns.
Betancourt, A. A., Oprns.
Sanchez, L. R., Oprns.
Cronin, J. L., Oprns.
Bywater, H. A., Engrg.
Clark, J. L., Engrg.
Dunlap, J., Engrg. (later assigned to DRC office)
Merrill, T. H., Jr., Bayou Bodcau Res. (later assigned to DRC field)
Lee, R. E., Texarkana Res.
Thomas, W. R., Ferrells Bridge Res. (later assigned to DRC field)

SUPPLY DIVISION

Waltzer, E. C.

CONSTRUCTION DIVISION

Clarke, C. W.

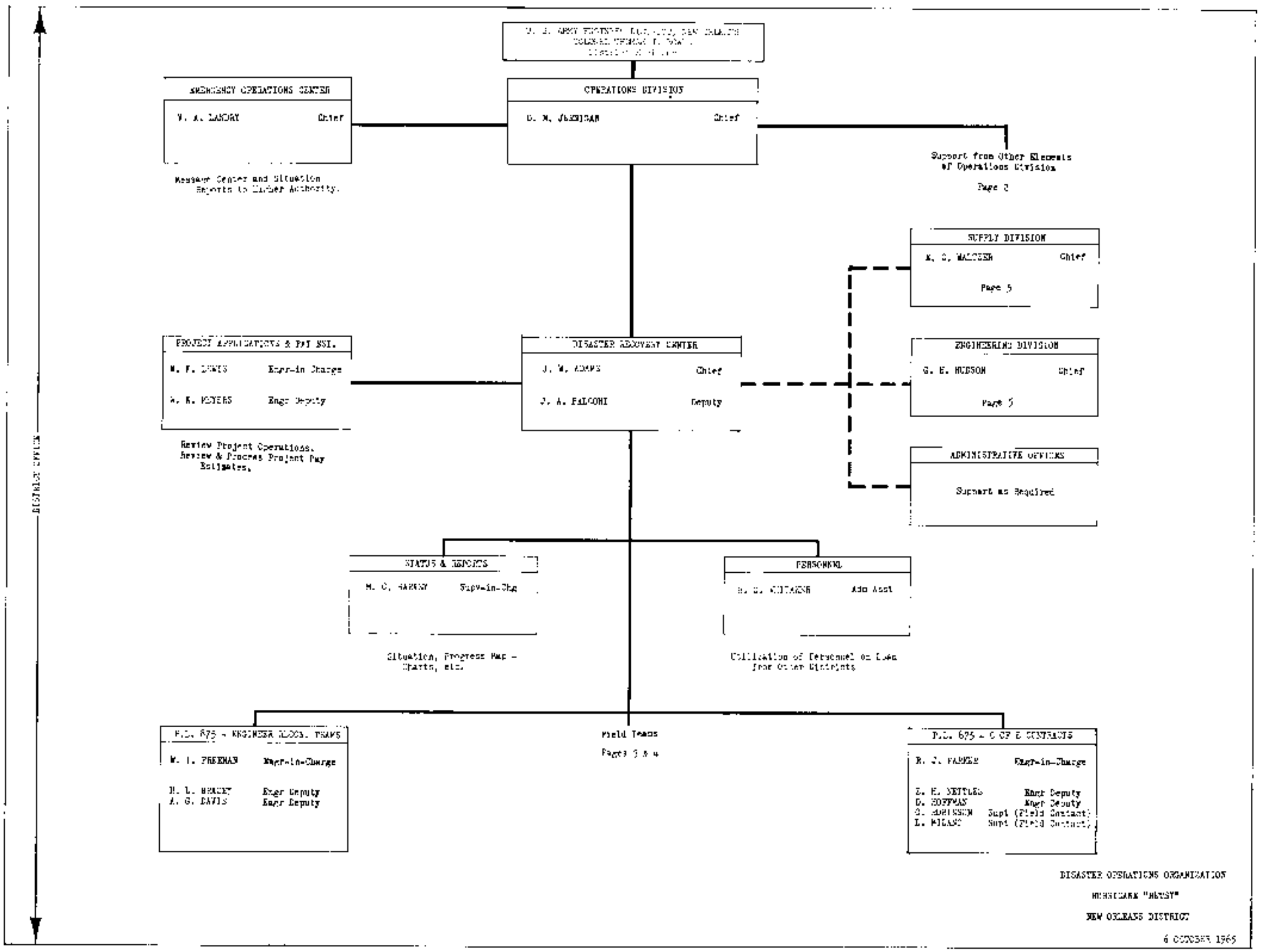

OPERATIONS DIVISION
Chief
Support from Other Elements of Operations Division
EMERGENCY OPERATIONS CENTER
Chief
SUPPLY DIVISION
Chief
Page 5
ENGINEERING DIVISION
G. E. HUDSON
Chief
Page 5
ADMINISTRATIVE OFFICES
Support as Required
DISASTER RECOVERY CENTER
Chief
J. A. FALCONI
Deputy
Engr-in Charge
Engr Deputy
Review Project Operations.
Review & Process Project Pay Estimates.
STATUS & REPORTS
Supv-in-Chg
Situation, Progress Map - Charts, etc.
PERSONNEL
Field Teams
Engr-in-Charge
Engr Deputy
Engr Deputy
Engr-in-Charge
Engr Deputy
Engr Deputy
DISASTER OPERATIONS ORGANIZATION
NEW ORLEANS DISTRICT

EXHIBIT 5-3

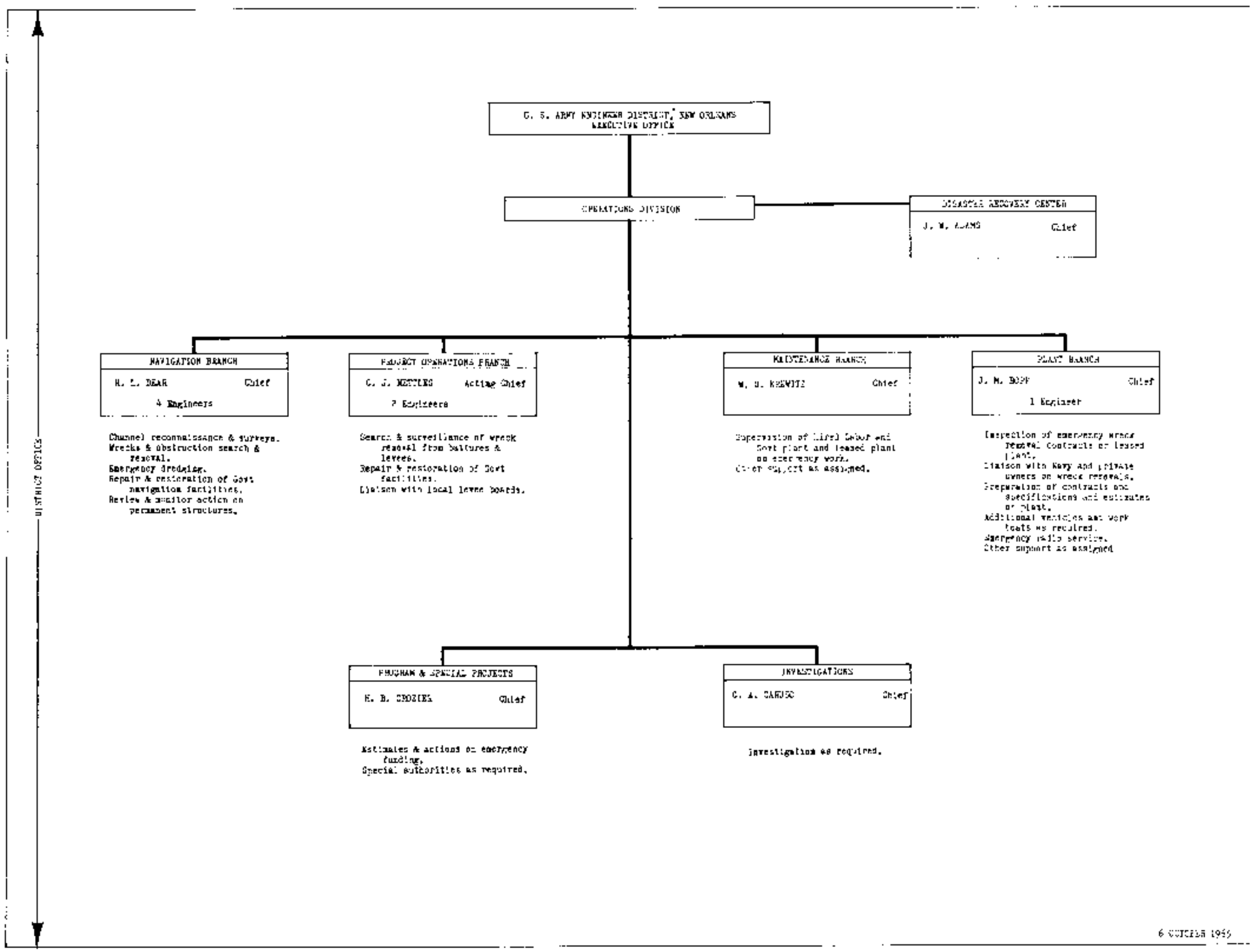
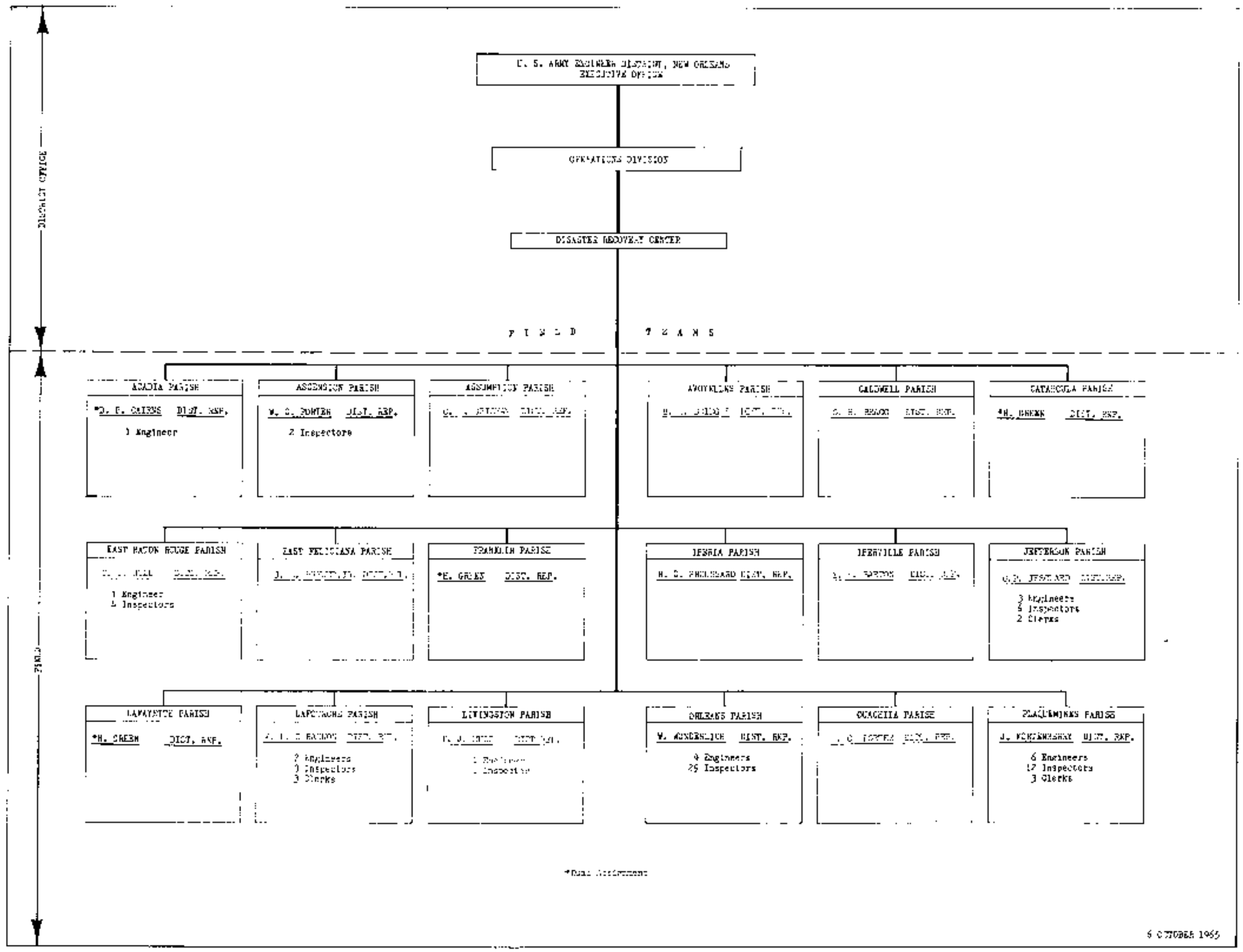


