Appendix 6
St. Bernard Basin

The St. Bernard (STB) basin is defined by the protection system along the GIWW to the north, MRGO to the east, Caernarvon Canal to the south, and the Mississippi River and Inner Harbor Navigation Canal (IHNC) to the west. Like New Orleans East, it is essentially separated into two distinct areas, a residential/commercial area on the south side of the basin and a marshlands area on the north side. These two sections are separated by a non-federal, interior local levee that runs across the basin from the northwest to the southeast. This area, along with other pertinent information relative to the IPET assessment, is depicted in Figure STB-1.

The levee and floodwall system surrounding the STB basin consists of approximately 157,800 linear feet of varying levels of protection. This provides protection for an area of approximately 81 square miles for the entire basin. The residential area makes up approximately 27 square miles of the basin. In addition, there are two water control sector gate structures along the MRGO at Bayou Bienvenue and Bayou Dupre. There are a total of nine pump stations within the basin, primarily along the interior local levee; one of these is located along the Caernarvon Canal. These major structures are also depicted in Figure STB-1.

Like the other basins, the STB was constructed during different times and modified at various places since the last Design Memorandums. For the purposes of IPET and coupled with varying versions of the most recently completed Design Memorandums (DM), the STB basin is separated into three major stretches. These are as follows:

- **North Side of IHNC Lock thru Caernarvon Canal.** This stretch of the STB basin represents the exterior hurricane protection system and begins at the tie-in to the north side of the IHNC Lock, continues northeast along the GIWW, turns and follows the MRGO to the southeast, then goes west back towards the tie-in to the Mississippi River levee.

- **Mississippi River Levee (MRL).** This section is the flood protection system along the Mississippi River system that contains a combination of floodwalls and levees. For numbering purposes, the MRL reaches begin at the tie-in with the Caernarvon Canal and runs northwest along the Mississippi River until it ties back in with the south side of the IHNC Lock.

- **Interior Local Levee (ILL)**. This section of levee and floodwall separates the residential and marshland areas of the STB basin. The ILL is actually owned by the State of Louisiana and maintained by the LADOTDD and Lake Borgne Basin Levee District. USACE was provided a one-time waiver from policy and was tasked with repairing the damage to this levee following Katrina. The ILL basically splits the basin in two and begins along the IHNC and heads generally in a southeast direction along the middle of the basin. The ILL "wraps" around the Violet Canal and goes generally east before turning south and tying back into the exterior levee protection system along the Caernarvon Canal.