EXHIBIT 5-3

EXHIBIT 5-3



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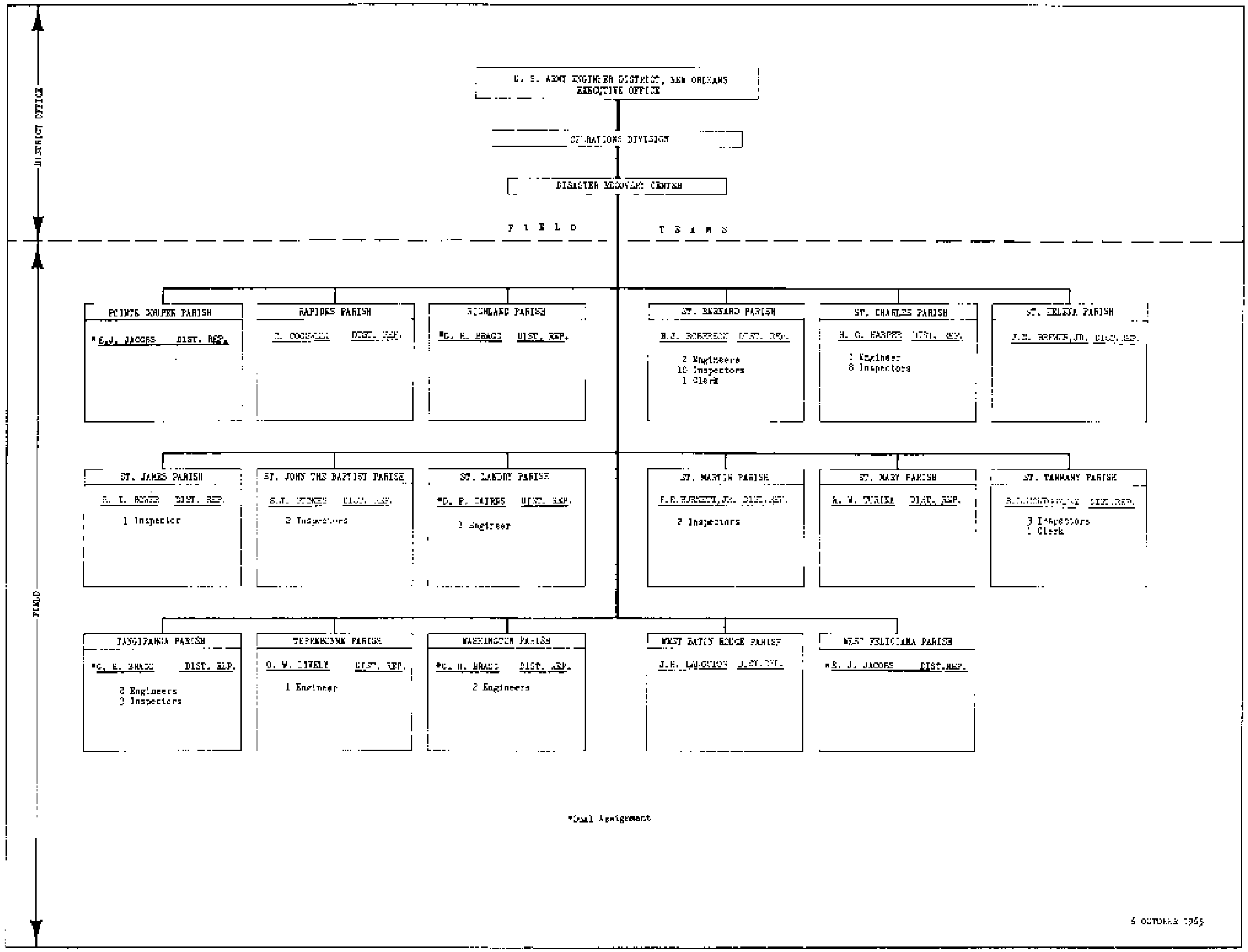


EXHIBIT 5-3

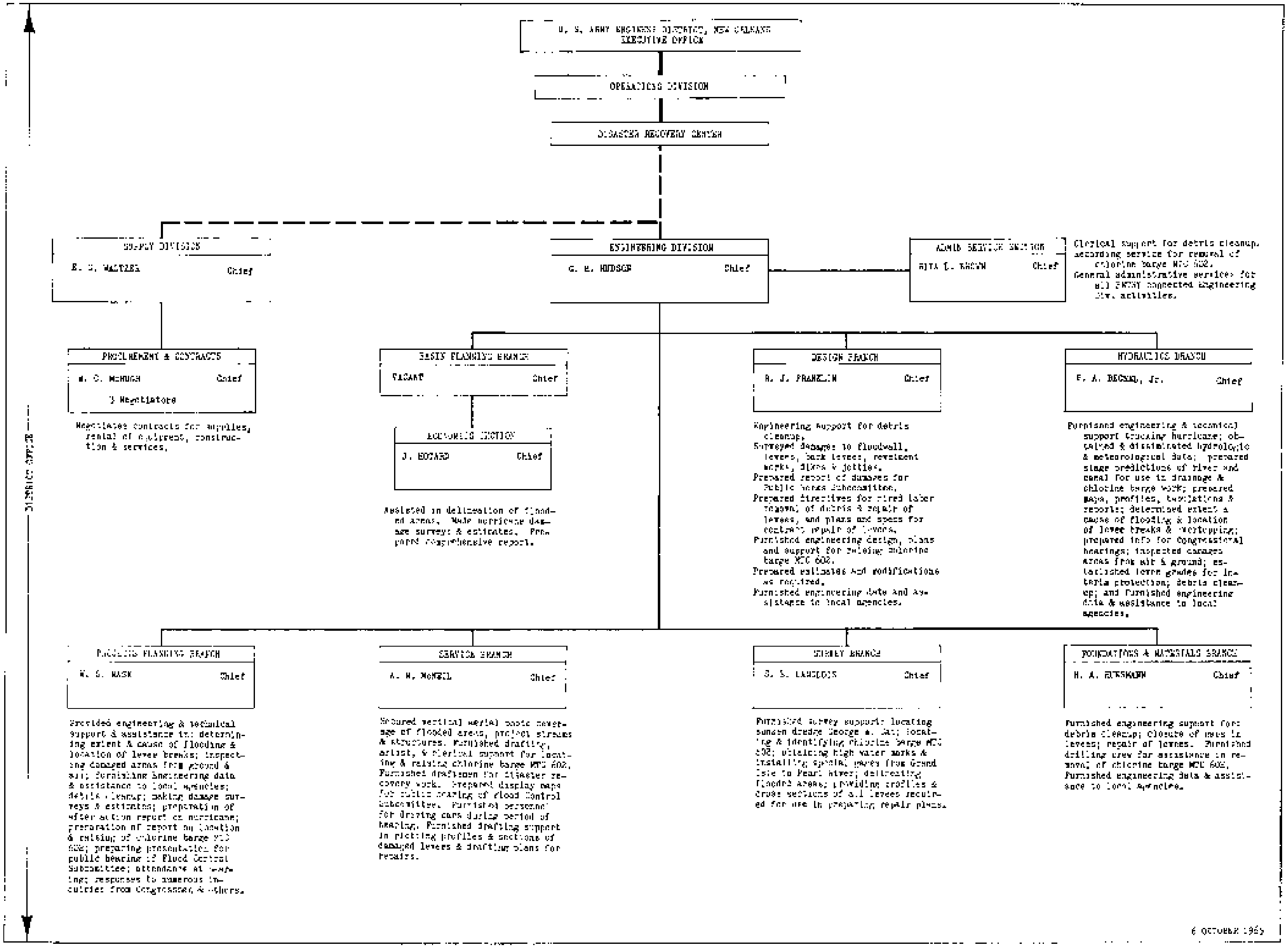

U. S. ARMY ENGINEER DISTRICT, NEW ORLEANS
EXECUTIVE OFFICE
OPERATIONS DIVISION
DISASTER RECOVERY CENTER
DISTRICT OFFICE
SUPPLY DIVISION
E. C. WALTZER Chief
ENGINEERING DIVISION
G. E. HUDSON Chief
ADMIN SERVICE SECTION
RITA L. BROWN Chief
Clerical support for debris cleanup, recording service for removal of chlorine barge MTC 602. General administrative services for all BETSY connected Engineering Div. activities.
PROCUREMENT & CONTRACTS
W. C. McHUGH Chief
3 Negotiators
Negotiates contracts for supplies, rental of equipment, construction & services.
BASIN PLANNING BRANCH
VACANT Chief
ECONOMICS SECTION
J. BOYARD Chief
Assisted in delineation of flooded areas. Made hurricane damage surveys & estimates. Prepared comprehensive report.
DESIGN BRANCH
R. J. FRANKLIN Chief
Engineering support for debris cleanup.
Surveyed damages to floodwall, levees, back levees, revetment works, dikes & jetties.
Prepared report of damages for Public Works Subcommittee.
Prepared directives for hired labor removal of debris & repair of levees, and plans and specs for contract repair of levees.
Furnished engineering design, plans and support for raising chlorine barge MTC 602.
Prepared estimates and modifications as required.
Furnished engineering data and assistance to local agencies.
HYDRAULICS BRANCH
F. A. BECKER, Jr. Chief
Furnished engineering & technical support tracking hurricane; obtained & disseminated hydrologic & meteorological data; prepared stage predictions of river and canal for use in drainage & chlorine barge work; prepared maps, profiles, tabulations & reports; determined extent & cause of flooding & location of levee breaks & overtopping; prepared info for Congressional hearings; inspected damaged areas from air & ground; established levee grades for interim protection; debris cleanup; and furnished engineering data & assistance to local agencies.
PROJECTS PLANNING BRANCH
W. S. MASK Chief
Provided engineering & technical support & assistance in: determining extent & cause of flooding & location of levee breaks; inspecting damaged areas from ground & air; furnishing engineering data & assistance to local agencies; debris cleanup; making damage surveys & estimates; preparation of after action report on hurricane; preparation of report on location & raising of chlorine barge MTC 602; preparing presentation for public hearing of Flood Control Subcommittee; attendance at hearing; responses to numerous inquiries from Congressmen & others.
SERVICE BRANCH
A. H. McNEIL Chief
Secured vertical aerial photo coverage of flooded areas, project streams & structures. Furnished drafting, artist, & clerical support for locating & raising chlorine barge MTC 602. Furnished draftsmen for disaster recovery work. Prepared display maps for public hearing of Flood Control Subcommittee. Furnished personnel for driving cars during period of hearing. Furnished drafting support in plotting profiles & sections of damaged levees & drafting plans for repairs.
SURVEY BRANCH
G. S. LANDDIS Chief
Furnished survey support: locating sunken dredge George W. Catt; locating & identifying chlorine barge MTC 602; obtaining high water marks & installing special gages from Grand Isle to Pearl River; delineating flooded areas; providing profiles & cross sections of all levees required for use in preparing repair plans.
FOUNDATIONS & MATERIALS BRANCH
H. A. HUSSMANN Chief
Furnished engineering support for: debris cleanup; closure of gaps in levees; repair of levees. Furnished drilling crew for assistance in removal of chlorine barge MTC 602. Furnished engineering data & assistance to local agencies.
6 OCTOBER 1965

EXHIBIT 5-3

U. S. ARMY ENGINEER DIVISION, LOWER MISSISSIPPI VALLEY
CORPS OF ENGINEERS
P. O. BOX 80
VICKSBURG, MISSISSIPPI

ADDRESS REPLY TO:
DIVISION ENGINEER

REFER TO FILE NO.

LMVCO 22 September 1965

SUBJECT: Major Disaster Assistance

TO: District Engineer
New Orleans District

There is inclosed copy of a letter from the Deputy Director, Office of Emergency Planning, to Lt. Gen. William F. Cassidy, U.S.A., Chief of Engineers, dated 17 September 1965, requesting the Corps of Engineers to perform major disaster assistance at indicated locations. The District Engineer, New Orleans, will comply with the full intent of the directive, consulting with the Director, Region 5, Office of Emergency Planning, Denton, Texas, as necessary.

Ellsworth I. Davis

1 Incl
as

ELLSWORTH I. DAVIS
Major General, USA
Division Engineer

EXHIBIT 6-1

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PLANNING
WASHINGTON 25, D.C.

OFFICE OF THE DEPUTY DIRECTOR

SEP 17 1965

OEP-208-DR
Louisiana - September 10, 1965
Corps of Engineers Request No. 1

Lt. General William F. Cassidy, USA
Chief of Engineers
Office of Chief of Engineers
Washington, D. C. 20315

Dear General Cassidy:

Pursuant to the provisions of Public Law 875, 81st Congress, as amended, (hereinafter called the Act); Reorganization Plan No. 1 of 1958; Public Laws 85-763 and 87-296; Executive Orders 10427, 10737, and 11051; and Title 32, Code of Federal Regulations, Part 1709-Reimbursement of Other Federal Agencies Performing Major Disaster Relief Functions, and Part 1710-Federal Disaster Assistance; your agency is hereby requested to perform the following major disaster assistance, at the locations indicated:

Make initial inspections and document work eligible under Public Law 81-875 in connection with debris clearance, other than from roads, streets and bridges; work for protection of life and property, repairs of dikes and levees, and reestablishment of drainage facilities, in those areas of the State of Louisiana designated and published in the Federal Register as included in the affected area. Other Federal agencies have already been requested to survey damages in connection with their field of competence. Reports on these surveys will be furnished for your use.

Upon receipt of official requests (OEP Circular 4000.4, pages 15 and 16 and Form OEP 57773) from the State or its political subdivisions, repair damage eligible under PL 81-875. Requests may be either for undertaking the entire work or completing work started by the State or its political subdivisions.

In addition to the above functions ordinarily assigned to the Corps of Engineers under PL 81-875, you are further requested to undertake the following:

> With respect to eligible work done by the State or its political subdivisions, the Corps of Engineers will provide technical assistance, administrative assistance and reimbursement. Reimbursement will be made periodically for completed work as necessary to assure that the progress of the projects will not be delayed. The Corps will also assist in the preparation of project applications, resolutions, vouchers and any further documentation necessary.

The Office of Emergency Planning will have a man available at the Corps office to certify as to the eligibility of work requested. The OEP will also provide advice and guidance as necessary when reimbursement is to be made.

The matter of payments to the State and its political subdivisions for eligible work performed by them has been cleared with the Bureau of the Budget.

In accordance with the provisions of Section 7 of the Act and with the "Reimbursement Regulations," Part 1709, no reimbursement may be made for expenses incurred while performing the herein requested work. However, if funds are allocated and the total costs for work requested and performed exceed the minimum as provided in Part 1709, a supplement to this letter of request may be issued stipulating that a request for reimbursement will be entertained in accordance with the regulations.

All communications related to this request must bear the above Federal agency initials and request number.

Sincerely,

Franklin B. Dryden
Deputy Director

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20315

IN REPLY REFER TO
ENGCW-OE

20 September 1965

MEMORANDUM FOR THE RECORD

SUBJECT: CE Mission in Louisiana Disaster Recovery

1. This summarizes telephone discussion today between the undersigned and Mr. C. H. Beal, Chief of OEP National Office's Natural Disaster Division regarding provisions of the recent OEP request (CE Request No. 1, 17 September 1965). Copy attached.

2. Points covered, and agreements reached:

a. Initial inspections and documentation.

(1) The exclusion from CE inspections of debris clearance on "roads, streets and bridges" is designed to avoid duplication of the surveys by the B.P.R., reports on which B.P.R. is to furnish the Corps. However, the Corps can optionally perform the debris clearance and other emergency work on those roads, streets and bridges which are not components of the Federal aid system (and hence not within B.P.R. statutory emergency authority).