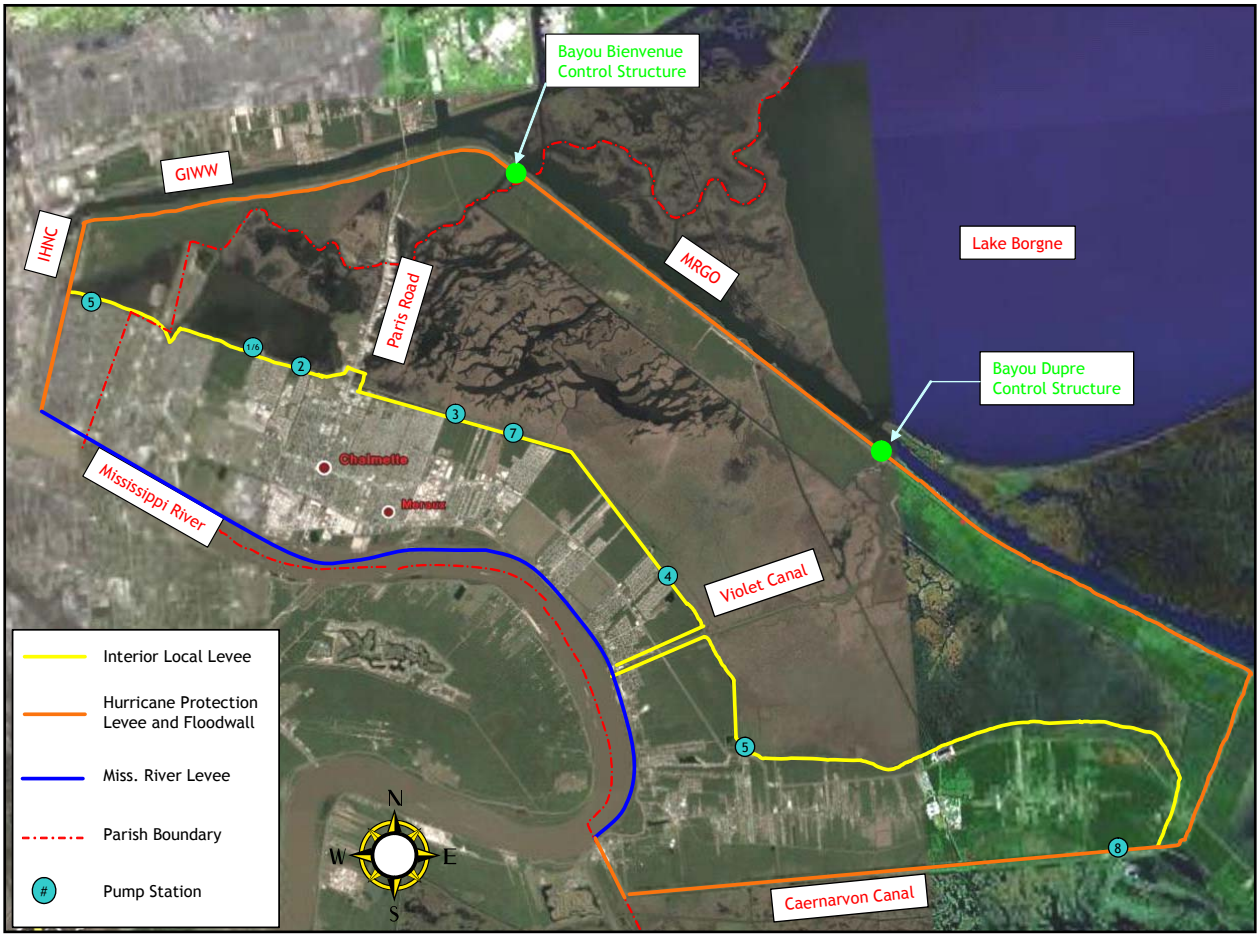

Figure STB 1. St. Bernard basin

STB Basin – Layout of Reaches for Risk Model by Physical Feature (Pre-Katrina)

Within these major stretches of the STB basin there are shorter reaches, which are defined by physical changes in the protection system, i.e. switching from floodwall to levee, etc., or by significant changes in geotechnical parameters. Within each reach, there are specific "key points" whose reliability needs to be determined in order to calculate the effect on the overall reach being evaluated. An example of a "key point" would be a closure gate at a road or rail line

crossing along a floodwall. Task 10 engineers reviewed existing plans, damage survey reports, and conducted field verification inspections to ensure each basin was accurately defined within the system. As a part of the field verification inspections, GPS coordinates were obtained and stationing from DM's and "as-built" plans was verified. For each basin, this information was transformed into a spread sheet and then a system map for each basin, as shown in Figure STB 2A. Finally, digital photographs with incorporated notes were developed to compliment the spread sheets and system map for further clarification. This collection of information was then categorized to get a clear picture of how the basin should be defined for risk assessment purposes. A summary of the reach and point definitions for STB is shown in Figure 2A with a brief supporting narrative on each reach. The layout shown in Figure STB 2 and the narrative that goes along with this figure relates to the pre-Katrina condition. Task Force Guardian (TFG) made several improvements to the levee/floodwall system which changes the risk for various reaches. These changes by reach are detailed in the next section.