(2) Inspection of dikes and levees, and their repair, is to be considered under PL 875 authority only if first determined not within available CE authorities. (NOTE: It does not appear that resort to PL 875 authority will be required, except as the required fulfillment by local interests of their maintenance commitments or responsibilities may generate certain minor items eligible for reimbursement under PL 875).

b. Accomplishment by the Corps of eligible work.

(1) Despite the limited wording of the request ("repair damage eligible") it is the OEP intent that Corps work can include eligible work under any of the three work categories under Section 3d of PL 875 (i.e., protective and other work essential for the preservation of life and property; clearance of debris and wreckage; and emergency repairs

SUBJECT: CE Mission in Louisiana Disaster Recovery

to and temporary replacements of State/local public facilities). Mr. Beal indicated that an amending supplement to Request No. 1 will be issued at a later date in part covering this matter.

(2) There will be cases where work is to be undertaken and completed by the Corps after having been started by the State or one of its political subdivisions. In such case, the effective date and time of the takeover will be determined by the New Orleans District Engineer, with reimbursement to be provided accordingly to the State or local agency.

S. Zeitlen

1 Incl
as

S. ZEITLEN
Chief, Emergency Operations Branch
Operations Division
Civil Works Directorate

ENGCW-OE 21 September 1965

SUBJECT: Hurricane BETSY Disaster Operations

TO: Division Engineer
U. S. Army Engineer Division, Lower Mississippi Valley

1. Inclosed for your guidance and appropriate action is copy of ENGCW-OE Memorandum for Record dated 21 September 1965, with attached copy of OEP Request No. 1, dated 17 September 1965 covering the Corps-assigned mission under PL 875 in Louisiana. Search and salvage activities in connection with Barge MTC-602 will be handled separately unless contrary decision is reached in the light of current proceedings.

2. Operational guidance is contained in OEP Circular 4000.4, "Natural Disaster Manual for State and Local Applicants," which is referred to in OEP Request No. 1. Additional guidance is set forth in OEP Order 4000.1, the "OEP Operating Guide, Natural Disaster Program." Eligibility criteria detailed in OEP Circular 4000.4 are based on the Federal Disaster Assistance Regulations included as Appendix C thereto (see Part 1710.10). In conforming with the established eligibility criteria, care should be taken that it be clearly understood by State and local authorities that the findings of the Corps of Engineers as to eligibility are subject to OEP review and certification.

3. With respect to eligible work done by the State or its political subdivisions, separate accounting will be maintained on their reimbursement as provided for in the OEP request. In supplementation of guidance contained in the inclosure, the term "reimbursement" will be construed to include "grants-in-lieu" (reference OEP Circular 4000.4, Section VI, subsection D). Also, while the HHFA and GSA will be the Federal agencies having primary responsibility in providing temporary housing and emergency shelter, engineering services in connection with the sites may be further requested by the OEP.

4. Funding of subject PL 875 activities will be accomplished in the same manner as for Hurricane HILDA (reference paragraph 2 of ENGCW-OE letter dated 18 November 1964, subject: "Funding of Emergency Operations in Connection with Hurricane HILDA"). Over-all funds requirements will

ENGCW-OE 21 September 1965
SUBJECT: Hurricane BETSY Disaster Operations

be kept under continuing review, with an over-all program cost estimate developed and adjusted as necessary. Additional requirements for reimbursable apportionment will be communicated to the Engineer Comptroller, attention: ENGEC-B. By separate action, $3 million of reimbursable apportionment is being initially provided to LMVD under the appropriation 96x3125, Flood Control, Hurricane, and Shore Protection Emergencies.

FOR THE CHIEF OF ENGINEERS:

Incl
as

R.J.B. PAGE
Colonel, Corps of Engineers
Deputy Director of Civil Works

EXHIBIT 6-1

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PLANNING
REGIONAL OFFICE 5
FEDERAL CENTER
DENTON, TEXAS 76202

September 20, 1965

OEP NATURAL DISASTER MEMORANDUM NO. 1

FEDERAL-STATE ENGINEERING, CONTRACT AND
REIMBURSEMENT PROCEDURES
HURRICANE BETSY - STATE OF LOUISIANA

Presidential Declaration of Major Disaster: September 10, 1965
Public Law 875
Agreement OEP 208 DR
Eligible Disaster Dates: Initial, September 9, 1965; Terminal date to be established.

* *

This memorandum supplements Schedule of Initial Engineering and Public Health Inspection Requirements dated September 15, 1965. The purpose of this memorandum is to describe three procedures which have been developed to assist applicants in completing emergency repair or temporary replacement of essential public facilities damaged by Hurricane Betsy. These procedures are as follows:

1. Federally-Operated Contract - When this procedure is selected, the applicant should prepare and submit a Resolution describing the emergency work to be performed, together with a letter of request to the District Engineer; U. S. Corps of Engineers; Foot of Prytania Street; New Orleans, Louisiana, 70160; P. O. Box 60267. A representative from the Corps of Engineers will assist the applicant in preparing the Resolution and letter of request.

If the applicant has not performed any emergency work on the damaged facility when the above arrangements are made, the Federally-Operated Contract will provide for sufficient emergency funds to restore the damaged facility to satisfactory operation.

EXHIBIT 6-2

If the applicant has performed a portion of emergency work on the damaged facility when above arrangements are made, the Corps of Engineers representative will review applicant's records of expenditures. The Corps of Engineers will pay to the applicant a check for the amount of expenditures eligible under Public Law 875. The Federally-Operated Contract will arrange for balance of eligible emergency work to be performed.

When the applicant has performed all emergency work on the damaged facility, procedure 3 is recommended for reimbursement of eligible expenditures.

2. Applicant-Operated Contract - If the applicant desires to perform emergency repair or temporary replacement of damaged facility in accordance with plans and specifications prepared by an Architectural or Consulting Engineer Office, applicant should forward a letter to Corps of Engineers setting forth proposed procedures. A representative from Corps of Engineers will consult with the applicant and review plans and specifications to determine extent and estimated cost of emergency work eligible under Public Law 875. An arrangement will be developed wherein the applicant will receive progress payments by check from Corps of Engineers during construction.

If a portion of the emergency work has been performed on above basis, an arrangement will be developed wherein applicant will receive a check from Corps of Engineers for cost of eligible emergency work to date. Additional progress payments will be made for remaining eligible emergency work during construction.

If all emergency work on damaged facility has been completed, Corps of Engineers will review plans and specifications to determine extent and cost of eligible work. Procedure 3 is recommended to reimburse applicant for eligible expenditures.

3. Applicant Force Account and/or Temporary Employees - If the applicant desires to perform emergency repair or temporary replacement of damaged facility with own force account and/or temporary employees, an initial engineering inspection will be made by representatives of appropriate Federal-State Agencies. Report of inspection delineating eligible emergency work and estimated cost therefor will be forwarded to Corps of Engineers. A project application will be prepared for the applicant in the amount of Federal funds recommended in inspection report. After approval of project application by State of Louisiana and Office of Emergency Planning, applicant may request a 75% advance of approved funds to assist with emergency work. When approved work is completed, balance of funds will be paid on basis of Federal-State audit of total expenditures.

If emergency work is in progress or has been completed when initial engineering inspection is made, applicant's eligible expenditures will be included in report and recommendation.

Inspection Procedures - Prior to making initial engineering inspections, members of Federal-State teams should have an entrance interview with the applicant. Extent, type, and location of damage should be discussed. An applicant's representative should accompany inspecting engineers during inspection. After inspection has been completed, the applicant should be informed of above three procedures for performing emergency work. Reports and recommendations should be forwarded to OEP Temporary Natural Disaster Offices 1 or 2 according to parishes assigned thereto.

Corps of Engineers Representative - The following list represents Corps of Engineers representatives who have been temporarily assigned to parishes indicated. These representatives will assist parish or other local officials in connection with procedures 1, 2, and 3.

Parish	Engineer in Charge	Location	Telephone No.
Ascension	V. L. Patton	Donaldsonville	473-7572 473-7529
Assumption	C. W. Grisham	Napoleonville	7435
Avoyelles	D.E. Bridges	Marksville	
Caldwell	*G.H. Bragg		
Catahoula	*H. Green		
E. Baton Rouge	D.F. Hull	Baton Rouge	348-1161
Franklin	*H. Green		
Iberia	*R.D. Broussard	Lafayette	234-2658
Iberville	E.E. Barton	Plaquemine	MU 7-3634
Jefferson	C.P. Jesclard	Gretna	367-6617
Lafayette	*R.D. Broussard	Lafayette	234-2658
Lafourche	W.L. O'Bannon	Thibodaux	HI 7-3057
Livingston	T.J. Mudd	Livingston	686-2265
Ouachita	W.C. Porter	Monroe	
Plaquemines	J. Fortenberry	Buras	823-3983
Richland	*G.H. Bragg		
St. Bernard	B.J. Roberson	Chalmette	271-0421
St. Charles	H.O. Harper	Hahnville	783-2233
St. James	R.I. Bower	Vacherie	265-4052
St. John the Baptist	S.J. Stokes	Edgard	497-3421
St. Martin	F.E. Burnett	St. Martinsville	394-3711
St. Mary	B.W. Turina	Franklin	828-1770 828-1810

Parish	Engineer in Charge	Location	Telephone No.
St. Tammany	R. L. Montgomery	Covington	892-2911
Terrebonne	E. Johnston	Houma	872-0768
West Baton Rouge	J. H. Langston	Port Allen	343-3572 DI 2-5532

George E. Hastings
Regional Director

*Dual Assignment.

EXHIBIT 6-2

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PLANNING
REGIONAL OFFICE 5
FEDERAL CENTER
DENTON, TEXAS 76202

September 20, 1965

OEP NATURAL DISASTER MEMORANDUM NO. 2

HURRICANE BETSY - STATE OF LOUISIANA
PUBLIC LAW 875
AGREEMENT OEP 208 DR

* *

In the Schedule of Initial Engineering and Public Health Inspection Requirements dated September 15, 1965, the Parishes of St. Charles and Terrebonne were included, along with other parishes, in the responsibility of OEP Temporary Natural Disaster Office No. 1, Baton Rouge, Louisiana.

The purpose of this memorandum is to notify all concerned that as of this date, responsibility for administering Federal assistance for the above parishes has been transferred to the OEP Temporary Natural Disaster Office No. 2, New Federal Office Bldg., 701 Loyola, Room 2016, New Orleans, Louisiana, Phone 527-6622; 529-4150; 529-4158.

George E. Hastings
George E. Hastings
Regional Director

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PLANNING
REGIONAL OFFICE 5
FEDERAL CENTER
DENTON, TEXAS 76202

September 21, 1965

OEP NATURAL DISASTER MEMORANDUM NO. 3

HURRICANE BETSY - STATE OF LOUISIANA
PUBLIC LAW 875
AGREEMENT OEP 208 DR

It has been administratively determined that the $1,000 minimum will be waived for project applications requesting Federal assistance in connection with emergency repair or temporary replacement of essential public facilities damaged by Hurricane Betsy.

George E. Hastings

George E. Hastings

EXHIBIT 6-2

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF EMERGENCY PLANNING
REGIONAL OFFICE 5
FEDERAL CENTER
DENTON, TEXAS 76202

September 27, 1965

OEP NATURAL DISASTER MEMORANDUM NO. 4

FEDERAL-STATE ENGINEERING, CONTRACT & REIMBURSEMENT PROCEDURES
HURRICANE BETSY - STATE OF LOUISIANA

Presidential Declaration of Major Disaster - September 10, 1965
Public Law 875 - Agreement OEP 208 DR
Eligible Disaster Dates - Initial September 9, 1965; Terminal Date to be established.

* *

This memorandum amends OEP Natural Disaster Memorandum No. 1 of September 20, 1965, which delineated three procedures for completing emergency repair or temporary replacement of essential public facilities damaged by Hurricane Betsy. These amended procedures are as follows:

1. Federally-Operated Contract - When this procedure is selected, the applicant should prepare and submit a Resolution describing the emergency work to be performed. The applicant should also prepare and submit Exhibit D - Assurance of Compliance with Office of Emergency Planning Regulation 5 under Title VI of the Civil Rights Act of 1964. These completed forms should be given to the representative of the U.S. Corps of Engineers, New Orleans District, who is assigned to the appropriate parish for consultation with applicants.

An initial engineering or public health inspection will immediately be arranged to determine the extent of emergency work eligible under provisions of Public Law 875. Representatives from appropriate Federal-State Agencies will make these inspections and the Federal funds recommended in their Report of Inspection will be the basis on which the Federally-Operated Contract will be undertaken.

If the applicant has performed a portion of emergency work on the damaged facility, or facilities, when above arrangements are made, the Corps of Engineers representative will review applicant's records of expenditures. The Corps of Engineers, New Orleans District, will pay to the applicant a check for the amount of expenditures for eligible emergency work. The Federally-Operated Contract will include balance of emergency work to be performed.

2. Applicant-Operated Contract - If the applicant desires to perform emergency repair or temporary replacement of the damaged facility, or facilities, in accordance with plans and specifications prepared by an Architectural or Consulting Engineer Office, the applicant will be provided with one copy OEP Circular 4000.5A, "Instructions to Applicants, Natural Disaster Program" and two copies Form 152, "Project Application for Supplemental Federal Financial Assistance". All general information on project application, except those portions rubber-

stamped not applicable, should be completed by applicant. One completed project application should be retained for applicant's disaster records, and one copy should be given to Corps of Engineers Representative. Plans and specifications will then be reviewed by this representative to determine extent and estimated cost of eligible emergency work delineated therein. Cost of any work not eligible will be applicant's responsibility for payment. An arrangement will be developed for the applicant to receive progress payments by check periodically from Corps of Engineers, New Orleans District, for cost of eligible work until project has been completed.

If a portion of the emergency work has been performed on above basis, an arrangement will be developed wherein applicant will receive a check from Corps of Engineers, New Orleans District, for cost of eligible work to date. Additional progress payments will be made to cover cost of remaining eligible emergency work during construction of project.

3. Applicant-Force Account and/or Temporary Employees - If the applicant desires to perform emergency repair or temporary replacement of damaged facility, or facilities, with own force account and/or temporary employees, an initial engineering or public-health inspection will be made by representatives of appropriate Federal-State Agencies. Funds recommended in Report of Inspection for eligible emergency work will generally be the extent of Federal participation for the project. Corps of Engineers representative will provide the applicant with one copy OEP Circular 4000.5A, two copies Form OEP 152, and one copy "Schedule of Approved Operating Rates for Publicly-Owned Equipment". Applicant should complete both copies Form OEP 152 as described in paragraph 2 above and give one copy to Corps of Engineers Representative.

An arrangement will be developed wherein the applicant will be reimbursed periodically by check from Corps of Engineers, New Orleans District. Project payments will continue until 75% of eligible work has been performed. Thereafter no further progress payments will be made until project has been completed and final inspection made. Applicant will then be provided with Form OEP 74, Summary of Documentation, and Form OEP 83, Blanket Certificate (See Chapter IV, Preparation of Claims, OEP Circular 4000.5A). After applicant has completed these forms representatives from Corps of Engineers, New Orleans District, will audit applicant's total expenditures. A Corps of Engineers check for balance of eligible expenditures will then be forwarded to the applicant and the project will be terminated.

Schedule of Approved Operating Rates for Publicly Owned Equipment - In procedure 3 above, it is anticipated applicant will use own equipment and augment with rented equipment only as required to expedite completion of project. Schedule of Approved Operating Rates is provided for applicant's use in tabulating equipment expenditures in claim documents.

Grant-in-lieu (Grant of Funds) - In procedures 1, 2 or 3, if applicant desires permanent repair or replacement of damaged facility, or facilities, instead of emergency repair or temporary replacement, a letter of intent should be given to appropriate Corps of Engineers Representative prior to construction. If it is initially agreed this procedure is feasible, funds recommended in Report of Inspection may be made available toward permanent construction on the basis that all funds in excess of the Federal grant which are required to complete the project will be provided by the applicant. See Section D, page 9, OEP Circular 4000.5A for additional details.

OEP Natural Disaster Memorandum No. 4

Completion of Work - All emergency work undertaken in procedures 1, 2 or 3 must be completed in sufficient time to allow for final engineering or public health inspection thereof before September 10, 1966.

Corps of Engineers Representative - The attached list represents Corps of Engineers Representatives who have been temporary assigned to parishes indicated. These representatives will assist parish or other local officials in connection with procedures 1, 2, and 3.

George E. Hastings

George E. Hastings
Regional Director

Attachments

REVISED LIST OF CORPS OF ENGINEERS REPRESENTATIVES IN VARIOUS PARISHES WITHIN DISASTER AREA — 25 Sept 65

Parish	Engineer in Charge	Location	Telephone No.
Acadia	*D. P. Cairns	Police Jury Office Courthouse Opelousas, La.	942-2241
Ascension	V. L. Patton	609 Railroad Ave. Donaldsonville, La.	473-7529 473-7572
Assumption	C. W. Grisham	Police Jury Office Napoleonville, La.	7435
Avoyelles	B. E. Bridges	Police Jury Office Marksville, La.	253-9208
Caldwell	*G. H. Bragg	Police Jury Office Columbia, La.	2681
Catahoula	*H. Green	Police Jury Office Winnsboro, La.	
E. Baton Rouge	D. F. Hull	Dept. of Public Wks.Off. Municipal Bldg. Baton Rouge, La.	348-1161
E. Feliciana	*J. N. Brewer, Jr.	Town Hall Clinton, La.	683-5531
Franklin	*H. Green	Police Jury Office Winnsboro, La.	
Iberia	*R. D. Broussard	Lafayette Area Office 220 Jefferson St. Lafayette, La.	234-2658
Iberville	E. E. Barton	Courthouse Plaquemine, La.	MU7-3634
Jefferson	G. P. Jesclard	Courthouse, RM 922 Gretna, La.	367-6611,Ext.288,289
Lafayette	*R. D. Broussard	Lafayette Area Office 220 Jefferson St. Lafayette, La.	234-2658
Lafourche	W. L. O'Bannon	Police Jury Office Thibodaux, La.	HI7-3057
Livingston	T. J. Mudd	Police Jury Office Livingston, La.	686-2132
Orleans	W. E. Wunderlich	Office of Civil Defense Room 8W05, City Hall New Orleans, La.	529-4311,Ext.275
Ouachita	W. C. Porter	Ouachita Parish Engineer's Office Monroe, La.	FA2-1821
Plaquemines	J. Fortenberry	Buras High School Buras, La.	622-3983
Pointe Coupee	*E. J. Jacobs	Police Jury Office New Roads, La.	638-9556
Rapides	C. Cogswell	Police Jury Office Alexandria, La.	445-3617
Richland	*G. H. Bragg	Police Jury Office Columbia, La.	2681
St. Bernard	B. J. Roberson	Courthouse Annex Chalmette, La.	271-0421
St. Charles	H. O. Harper	Police Jury Office Courthouse Hahnville, La.	783-2233

Parish	Engineer in Charge	Location	Telephone No.
St. Helena	*J. N. Brewer, Jr.	Town Hall Clinton, La.	683-5531
St. James	R. I. Bower	c/o Francis Waguespack Vacheria, La.	265-4052
St. John the Baptist	S. J. Stokes	Police Jury Office Edgard, La.	497-3421
St. Landry	*D. P. Cairns	Police Jury Office Opelousas, La.	942-2241
St. Martin	F. E. Burnett, Jr.	Courthouse St. Martinville, La.	394-3711
St. Mary	B. W. Turina	Police Jury Office Franklin, La.	828-1770
St. Tammany	R. L. Montgomery	Police Jury Office Covington, La.	892-2911
Tangipahoa	*J. A. Brown	Police Jury Office Amite, La.	4381
Terrebonne	T. E. Johnston	Petti Grew Hotel Room 511 Houma, La.	872-0768
Washington	*J. A. Brown	Police Jury Office Amite, La.	4381
West Baton Rouge	J. H. Langston	Police Jury Office Port Allen, La.	343-3752
West Feliciana	*E. J. Jacobs	Police Jury Office New Roads, La.	638-9556

EXHIBIT 7-1
ESTIMATED COSTS UNDER PUBLIC LAW 875/81

LOCATION	CATEGORY	COST TO DATE (30 JUN 66)	ESTIMATE TO COMPLETE	TOTAL ESTIMATED COST
Acadia Parish	A	$ 4,058	$ -	$ 4,058
	D	1,101	-	1,101
	E	60	-	60
	F	1,773	-	1,773
Parish Total		6,992	-	6,992
Ascension Parish	A	382,519	-	382,519
	B	4,284	-	4,284
	D	1,395	-	1,395
	E	3,869	26,500	30,369
	F	2,571	-	2,571
Parish Total		394,638	26,500	421,138
Assumption Parish	A	14,522	-	14,522
	B	3,727	-	3,727
	D	2,936	-	2,936
	E	947	52,849	53,796
Parish Total		22,132	52,849	74,981
Avoyelles Parish	A	12,329	-	12,329
	C	19	-	19
	D	583	-	583
Parish Total		12,931	-	12,931
Caldwell Parish	A	925	-	925
Catahoula Parish	A	1,356	-	1,356
Concordia Parish	A	4,185	-	4,185
	F	7,948	-	7,948
Parish Total		12,133	-	12,133
East Baton Rouge Parish	A	711,297	33,805	745,102
	B	15,381	6,673	22,054
	C	1,524	-	1,524
	D	63,801	-	63,801
	E	3,738	16,595	20,333
Parish Total		795,741	57,073	852,814
East Baton Rouge Operation "602" *	B	1,709,386	-	1,709,386

* Cost as of 26 April 1966.

LOCATION	CATEGORY	COST TO DATE (30 JUN 66)	ESTIMATE TO COMPLETE	TOTAL ESTIMATED COST
East Feliciana Parish	A	$ 12,625	$ 100	$ 12,725
	E	2,412	1,050	3,462
	F	7,648	-	7,648
Parish Total		22,685	1,150	23,835
Evangeline Parish	A	2,072	-	2,072
	B	969	50	1,019
Parish Total		3,041	50	3,091
Franklin Parish	A	665	-	665
Iberia Parish	A	18,824	-	18,824
	B	2,725	-	2,725
	E	835	-	835
Parish Total		22,384	-	22,384
Iberville Parish	A	34,809	1,323	36,132
	B	4,024	-	4,024
	D	1,534	-	1,534
	E	6,058	16,501	22,559
	F	9,862	11,800	21,662
Parish Total		56,287	29,624	85,911
Jefferson Parish	A	2,528,090	491,496	3,019,586
	B	110,709	42,145	152,854
	C	36,021	17,500	53,521
	D	122,019	324,069	446,088
	E	270,124	321,505	591,629
	F	120,798	46,859	167,657
Parish Total		3,187,761	1,243,574	4,431,335
Lafayette Parish	A	70,801	15,216	86,017
	B	1,549	-	1,549
	D	372	-	372
	E	2,211	11,092	13,303
	F	-	21,000	21,000
Parish Total		74,933	47,308	122,241
Lafourche Parish	A	575,245	29,338	604,583
	B	5,807	34,158	39,965
	C	9,043	1,642	10,685
	D	49,211	27,711	76,922
	E	5,580	315,735	321,315
	F	103,897	28,078	131,975
Parish Total		748,783	436,662	1,185,445

LOCATION	CATEGORY	COST TO DATE (30 JUN 66)	ESTIMATE TO COMPLETE	TOTAL ESTIMATED COST
Livingston Parish	A	$ 102,030	$ 16,343	$ 118,373
	D	30	-	30
	E	1,077	500	1,577
Parish Total		103,137	16,843	119,980
Orleans Parish	A	6,952,472	456,000	7,408,472
	B	521,595	2,348,500	2,870,095
	C	36,273	349,460	385,733
	D	386,054	2,112,238	2,498,292
	E	2,799,741	2,821,111	5,620,852
Parish Total		10,696,135	8,087,309	18,783,444
Ouachita Parish	A	5,401	-	5,401
Plaquemines Parish	A	2,489,497	4,500	2,493,997
	B	122,326	60,988	183,314
	C	41,395	760	42,155
	D	303,482	-	303,482
	E	58,075	-	58,075
Parish Total		3,014,775	66,248	3,081,023
Pointe Coupee Parish	A	65,190	-	65,190
	E	311	8,675	8,986
	F	5,407	1,193	6,600
Parish Total		70,908	9,868	80,776
Rapides Parish	A	15,432	-	15,432
	F	12,775	-	12,775
Parish Total		28,207	-	28,207
Richland Parish	A	596	-	596
St. Bernard Parish	A	1,259,661	-	1,259,661
	B	119,401	79,283	198,684
	C	-	8,494	8,494
	D	83,250	126,222	209,472
	E	377,380	132,391	509,771
Parish Total		1,839,692	346,390	2,186,082
St. Charles Parish	A	785,250	1,759	787,009
	B	-	51,900	51,900
	C	35,391	27,109	62,500
	D	22	1,678	1,700
	E	1,852	-	1,852
Parish Total		822,515	82,446	904,961

LOCATION	CATEGORY	COST TO DATE (30 JUN 66)	ESTIMATE TO COMPLETE	TOTAL ESTIMATED COST
St. Helena Parish	A	$ 13,307	$ -	$ 13,307
	E	-	64	64
Parish Total		13,307	64	13,371
St. James Parish	A	615,243	-	615,243
	B	5,774	7,083	12,857
	D	3,762	1,498	5,260
	E	2,559	213,924	216,483
	F	866	-	866
Parish Total		628,204	222,505	850,709
St. John the Baptist Parish	A	157,643	-	157,643
	B	19,206	100	19,306
	D	974	5,535	6,509
	E	3,362	38,100	41,462
Parish Total		181,185	43,735	224,920
St. Landry Parish	A	14,294	-	14,294
	D	54	-	54
	E	1,474	32,301	33,775
	F	1,325	15,600	16,925
Parish Total		17,147	47,901	65,048
St. Martin Parish	A	157,070	-	157,070
	C	1,065	-	1,065
	F	10,220	-	10,220
Parish Total		168,355	-	168,355
St. Mary Parish	A	144,557	-	144,557
	B	13,616	-	13,616
	C	836	-	836
	D	6,962	-	6,962
	E	2,285	3,500	5,785
	F	42,077	-	42,077
Parish Total		210,333	3,500	213,833
St. Tammany Parish	A	195,479	-	195,479
	B	821	-	821
	C	6,364	753	7,117
	D	2,052	3,695	5,747
Parish Total		204,716	4,448	209,164
Tangipahoa Parish	A	313,709	-	313,709
	B	340	1,050	1,390
	D	30	-	30
	E	355	8,087	8,442
Parish Total		314,434	9,137	323,571