Task 10 basin reach definitions for STB start at the tie-in to the north side of the IHNC Lock. The numbering system for reach definitions continues along the exterior protection system along the GIWW, MRGO, Caernarvon Canal, and then up through the Mississippi River levee system to where it ties back into the south side of the IHNC Lock. Finally, the interior local levee reaches' numbers begin at the IHNC and extend southeast until they end at the Caernarvon Canal. Please refer to Figure STB1, STB2A, and STB2B for further clarification. The STB basin is summarized by the reaches as follows:

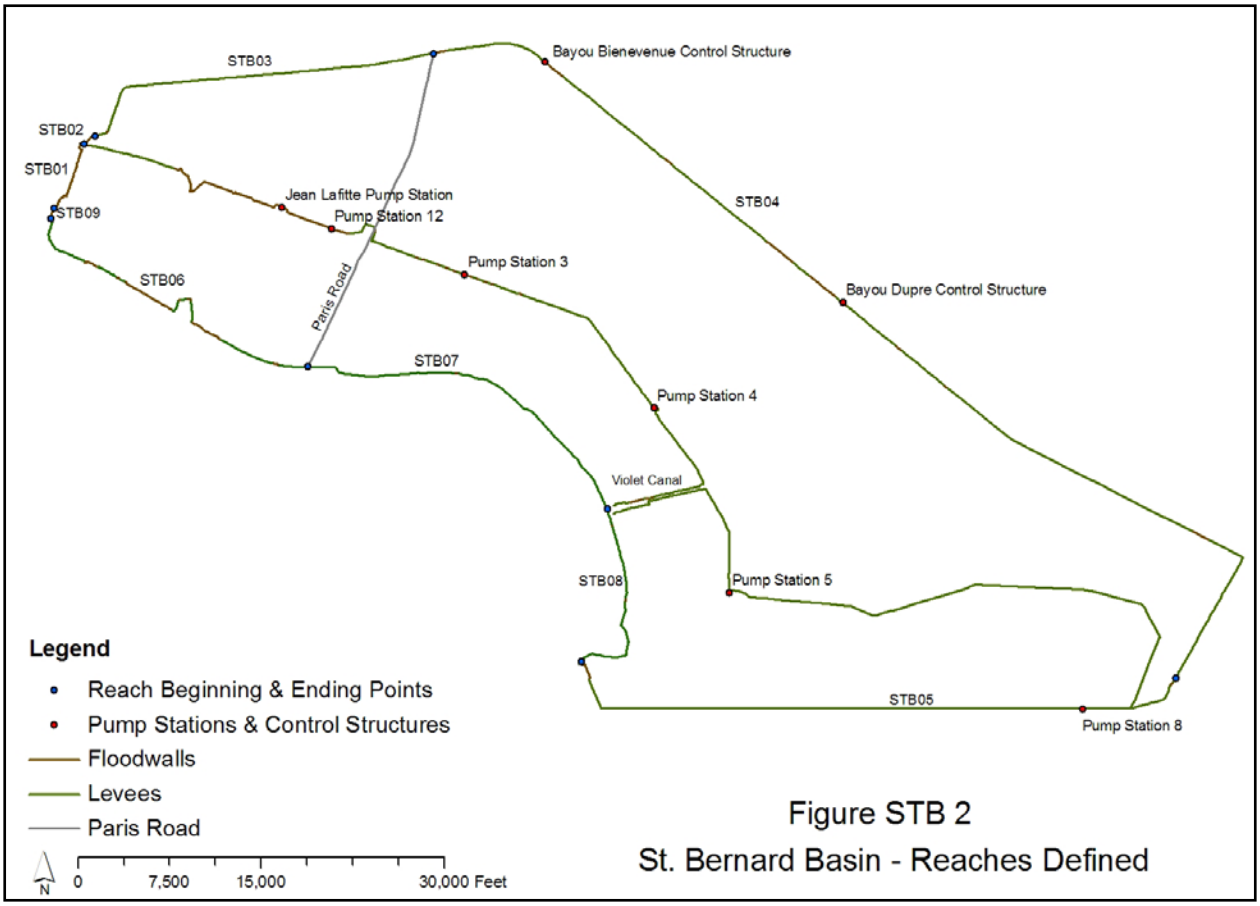

Figure STB 2A. St. Bernard Basin – Reaches Defined

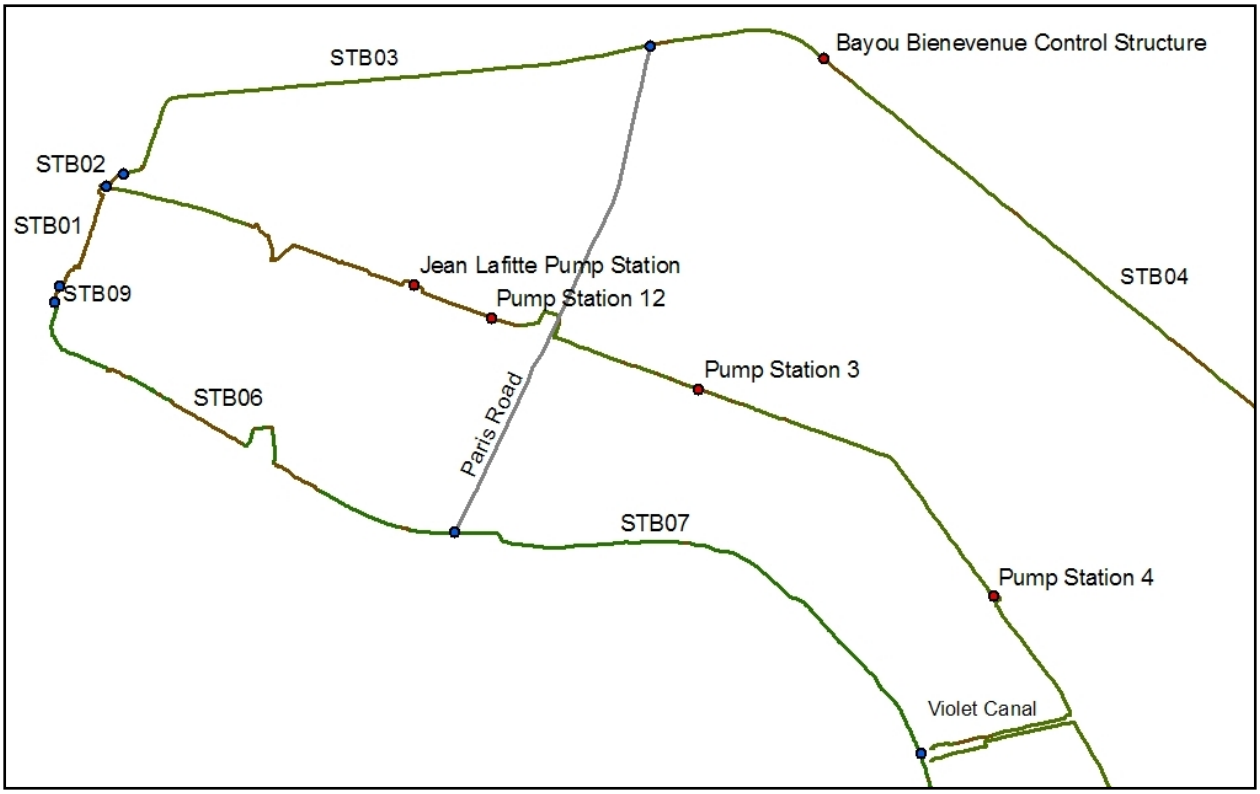

Figure STB 2B. St. Bernard Basin Reaches

Reach STB1

This reach is defined by concrete capped I-wall that ties into the northeast side of the INHC Lock and generally follows the IHNC north, see Figure STB 3, which shows the beginning of the reach where it ties into the northeast lock wall of the IHNC. There is one key point (stb1a) at the beginning of this reach where the natural ground line transitions between the lock wall and I-wall, as shown in Figure STB 4. The reach ends at the south end of the I-wall failure that occurred in the Lower 9th Ward. Other sections of this reach were overtopped during Katrina, but did not fail, in particular near the Claiborne Bridge, as shown in Figure STB 4.

Figure STB 3. I-wall section tying into IHNC lock wall (standing on top of lock wall and looking away from IHNC)

Figure STB 4. Section of Reach STB1 overtopped during Katrina (location is just north of Claiborne Avenue Bridge)

This reach also includes an I-wall between the Claiborne Avenue Bridge and the railroad bridge near Florida Avenue. There were two separate breaches of this I-wall during Katrina. The southern section of I-wall that failed in the Lower 9th Ward area of St. Bernard during Hurricane Katrina is shown in Figure STB 5. The northern section of I-wall that failed was near the blue railroad bridge close to Florida Avenue. This breach is depicted in Figure STB 7. There were no "key points" within this entire reach. Refer to changes made by Task Force Guardian (TFG) in the post-Katrina narrative.