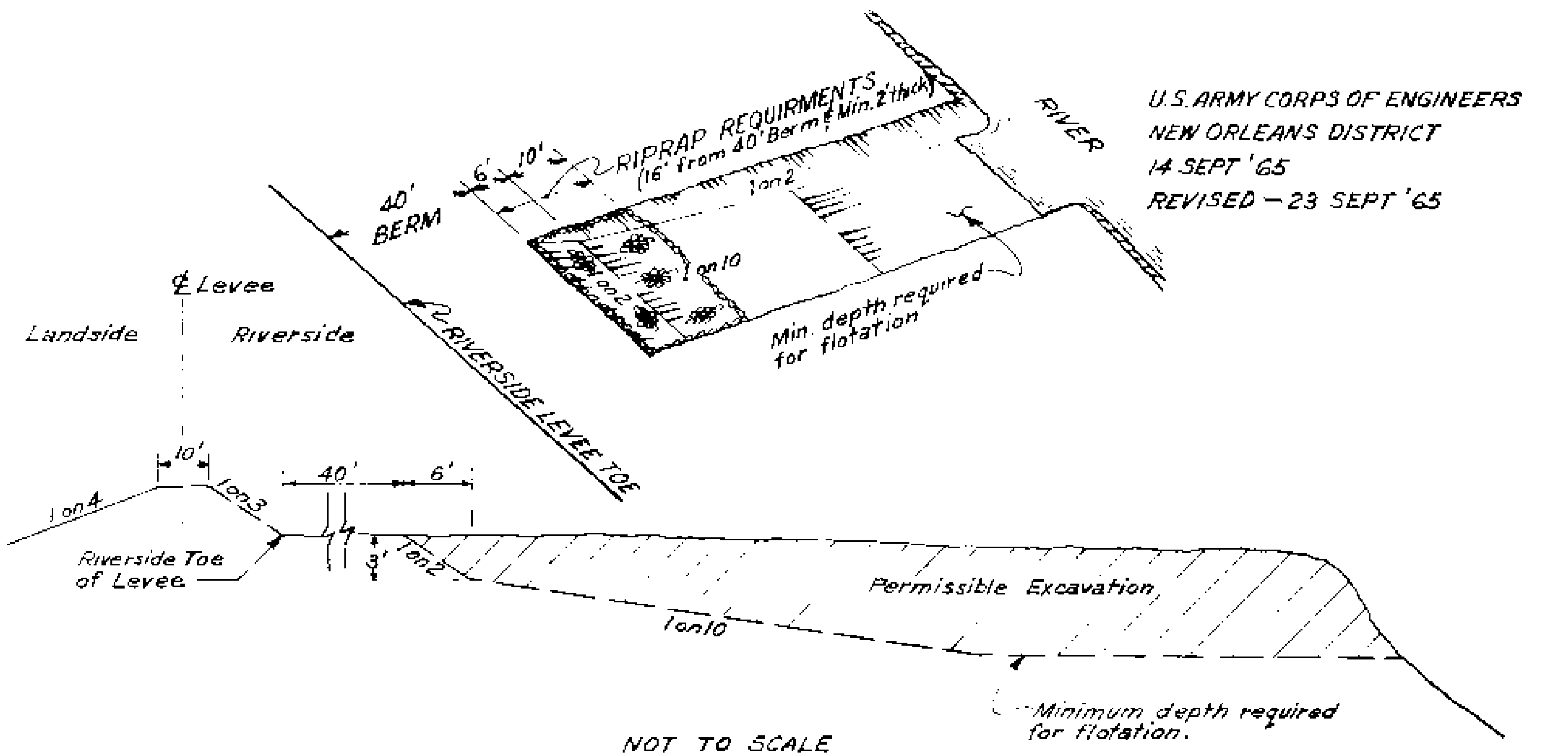
EXHIBIT 7-1

LOCATION	CATEGORY	COST TO DATE (30 JUN 66)	ESTIMATE TO COMPLETE	TOTAL ESTIMATED COST
Tensas Parish	A	$ 2,286	$ -	$ 2,286
Terrebonne Parish	A	560,993	52,760	613,753
	B	-	28,900	28,900
	C	80,550	-	80,550
	E	-	14,100	14,100
	F	-	45,500	45,500
Parish Total		641,543	141,260	782,803
Washington Parish	A	20,653	-	20,653
West Baton Rouge Parish	A	95,885	-	95,885
	B	10,060	2,440	12,500
	D	30	5,260	5,290
	E	2,873	9,695	12,568
	F	-	320	320
Parish Total		108,848	17,715	126,563
West Feliciana Parish	A	3,093	-	3,093
District Overhead		261,027	216,000	477,027
Total P.L. 875/81 Expenditures		$26,429,270	$11,210,159	$37,639,429

EXHIBIT 7-1

EXHIBIT 7-2
SUMMARY OF PUBLIC LAW 875/81 EXPENDITURES

CATEGORY	AMOUNT
A	$19,446,703
B	5,334,970
C	654,199
D	3,637,560
E	7,591,453
F	497,517
District Overhead	477,027
Total	$37,639,429



NOTE: For Levees on West Bank from Jefferson - Orleans Parish line upstream slopes are 1 on 5.5 (L.S.) and 1 on 4 (R.S.)

For Levees on East Bank from St. Bernard - Orleans Parish line upstream slopes are 1 on 5.5 (L.S.) 1 on 4 (R.S.)

LIMITS OF EXCAVATION FOR REMOVAL OF MARINE VESSELS FROM MISSISSIPPI RIVER LEVEES

A.E.F.

EXHIBIT 10-1

EXHIBIT 10-1

SELECTED NEWSPAPER ARTICLES

EXHIBIT 16-1

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
STATES-ITEM 20 Sep 65

Engineers Hire Equipment to Speed Cleanup

A fleet of private trucks and other equipment has been hired by the U.S. Army Engineers to speed the cleanup in the aftermath of Hurricane Betsy.

Col. Thomas J. Bowen of the Corps of Engineers said today that 267 dump trucks, 13 winches, 10 bulldozers, 15 loaders and other miscelleanous equipment have been put into service.

He said this would be paid for out of the $2 million emergency funds granted by President Lyndon B. Johnson through the Office of Emergency planning.

He said there had been reports of persons asked to pay for having debris removed. He stressed that this is being done free of charge, and that any person asked to pay should take the truck's license number and report it to the Corps of Engineers, phone 865-1121.

Col. Bowen said local contractors were called together to determine just what equipment was available, and as soon as a piece of equipment became available, it was hired.

He also revealed that two Army Engineers dredges and a pump were at work draining the flooded Venice area, and four such pumps are in operation at the Citrus st. pumping station in eastern New Orleans, draining the Pine Village and Donna Villa areas.

STATES—TIMES

27 SEP 1965

Army Engineers Aid Hurricane Clearance Work

NEW ORLEANS — The New Orleans District Office of the Army Corps of Engineers now has 257 dump trucks, 13 winch trucks, 10 dozers and 15 loaders, with miscellaneous other equipment at work on debris cleanup in the aftermath of Hurricane Betsy, Col. Thomas J. Bowen, district engineer, reported today.

The Corps is working in conjunction with the Federal Office of Emergency Planning in the clean-up project in this area.

Bowen advised residents there is no charge for any of this debris removal from the streets. He said anyone approached by debris removal personnel for payment should note the number of the truck and telephone the Army Engineers office at 865-1121, Ext. 293. Some reports of solicitations have been received, he explained.

Col. Bowen said the engineers still have one hydraulic dredge pumping floodwaters from the area north of the Mississippi River-Gulf Outlet, stationed near the Bulk Handling Facility. He said they also have two dredges and a pump barge in operation relieving the flooded Venice area.

At Citrus, the corps has installed one 30-inch, two 36-inch, one 8-inch, and one 6-inch pumps to remove water from the Pines Village-Dona Villa areas.

Corps emergency assistance teams are working with parish and city officials in 28 parishes to effect flood relief and debris clearance, as needed. Additional parishes will have assistance teams in as fast as needed and available, Bowen said.

EXHIBIT 16-1

STATES—TIMES

21 SEP 1965

Waterway Sites Damage Reports Asked by Corps

NEW ORLEANS — The U.S. Army Corps of Engineers here has asked holders of permits for structures or work in navigable waters to report any damages suffered in Hurricane Betsy.

The district office here is seeking all information available on damaged structures and vessels so "necessary precautions can be taken for the protection of navigation," Col. Thomas J. Bowen, district engineer, said.

Included in information being sought by the engineers are definite location of structure, permit file number and date, damage report, depth of water above highest point, repair and salvage arrangements and only other pertinent data which will aid in protecting navigation.

Bowen said permit holders should forward the information to Permit Section, U.S. Army Engineer District, Foot of Prytania Street, New Orleans.

EXHIBIT 16-1

LEVEE WORK DUE 'IMMEDIATELY'

Trucks Fan Out Across City to Speed Cleanup

Three hundred trucks and crews fanned out across the city this morning to speed the cleanup from Hurricane Betsy.

Meanwhile, construction was scheduled to begin "immediately" on hurricane protection levees arcoss Lounsiana from the mouth of the Mississippi River to Texas, according to Gov. John J. McKeithen.

The governor, who spoke here yesterday and toured the flood-damaged areas of New Orleans and St. Bernard parishes, said he saw an immediate need for trucks to haul away debris. The U.S. Army Engineers was hiring private trucks to meet this need.

M'KEITHEN CALLED the storm the "greatest adversity that came our way since Louisiana became a state," with the possible exception of the Civil War.

He said the Mississippi River levees now standing probably prevented the tidal surge which followed Betsy from causing even more destruction in the New Orleans area. Exposed coastal areas to the city's west have no such levees, he added.

"We've got to protect this great southern part of our state . . . We've got to start construction immediately, and we shall." He said he expected federal funds to help pay for the work.

COUNCILMAN Walter F. Marcus yesterday gave a briefing on the trash and debris situation after a meeting with city department heads and Mayor Victor H. Schiro.

"No area is yet completed, but all are now in the process. We are giving priority, however ,to areas that were flooded," Marcus said.

"It's pretty disheartening to try to restore your damaged home if soaked mattresses and ruined furniture are still sitting outside."

MARCUS STRESSED that no one is to pay truckers for the pickup service. He said some had been trying to collect money from residents.

Marcus noted that trucks often have to return to a neighborhood several times.

John Cassreino, head of the sanitation department, said many complaints have been received from residents of the Pines Village and Donna Villa areas.

"I WANT TO TELL these people that we've already been there and picked up and will return again. The thing is that some are returning home for the first time since the storm and didn't see what it looked like immediately after," he said.

Mayor Schiro announced that he would appoint a committee to look into a moratorium on interest payments for those sustaining property losses.

The mayor appointed Councilman John J. Petre and Joseph W. Simon, executive director of the Chamber of Commerce of the New Orleans Area, to develop the moratorium proposal.

See BETSY—Page 4

PETRE, ALREADY heading a complaint bureau to look into profiteering, said "the number of complaints justifies this operation . . . Further, we hope its existence will discourage continuation of this practice."

Dr. Rodney C. Jung, city health officer, said the population of evacuees at the Algiers Naval Station is now less than 3,500.

Residents of Plum Orchard subdivision in eastern New Orleans said flood water was still above their sidewalks this morning. Yesterday some flooding remained in Pines Village and Donna Villa. Other previously flooded areas were reported dry.

EXHIBIT 16-1

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
TIMES-PICAYUNE **21 Sep 65**

Betsy Damage Hearings Due in N.O., Baton Rouge

(Times-Picayune Washington Bureau)

WASHINGTON — The House Public Works Committee will hold hearings Saturday and Sunday in New Orleans and Baton Rouge on property damage caused by Hurricane Betsy.

Four members of the committee will inspect the hurricane-devastated South Louisiana areas Friday afternoon.

The committee will be joined in the inspection tour and hearings by Reps. Hale Boggs, James H. Morrison and Edwin E. Willis.

Announcement of the hearings was made by Reps. Boggs and Morrison.

The group will be headed by Rep. Robert E. Jones, D-Ala., chairman of the House flood control subcommittee.

The committee will take testimony on public and private property damage in four states from state, city, parish and federal officials. The states are Louisiana, Mississippi, Alabama and Florida.

Members of the committee will include Reps. Kenneth Gray, D-Ill., John R. Schmidhauser, D-Iowa, and Robert Sweeney, D-Ohio.

Reps. Boggs and Morrison said the committee will collect testimony with the idea of making recommendations for special legislation to aid hurricane victims.

The committee may also recommend further work and improvements on the proposed $85 million hurricane barrier protection plan for New Orleans.

Since the barrier project is included in the omnibus rivers and harbors bill scheduled for House action Tuesday, these recommendations would have to be offered later.

Joining the committee over the weekend will be Rex M. Whitton, director of the bureau of public roads, and representatives from the Agriculture Department, Economic Development Administration, Housing and Home Finance Administration, Army Engineers, Maritime Administration, Small Business Administration, U. S. Public Health Service, Office of Emergency Planning and perhaps the Interior Department.

EXHIBIT 16-1

U S ARMY ENGINEER DISTRICT, NEW ORLEANS

MORNING ADVOCATE

22 SEP 1965

Corps Assisting Flood Relief, Debris Cleanup

NEW ORLEANS—Emergency assistance teams of the Army Corps of Engineers are working in 28 parishes to effect flood relief and debris clearance, Col. Thomas J. Bowen, New Orleans district engineer, said Tuesday.

The New Orleans district has 267 dump trucks, 13 winch trucks, 10 bulldozers and 15 loaders at work on debris clean-up, he said. A hydraulic dredge is pumping floodwaters from the area north of the Mississippi River-Gulf Outlet, two dredges and a pump barge are in the flooded Venice area, and other water-removing equipment is at work in the Pines Village-Dona Villa areas at Citrus.

EXHIBIT 16-1

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
TIMES-PICAYUNE 25 Sep 65

Engineer Corps Restoring Dike

Aids Work on Chalmette Back Levee

U.S. Army Corps of Engineers personnel and equipment are working rapidly to restore about 600 feet of the storm-damaged Chalmette back levee behind Carolyn Park and adjacent areas.

Col. Thomas J. Bowen, the New Orleans district engineer, said water flowing over the levee caused numerous crevasses on the landside and damaged the protective work extensively.

Through the early part of this week, prolonged high tides covered the marsh area outside the levee; and additional levee failures were viewed as possibilities.

The Corps went into the area to assist the Lake Borgne Levee District and the area engineer, Lousiana Department of Public Works, in making emergency closures. After these closures were made, the corps undertook the job of restoring the 600-foot damaged section of the levee.

Along the Chef Menteur hwy., W. E. Wunderlich, liaison officer between the Corps and the city of New Orleans, reported Friday at a mayor's briefing, that there "is only a little bit of water in some of the streets of Pines Village and Donna Villa and other subdivisions along Hwy. 90."

He told those attending a briefing at City Hall that "the culverts are being opened by the Sewerage and Water Board to release additional water from the flooded area east of Hwy. 90 so that it can flow to Citrus Pump Station and be pumped into the lake."

Col. Bowen said that the corps-installed five pumps at the Citrus Pumping Plant on the lakefront continued to remove floodwaters from the area east of the Industrial Canal.

One hydraulic dredge and pump barge continued to pump out the Venice area, and two pumps were installed at Fort Jackson for water-removal operations there. Two marsh cranes are in that area cutting and clearing drainage ditches.

Trucks and loaders ordered by the corps continue to roll into debris-clearance service in the parishes affected by Betsy.

Col. Bowen noted that the corps now has 691 vehicles clearing debris from 11 Louisiana parishes. This total is constantly building up as local authorities make their needs known and equipment becomes available. Parishes, cities, or towns that have the capability and can mobilize equipment to remove debris from public property in their areas will be reimbursed by the federal government, through the Army Corps of Engineers.

U S ARMY ENGINEER DISTRICT, NEW ORLEANS

THE TIMES-PICAYUNE 2 - OCT 1965

OEP Continues Working to Coordinate Repair, Aid

Hurricane Recovery Activity Advances

The hurricane recovery activity showed little letup Friday, a report by the Office of Emergency Planning indicated.

Four disaster specialists from the federal OEP continued working with state and local officals to coordinate damage repair and monetary assistance.

For those still without individual shelter, the General Services Administration has purchased 360 mobile homes, some of which have been delivered to Grand Isle, Pointe a La Hache, Port Sulphur, Empire, Buras, Venice, Yscloskey and Reggio.

More of these units, said the OEP, will be needed in several of these communities as the areas become more habitable.

Requests for federal financial assistance to schools and public facilities are expected to continue for "several weeks," the report stated.

The Small Business Administration has received more than 2,278 applications for home repair and business loans, asking a total of $16,139,612, according to the OEP. Of these, 331 have been approved for $904,977, and disbursements totaling $266,310 have been made on 141 of the approved loan requests.

Debris clearance and structure repairs in Orleans, Jefferson, St. Bernard and Plaquemines Parishes continues under direction of the U.S. Army Corps of Engineers.

In Orleans, structurally unsafe buildings were being demolished by contractors and, said the OEP, the Army agency is assisting parish drainage pumps with its own against high tides caused by tropical storm Debbie in the eastern New Orleans area.

The corps' contractors are also removing houses still obstructing roads in Plaquemines Parish, although some operations in the vicinity of Lake Borgne are being hampered by minor flooding also brought by tropical storm Debbie. Pumping operations in the Boothville Water Plant reservoir are continuing, the report said.

Low spots and holes in St. Bernard's Chalmette-Arabi back levee are being repaired by Corps of Engineers crews, and contractors are hauling material for levee repairs and assisting in clearing drainage canals.

Also released were estimates of damage to U. S. Coast Guard aids to navigation. Of 1,423 damage units, 1,235 have been restored to normal operation, according to the OEP, with another 104 temporarily repaired.

EXHIBIT 16-1

THE TIMES-PICAYUNE 5 OCT 1965

Releases Needed by Army for Grand Isle Cleanup

Owners' Refusal to Hinder Rebuilding, Claim

No one thing will hinder reconstruction in Grand Isle more than failure of property owners to submit releases granting permission for cleanup to the U. S. Army Corps of Engineers, according to Samuel Sands, resident engineer.

Of the [illegible] homes located on Grand Isle prior to hurricane Betsy, [illegible] are beyond repair, according to the Jefferson Health Unit. Eighty per cent of the motels and all house trailers were destroyed, it said.

The U. S. Army Corps of Engineers has moved heavy equipment to Grand Isle to clear debris, Sands said. Forms granting access to the corps to clear property should be mailed to Mrs. Virginia Adam, Town Clerk, Grand Isle, or returned to an alderman, he said.

Rainfall from tropical storm Debbie saturated the island and all ditches are clogged with debris and sand. Drainage is a serious problem. John Blanchard, Grand Isle alderman, said he is seeking help in getting drainage ditches reopened immediately. Gov. McKeithen has been asked to extend the authority of the highway department to cope with this need.

Many people are back in business and regular suppliers are making daily deliveries. Sightseers are urged to stay away from the island.

Presently, the Grand Isle school is the community nerve center and is supplying temporary offices for the town, the Red Cross, the Salvation Army, the U.S. Corps of Engineers, communications, and the local physician, Dr. John Meador.

HOPES TO BEGIN CLASSES

Louis Cheramie, principal of the Grand Isle School, said he hopes to get classes started soon.

Shortly after the storm, the Red Cross and Salvation Army distributed food and clothing to persons returning to check their homes. Mel Little, of the Red Cross Disaster Relief unit, said the Red Cross served three hot meals each day to those who applied. It maintains a mobile unit which travels the island with refreshments for utility and road crewmen and residents. He said the moible unit will remain as long as needed and will feed any workmen staying on Grand Isle to rebuild homes, businesses, or public buildings.

State Highway No. 1 has been closed to facilitate rebuilding and supplying of the island. Daily mail service has been re-established. The Lafourche Telephone Co. has installed a number of pay stations for general use. Herbert Shaws, company executive, said individual telephones should be reinstated in some cases in a few days. The Lafourche Telephone Co. has maintained communications through its mobile operator in Golden Meadow.

WATER MAIN FLUSHED

Early last week, the water main was being flushed with chlorine. Service will be restored when samples are approved by the health department. Restoration of natural gas will require about four weeks because of damage to the pressure reduction and odorizing stations.

The Louisiana Power and Light Company has some power restored. The first to receive electricity were services essential to the community.

Visitors wishing to remain overnight in Grand Isle should obtain hotel accommodations in Golden Meadow.

EXHIBIT 16-1

MORNING ADVOCATE
8 Oct. 1965

N.O. District Engineer Tells Of Corps' Role in Hurricane

By ROY WELLS

Col. Thomas J. Bowen, Corps of Engineers, told a meeting of the Society of American Military Engineers Thursday evening at LSU about the role of the Corps of Engineers during Hurricane Betsy.

With Bowen was the deputy engineer for the New Orleans district, Lt. Col. Lawrence W. Norton, who is supervising raising of the sunken chlorine barge in Baton Rouge.

Bowen, district engineer for New Orleans, discussed the damage caused by Hurricane Betsy in Southern Louisiana. He illustrated his remarks with color transparencies.

Grand Isle Worst

Bowen said that the storm had a very high forward speed of 20 miles per hour, and that the degree of damage was high in the vicinity of Grand Isle and varied to lesser amounts as it moved northward.

Flooding in the New Orleans area reached a reported height of eight feet. The Industrial Levee was broken in three places and appeared to have been eroded from both sides. Pictures were shown of homes with water at door-top height and furniture stacked on rooftops.

Homes were washed across highways and in some cases completely blocked traffic in both lanes.

There was evidence that many homes were lifted off their foundations and blown away by the high winds. Some foundation structures are still standing.

As engineer for the Office of Emergency Planning, the district engineer's office mobilized six dredges and had contractors bring in equipment to pump water from low, flooded areas. This was necessary because city pumps were under water and not working.

The engineers were also responsible for removing debris in order to restore public facilities. Much of the work was done by private contractors under Corps of Engineer supervision.

Lt. Col. Norton described the search and finding of the sunken chlorine barge. He said that the barge is believed to have been sunk early in the morning of Sept. 10.

The barge was located by a sonic-profiler provided by the Tennessee Gas Pipeline Company with the company's crew operating the device. He said the operator, Lee Miller, discovered the barge before the Navy was able to detect it with magnetic devices. The sonic-profiler draws an outline of the object on a piece of graph paper after passing over it.

Describes Sunken Barge

Using a scale model of the barge, Norton showed the group that the vessel contained four separate tanks. Each of the tanks is independent from the other and is filled to about 85 per cent capacity.

Pipes which are on the outside of the tanks do not contain any of the chlorine gas. Pictures of similar tanks with valves and pipes were shown and explained to the group.

Norton said the plan is to lift the barge intact. He indicated that there are derricks available which can lift up to 800 tons. Submerged, the barge weighs about 388 tons. Underwater inspection of the tanks indicates that the tanks are not damaged in any way.

Explaining the participation of the Corps of Engineers in the operation of finding the missing barge, he said the engineers were responsible for the search and identification, and the final salvage operations when the barge is raised. The lifting of the barge will also be under Corps of Engineer supervision, he said.

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
STATES-ITEM 11 Oct 65

Engineer Corps Cites Cleanup Role Success

United States Corps of Engineers officials said today they believe their part in the citywide debris-removal program has been carried out with a high degree of success.

They noted that the corps and city officials have a target date of next weekend for complete cleanup of the city. Corps contract equipment and men have already covered the entire city once.

Col. Thomas J. Bowen, district engineer for the New Orleans area, recalled that within 48 hours after Hurricane Betsy hit the coast of Louisiana, the corps was organizing contractor's equipment "for the herculean debris-removal task the city would be confronted with."

AT THE PEAK of the operation, 1,001 trucks, 273 loaders, bulldozers, 190 power saw crews and related rolling support equipment were functioning in the operation.

Col. Bowen noted that the removal of debris is but one facet of the Corps' overall disaster recovery program. However, it is one that has been viewed as top-priority.

Corps officials say the clean-up story is not a very glamorous one—but picking up debris never is.

They recall being told by one New Orleanian—"I never thought I'd be so happy to see a trash truck."

CITY SANITATION officials are now making a city-wide survey to determine locations where debris may not yet have been removed or where debris has been placed since the Corps made its initial sweep of the areas.

The Corps, in cooperation with city and surrounding parish officials, is planning that its second sweep will insure complete debris removed from these areas.

Individual homeowners have been encouraged to cooperate by clearing their property as soon as possible and getting the debris out along the streets so it can be picked up.

Corps officials say that nearly 4,000 laborers have taken part in their massive operation and more than [illegible] truckloads a day—more than [illegible] since the operation [illegible] have been hauled to city and parish dumps for burning.

They say that although only one month has passed since Hurricane Betsy struck, the metropolitan area is now virtually clean.

Among the vast array of debris swept up by cleanup crews have not only been countless branches and whole trees but also the entire contents of homes, Corps officials say.

Included among the ruined items that have been discarded were thousands of television sets, sofas, mattresses, box springs, rugs, tables, children's toys and even family photo albums.

EXHIBIT 16-1

U.S. ARMY ENGINEER DISTRICT, NEW ORLEANS
TIMES-PICAYUNE 16 Oct 1965

Grand Isle Clearing Okayed

(Times-Picayune Washington Bureau)

WASHINGTON — To safeguard the health of Grand Isle, La., citizens, the Army Corps of Engineers will conduct further wreckage and debris clearance on private property there as quickly as possible, Rep. Hale Boggs announced Friday.

Boggs' announcement came after Grand Isle Mayor Michael "Mickey" Harris notified him of the approval of a resolution designating certain private property areas as health hazards and giving the Army Engineers permission to move in with bulldozers, trucks and other equipment to clear out more debris.

Some 98 per cent of the homes and other buildings on Grand Isle were destroyed or severely damaged by hurricane Betsy, which raked across the island on the night of Sept. 9. In the wake of Betsy's 125-mile-an-hour wind, wreckage and debris covered all parts of the community.

"I am quite pleased and relieved that the aldermen of Grand Isle and Mayor Harris have acted with such dispatch so that the army engineers can clear more wreckage and debris from the island," Boggs said.

"There is no doubt that the continued presence of so much debris after five weeks' time constitute a severe health hazard. I am glad to be able to assist Mayor Harris and the people of Grand Isle in this way so that they may enjoy protection against the dangers of disease."

In other developments concerning Grand Isle, Boggs noted that the Army engineers had completed the necessary survey for rebuilding the beach on the island and "this work should begin very soon."

The Louisiana congressman also pointed out that the House public works committee next week is expected to approve his resolution calling for a new review of direct hurricane protection for Grand Isle.

"With the committee's approval, the army engineers will conduct another thorough study of the need and the desirability for hurricane protection for the island," Boggs added.

He also said that the "special bill" to provide additional financial aid to hurricane Betsy victims, which Congress is expected to act upon next week, will allow Grand Isle citizens now living in government-owned-trailers to purchase them at "fair and equitable prices."

:XHIBIT 16-1

NEW ORLEANS STATES AND ITEM

2 4 NOV 1965

EROSION FROM BETSY TARGET

Vast Program to Restore Grand Isle Shoreline

United States Engineers and the State Department of Public Works have launched a twofold program to restore the beaches and reduce erosion along the shoreline of hurricane-battered Grand Isle.

Immediate plans call for restoration of a jetty extending out from the eastern end of the island, dredging and hauling more than 1.5 million yards of sand to reconstruct the beaches and completion of a study to eliminate beach erosion.

These plans were discussed today by Congressman Hale Boggs, Grand Isle Mayor Michael "Mickey" Harris, Col. Thomas J. Bowen, district engineer for the Corps of Engineers, and George Hudson, chief of engineering for the New Orleans district.

HUDSON SAID at the meeting bids would be let Tuesday for the reconstruction of the jetty, which was severely damaged by Hurricane Betsy Sept. 9.

Col. Bowen said the engineers are hopeful of starting within 90 days to haul in the sand necessary to bring the beaches up to their former level. This phase is expected to take five to six months to complete.

The engineer said most of the sand used to restore the beaches will probably be dredged from the area immediately in front of the jetty and then trucked to the low areas of the beach.

COL. BOWEN, however, said it is hoped that some sand may be dredged from the Gulf closer to the areas where restoration work is being undertaken.

Boggs emphasized that the whole area has been under study by the beach erosion division of the Corps of Engineers for some time and "a survey in depth" is continuing to reduce sand erosion.

He said the engineers will restore the sand dunes along the Louisiana hwy. 1, which runs along the island's Gulf coast.

"All of this, of course, was made possible by legislation which Congress passed recently giving the engineers quite a bit of latitude in the work they are doing there," Boggs said.

"Without the help of the Army engineers I think it would be safe to say that these beaches would never be restored."

Grand Isle was the major population center struck by the full intensity of Hurricane Betsy, he said.

While almost all of the work in reconstruction and planning is being done by the Corps of Engineers, the Department of Public Works will have the responsibility of maintaining the area once it is completed.

Betsy Still Vital Factor In Lives Of Many People

NEW ORLEANS, La. (AP) — Tourists are gleeful in the naughty French Quarter, the nation's No. 2 port is busy and midtown New Orleans seems miraculously unscarred.

The casual eye sees little evidence that the century's most destructive herricane passed this way three months ago, leaving about $1 billion damage.

Except for a few broken billboards or neon signs, the midtown area looks much as it did before Hurricane Betsy's 125 m.p.h. winds.

Florida

The same is true of the Miami, Fla., vicinity, raked by Betsy when she doubled back out of the Atlantic to run the slot between Florida and the Bahamas and rago into the Gulf of Mexico.

But Betsy, 90 days after, remains a major factor in the daily libes of thousands. Tse aftermath will linger for months to come in some sections.

Louisiana was hardest hit. Midtown New Orleans may show few scars but in residential areas the roof is rare which doesn't need or wear a patch.

In New Orleans sections flooded by levee breaks due to tidal surges, thousands of home owners still struggle with "do it yourself" repairs.

The corrosive salt water ruined clothing, furniture, floors, wallboard, electrical appliances, shrubbery—and cars.

The water left behind a heavy mold of black, gray, green and yellow. It persisted nearly two months, despite scrubbings.

For reasonably prosperous citizens Betsy was a staggering financial blow. For the less prosperous it would have been a knockout except for Red Cross or other welfare agency help.

The Insurance Information Institute estimates total claims in Florida and Louisiana will reach $750 million — most of it in Louisiana.

Wells Hit

The enormously expensive offshore oil well installations which dot the blue Gulf for 60 miles out to sea from the Louisiana coast caught 150 m.p.h. winds and battering waves.

Shipping losses on the river, which wrung a cry of financial pain from Lloyds of London, are best capsuled by this recent survey by Army Engineers.

	Sunk	Salvaged
Barges	41	21
Ships	3	1
Boats	10	7
Misc.	16	0
	Beached	**Salvaged**
Barges	131	112
Ships	5	5
Boats	18	10
Misc.	22	10

In these figures, a craft over 200 feet long was considered a ship. About 12,000 small craft estimated to be Betsy casualties are not included.

"Miscellaneous" ranged from a Navy floating drydock, which went down just off the New Orleans waterfront, to a $5 million oil well drilling rig, river ferries, dredges and even a steam shovel.

Death Toll

The Red Cross listed the Louisiana death toll from Betsy at 7—a lot lower than most people thought it would be.

The cleanup in New Orleans and Miami continues. Hundreds of thousands of truckloads of debris have been hauled away in the New Orleans metropolitan area.

In mid-November, the federal Neighborhood Youth Corps extended its cleanup project in Louisiana another eight weeks.

From New Orleans, the further south you go along the flat Mississippi Delta strip extending 90 miles to the Gulf the greater the destruction on land.

Venice, Buras, Boothesville, Delacroix, Yscloskey, Grand Isle — these and other small towns in that oil, fishing, cattle and citrus area are slowly coming back to life.

Many of the 1,233 homes which the Red Cross listed as totally destroyed were in the areas south of New Orleans.

:XHIBIT 16-1

MINIMUM SAFETY REQUIREMENTS - DEBRIS CLEARANCE

1. All trucks will obey local traffic laws.

2. Employees riding in trucks will ride with all parts of their bodies within the truck beds.

3. Employees will not jump down from the beds of trucks. Dump bodies will be locked in position while transporting personnel.

4. At least one employee will signal traffic and the contractor's truck while it is being positioned or moved.

5. Employees working under booms or other hoisting equipment will wear hard hats.

6. Employees doing manual debris pick-up will wear gloves.

7. When loads are being lifted by cranes, only one appointed man will signal. Employees hooking load must be in the clear before the load is lifted.

8. One employee will be in proper position and will signal the operator when work is being done in the vicinity of electrical lines.

9. Employees will not lean against or touch any hoisting equipment unless equipment is shut down.

10. Employees handling or using gasoline will not smoke. Employees will be cautioned not to spill gasoline on themselves or other persons.

11. Gasoline will not be used for burning.

12. When trees are being trimmed, either the ground man or a signal man will keep all persons in the clear.

13. Saw units shall be spaced far enough apart so that the action of one unit will not interfere with that of another.

14. Employee will be instructed to report <u>all</u> injuries.

U.S. ARMY
CORPS OF ENGINEERS

BONNET CARRE QUADRANGLE
LOUISIANA

PRINTED BY ARMY M.R.C., VICKSBURG, MISS. 10-96 1212

Mapped, edited and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Compiled in 1969 from U.S.G.S., 7.5-minute quadrangles, Bonnet Carre NE, Ruddock NW, Labranche SE and Laplace SW, scale 1:24,000.

Revised in 1989 & 1996 from aerial photography taken in 1988 & 1995 and other source materials.

This information was not field checked.

Control by Mississippi River Commission and U.S. Army Engineer District, New Orleans, Corps of Engineers, National Geodetic Survey and Louisiana Geodetic Survey.

Polyconic Projection 1927, North American Datum.

Descriptions, elevations and geodetic positions of permanent survey marks may be obtained from the U.S. Army Engineer District.

Political boundaries are shown according to best available information.

Work under Flood Control Act shown as of October 1996.

Scale 1:62,500

Contour Interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

APPROXIMATE MEAN DECLINATION 1996 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 7' WESTERLY

LEGEND

Project Levee	Levee Mile Post LMP
Secondary Levee	Levee Station LS
Retards and Dikes	Towhead TH
Revetment	Gaging Station

ROAD DATA 1996

In developed areas, only through roads are classified.

Hard surface, heavy duty
Hard surface, medium duty
Loose surface, graded and drained, or narrow hard surface road
Improved dirt road or street

U.S. ARMY
CORPS OF ENGINEERS

BONNET CARRE QUADRANGLE
LOUISIANA

Mapped, edited and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Compiled in 1969 from U.S.G.S., 7.5-minute quadrangles, Bonnet Carre NE, Ruddock NW, Labranche SE and Laplace SW, scale 1:24,000.

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This information was not field checked.

Control by Mississippi River Commission and U.S. Army Engineer District, New Orleans, Corps of Engineers, National Geodetic Survey and Louisiana Geodetic Survey.

Polyconic Projection 1927, North American Datum.

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Work under Flood Control Act shown as of October 1996.

Scale 1:62,500

Contour Interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15 IS INDICATED BY TICKS OUTSIDE THE NEATLINE
LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

APPROXIMATE MEAN DECLINATION 1996 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 7' WESTERLY

PRINTED BY ARMY M.R.C., VICKSBURG, MISS. 10-96 1212

LEGEND

Project Levee		Levee Mile Post	LMP
Secondary Levee		Levee Station	LS
Retards and Dikes		Towhead	TH
Revetment		Gaging Station	•

ROAD DATA 1996

In developed areas, only through roads are classified.

Hard surface, heavy duty
Hard surface, medium duty
Loose surface, graded and drained, or narrow hard surface road
Improved dirt road or street

U.S. ARMY
CORPS OF ENGINEERS

CHEF MENTEUR QUADRANGLE
LOUISIANA

PRINTED BY ARMY W.R.C., VICKSBURG, MISS. 5-96 1208

Mapped, edited and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Compiled in 1983 from U.S.G.S., 7.5-minute quadrangles, North Point, South Point, Little Woods and Chef Menteur, 1967, scale 1:24,000.

Revised in 1995 from aerial photography taken in 1994 and other source materials.

This information was not field checked.

Control by Mississippi River Commission and U.S. Army Engineer District, New Orleans, Corps of Engineers, National Geodetic Survey and Louisiana Geodetic Survey.

Polyconic Projection 1927, North American Datum.

Descriptions, elevations and geodetic positions of permanent survey marks may be obtained from the U.S. Army Engineer District, New Orleans, Corps of Engineers, New Orleans, Louisiana.

Political boundaries are shown according to best available information.

Work under Flood Control Act shown as of June 1995

Scale 1:62,500

Contour Interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 16 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

BLUE NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 16

LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

APPROXIMATE MEAN DECLINATION 1995 FOR CENTER OF SHEET ANNUAL MAGNETIC CHANGE 1' WESTERLY

Distances on Intracoastal Waterway from Harvey Lock at New Orleans, Louisiana, are shown at 5 mile intervals.

Distances on Mississippi River-Gulf Outlet landward

LEGEND

Project Levee		Levee Mile Post	LMP
Secondary Levee		Levee Station	LS
Retards and Dikes		Towhead	TH
Revetment		Gaging Station	

ROAD DATA 1994

In developed areas, only through roads are classified

Hard surface, heavy duty
Hard surface, medium duty
Loose surface, graded and drained, or narrow hard surface road
Improved dirt road or street
Unimproved dirt road; trail

U.S. ARMY
CORPS OF ENGINEERS

HAHNVILLE QUADRANGLE
LOUISIANA

(Cut-off)
(USGS)

Scale 1:62,500

Contour Interval 5 feet
NATIONAL GEODETIC VERTICAL DATUM OF 1929
ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15
IS INDICATED BY TICKS OUTSIDE THE NEATLINE
LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS
OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

Additional copies may be procured from
U.S. Army Engineer District, Vicksburg, Corps of Engineers

Mapped, edited, and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Revised in 1992 from aerial photography taken in 1988 and other source materials. This information was not field checked. Map edited in 1992.

Compiled in 1969 from Louisiana, 1:24,000, U.S.G.S., Des Allemands, Hahnville, Lake Cataouatche West and Luling, 1967. Planimetry by photogrammetric methods from aerial photography 1965.

Original maps compiled by plane table surveys by the U.S. Geological Survey 1963.

Control by U.S. Geological Survey, National Geodetic Survey and U.S. Army Engineer District, New Orleans, Corps of Engineers.

Polyconic Projection, 1927 North American Datum.

Descriptions, elevations and geodetic position of permanent survey marks may be obtained from the U.S. Army Engineer District, New Orleans, Corps of Engineers, New Orleans, Louisiana.

APPROXIMATE MEAN DECLINATION 1992
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 1' WESTERLY

Distances on Mississippi River above Head of Passes are shown at 5 mile intervals.

PRINTED BY ARMY M.R.C., VICKSBURG, MISS 11-92 1215

LEGEND

Levee		Levee Station	
Secondary Levee		Towhead	TH
Retards and dikes		Gaging Station	
Revetment			

ROAD DATA 1992

In developed areas, only through roads are classified

Hard surface, heavy duty
Hard surface, medium duty
Improved dirt road or street
Unimproved dirt road; trail

Interstate Route U.S. Route State Route

U.S. ARMY
CORPS OF ENGINEERS

HAHNVILLE QUADRANGLE
LOUISIANA

Mapped, edited, and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Revised in 1992 from aerial photography taken in 1988 and other source materials. This information was not field checked. Map edited in 1992.

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Original maps compiled by plane table surveys by the U.S. Geological Survey 1963.

Control by U.S. Geological Survey, National Geodetic Survey and U.S. Army Engineer District, New Orleans, Corps of Engineers.

Polyconic Projection, 1927 North American Datum.

Descriptions, elevations and geodetic position of permanent survey marks may be obtained from the U.S. Army Engineer District, New Orleans, Corp of Engineers, New Orleans, Louisiana.

Scale 1:62,500

Contour Interval 5 feet
NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

Additional copies may be procured from
U.S. Army Engineer District, Vicksburg, Corps of Engineers

APPROXIMATE MEAN DECLINATION 1992
FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 7' WESTERLY

Distances on Mississippi River above Head of Passes are shown at 5 mile intervals.

PRINTED BY ARMY M.R.C., VICKSBURG, MISS 11/92 1215

LEGEND

Levee	Levee Station
Secondary Levee	Towhead TH
Retards and dikes	Gaging Station
Revetment	

ROAD DATA 1992

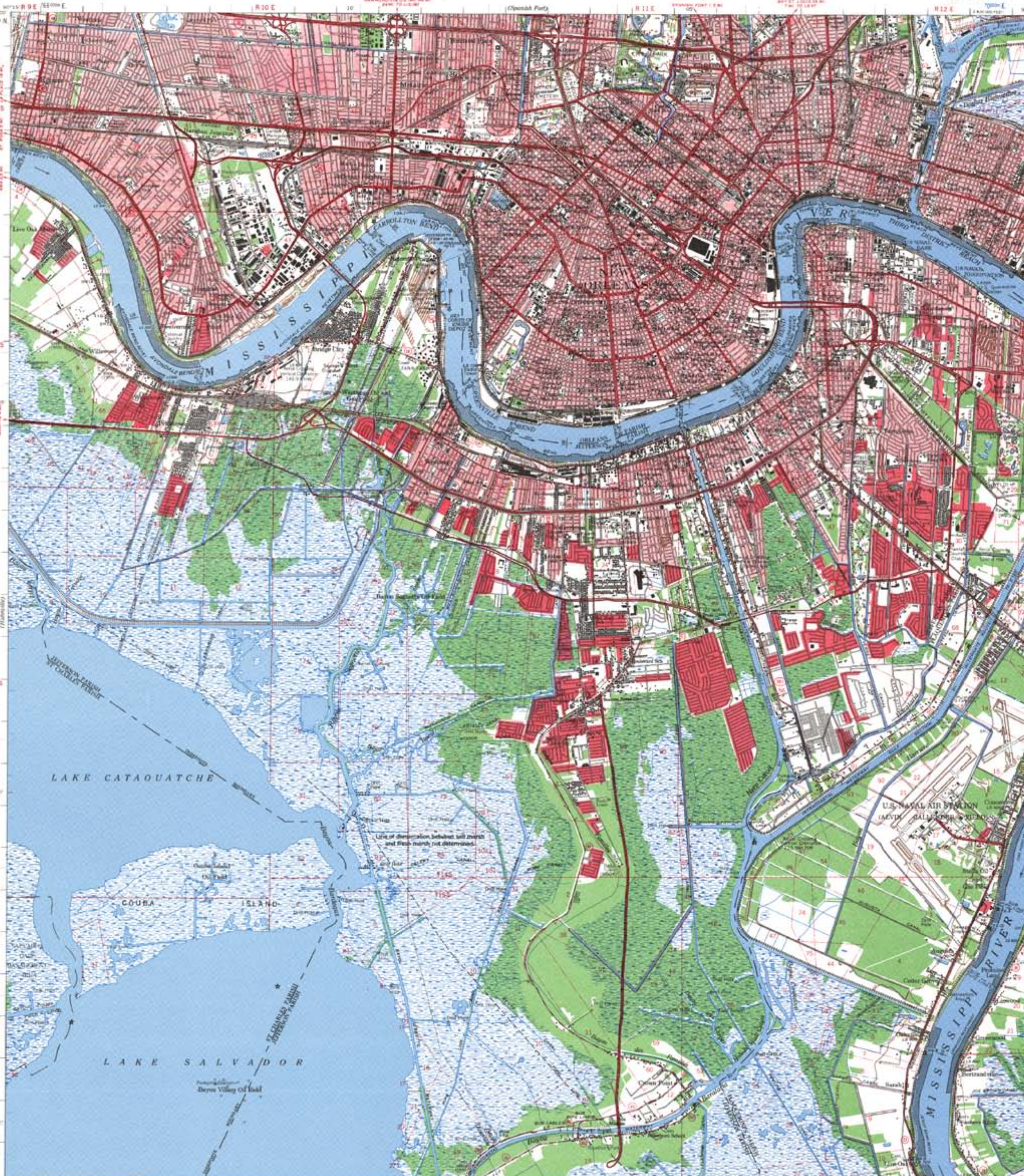
In developed areas, only through roads are classified

Hard surface, heavy duty
Hard surface, medium duty
Improved dirt road or street
Unimproved dirt road; trail

Interstate Route U.S. Route State Route

U.S. ARMY
CORPS OF ENGINEERS

NEW ORLEANS QUADRANGLE
LOUISIANA



PRINTED BY ARMY M.R.C., VICKSBURG, MISS. 1204

Mapped, edited and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

To place features on the North American Datum 1983 move the projection lines 23 meters south and 7 meters east as shown by dashed corner ticks.

This map is not to be used for navigational purposes.

Revised in 1992 from aerial photography taken in 1988 and other source materials. This information was not field checked. Map edited in 1992.

Compiled in 1968 from Louisiana, 1:24,000, U.S.G.S., Bertrandville, Lake Cataouatche East, New Orleans East, 1966 and New Orleans West 1965. Planimetry by photogrammetric methods from aerial photography 1964.

Original maps compiled by plane table surveys by the U.S. Geological Survey 1965-66.

Control by U.S. Geological Survey, National Geodetic Survey and U.S. Army Engineer District, New Orleans, Corps of Engineers.

Polyconic Projection. 1927 North American Datum.

Descriptions, elevations and geodetic position of permanent survey marks

Scale 1:62,500

Contour interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 15 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

BLUE NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1 000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 15

LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

APPROXIMATE MEAN DECLINATION 1992 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 7' WESTERLY

Distances on Mississippi River, above Head of Passes, are shown at 5 mile intervals. 1962 Survey.

LEGEND

Levee		Levee Station	
Secondary Levee		Towhead	
Retards and dikes		Gaging Station	
Revetment			

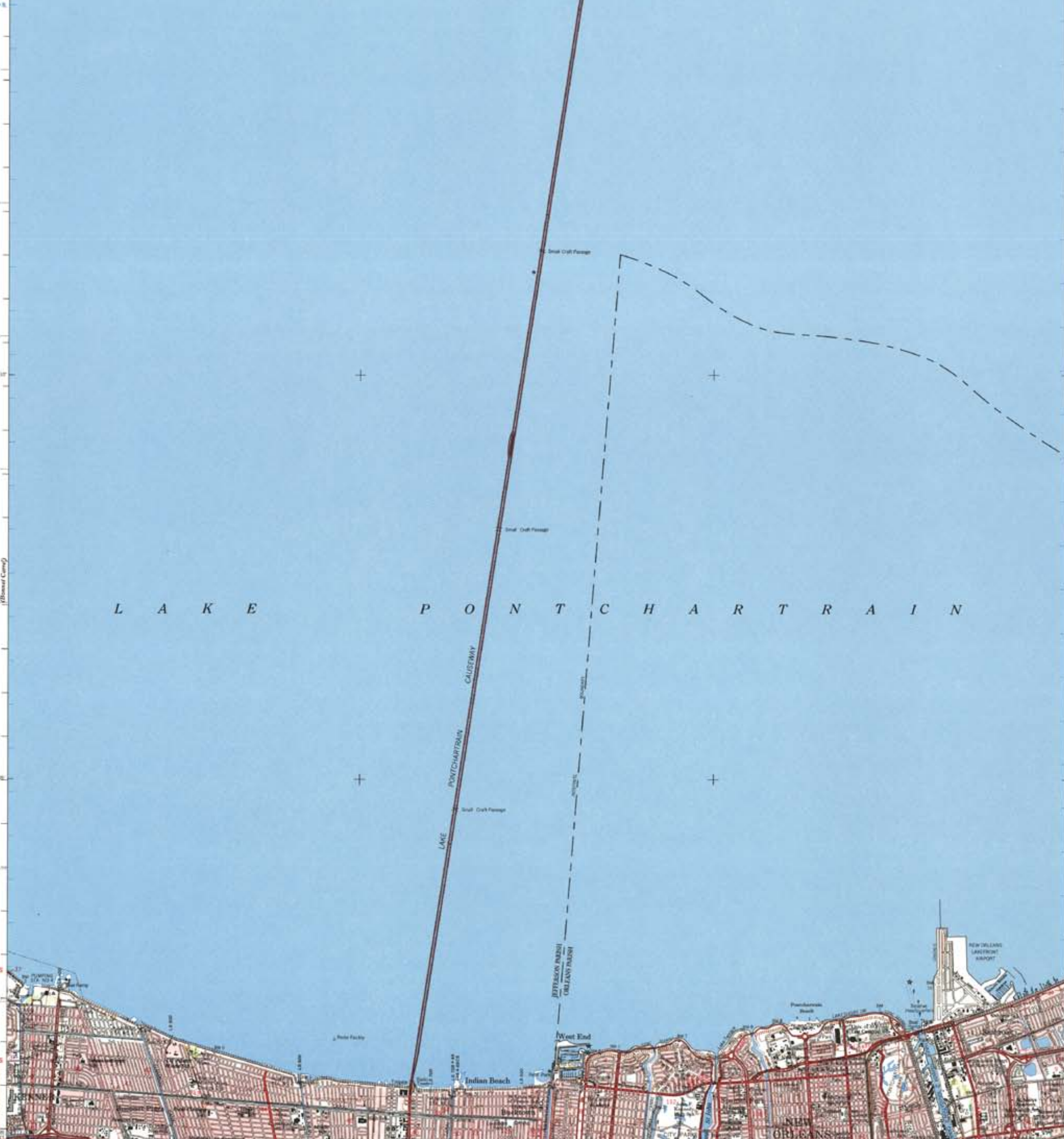
ROAD DATA 1992

In developed areas, only through roads are classified

Hard surface, heavy duty
Hard surface, medium duty
Loose surface, graded and drained, or narrow hard surface road
Improved dirt road or street
Unimproved dirt road, trail

U.S. ARMY
CORPS OF ENGINEERS

SPANISH FORT QUADRANGLE
LOUISIANA



Mapped, edited and published under the direction of the President, Mississippi River Commission, by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Compiled in 1983 from U.S.G.S., 7.5-minute quadrangles, Spanish Fort and Indian Beach scale 1:24,000.

Revised in 1996 from aerial photography taken in 1995 and other source materials. This information was not field checked.

Control by Mississippi River Commission and U.S. Army Engineer District, New Orleans, Corps of Engineers, National Geodetic Survey and Louisiana Geodetic Survey.

Polyconic Projection 1927, North American Datum.

Descriptions, elevations and geodetic positions of permanent survey marks may be obtained from the U.S. Army Engineer District, New Orleans, Corps of Engineers, New Orleans, La.

Political boundaries are shown according to best available information.

Work under Flood Control Act shown as of May 1994.

Scale 1:62,500

1 ½ 0 1 2 3 4 Miles

3000 0 3000 6000 9000 12000 15000 18000 21000 Feet

1 .5 0 1 2 3 4 5 Kilometers

Contour Interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

BLUE NUMBERED TICKS INSIDE THE NEATLINE INDICATE THE 1 000 METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 15

LOUISIANA STATE GRID ZONE SOUTH IS INDICATED BY DOTTED TICKS OUTSIDE THE NEATLINE AT 10,000 FOOT INTERVALS

APPROXIMATE MEAN DECLINATION 1996 FOR CENTER OF SHEET
ANNUAL MAGNETIC CHANGE 1' WESTERLY

PRINTED BY ARMY M.R.C., VICKSBURG, MISS. 6-96 1205

LEGEND

Project Levee		Levee Mile Post	LMP
Secondary Levee		Levee Station	LS
Retards and Dikes		Towhead	TH
Revetment		Gaging Station	

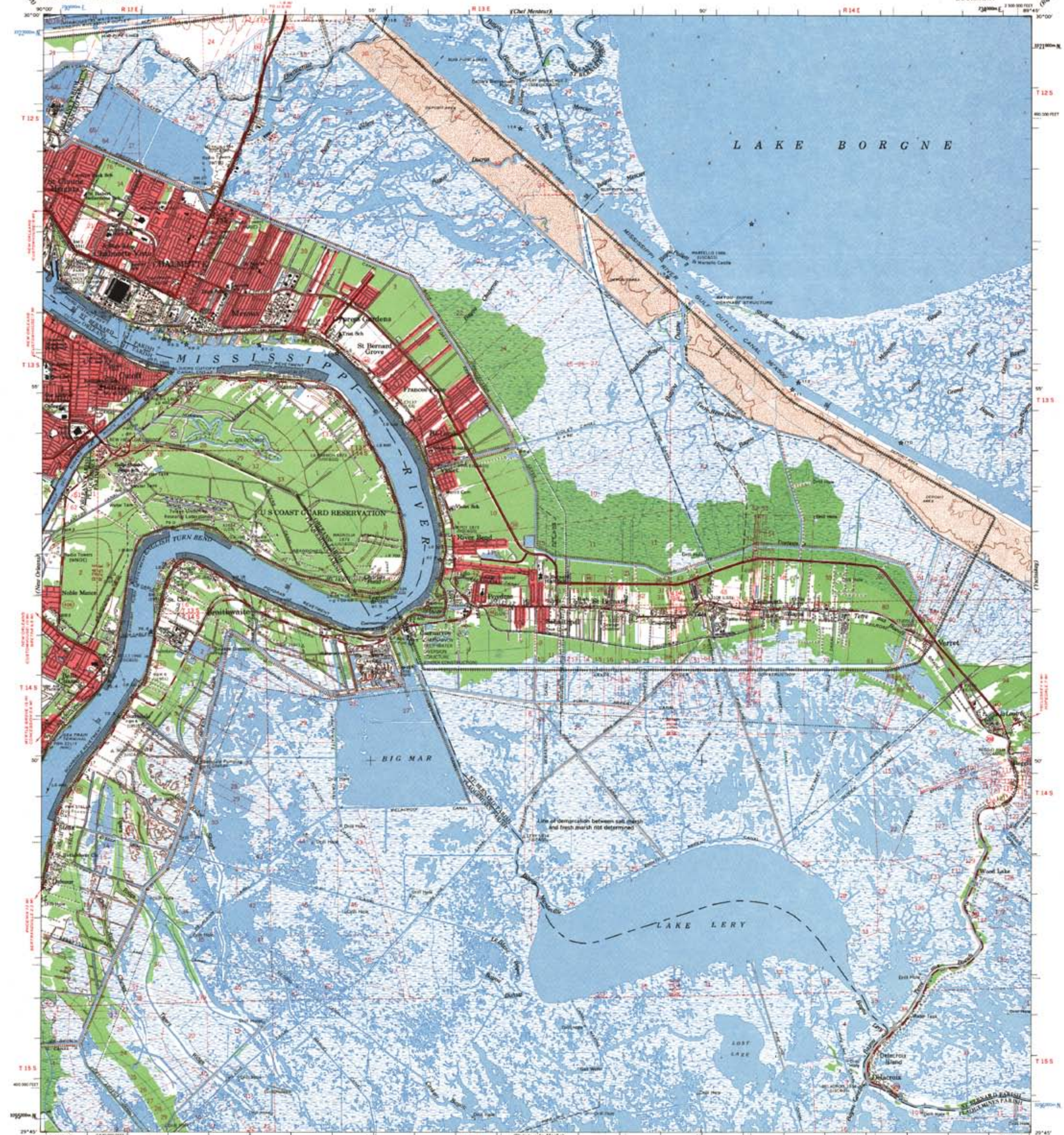
ROAD DATA 1996

In developed areas, only through roads are classified

Hard surface, heavy duty
Hard surface, medium duty
Loose surface, graded and drained or narrow hard surface road
Improved dirt road or street

U.S. ARMY
CORPS OF ENGINEERS

ST. BERNARD QUADRANGLE
LOUISIANA



Mapped, edited and published under the direction of the President, Mississippi River Commission by the U.S. Army Engineer District, New Orleans, Corps of Engineers.

Revised in 1989 from aerial photography taken in 1988 and other source materials. This information was not field checked. Map edited in 1989.

Original maps compiled by plane table surveys by the U.S. Geological Survey 1966-67.

Control by U.S. Geological Survey, National Geodetic Survey and U.S. Army Engineer District, New Orleans, Corps of Engineers.

Polyconic Projection, 1927 North American Datum.

Descriptions, elevations and geodetic positions of permanent survey marks may be obtained from the U.S. Army Engineer District, New Orleans, Corps of Engineers, New Orleans, Louisiana.

Where omitted, land lines have not been established.

Work under Flood Control Act shown as of 1989.

Scale 1:62,500

1 ½ 0 1 2 3 4 Miles

3000 0 3000 6000 9000 12000 15000 18000 21000 Feet

1 .5 0 1 2 3 4 5 Kilometers

Contour Interval 5 feet

NATIONAL GEODETIC VERTICAL DATUM OF 1929

ONE THOUSAND METER UNIVERSAL TRANSVERSE MERCATOR GRID ZONE 16 IS INDICATED BY TICKS OUTSIDE THE NEATLINE

APPROXIMATE MEAN DECLINATION 1989 FOR CENTER OF SHEET

Distances on Mississippi River, above Head of Passes, are shown at 5 mile intervals.

Distances on Mississippi River-Gulf Outlet landward

PRINTED BY ARMY M.R.C., VICKSBURG, MISS. 12-89 1210

LEGEND

Levee		Levee Station	L.S.
Secondary Levee		Towhead	TH
Retards and dikes		Gaging Station	•
Revetment			

ROAD DATA, 1989

In developed areas, only through roads are classified

Hard surface, heavy duty

Hard surface, medium duty

Loose surface, graded and drained, or narrow hard surface road

Improved dirt road or street

Unimproved dirt road, trail