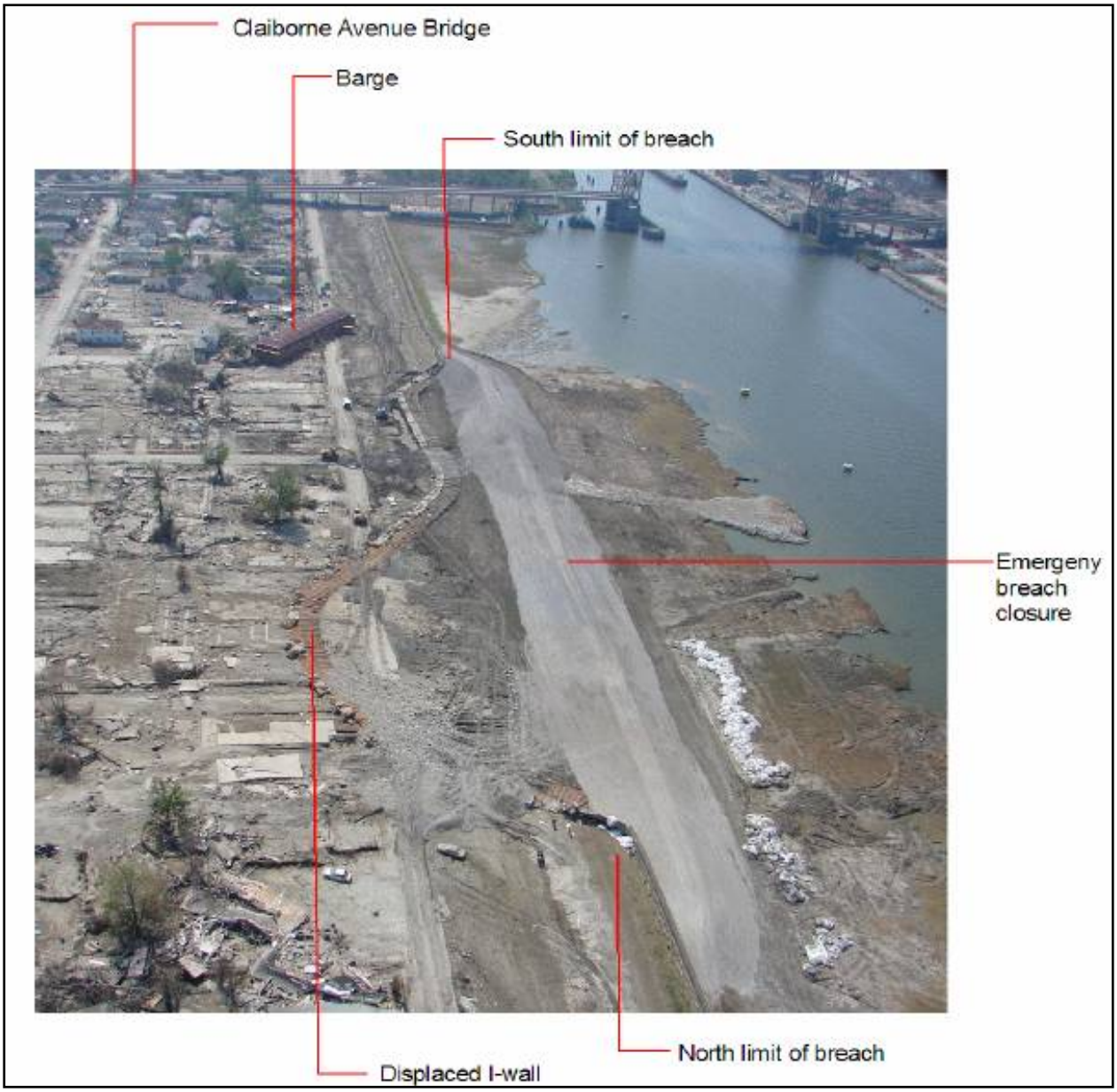

Figure STB 5. Failed I-wall section of Lower 9th Ward (Reach STB2) (looking south along IHNC)

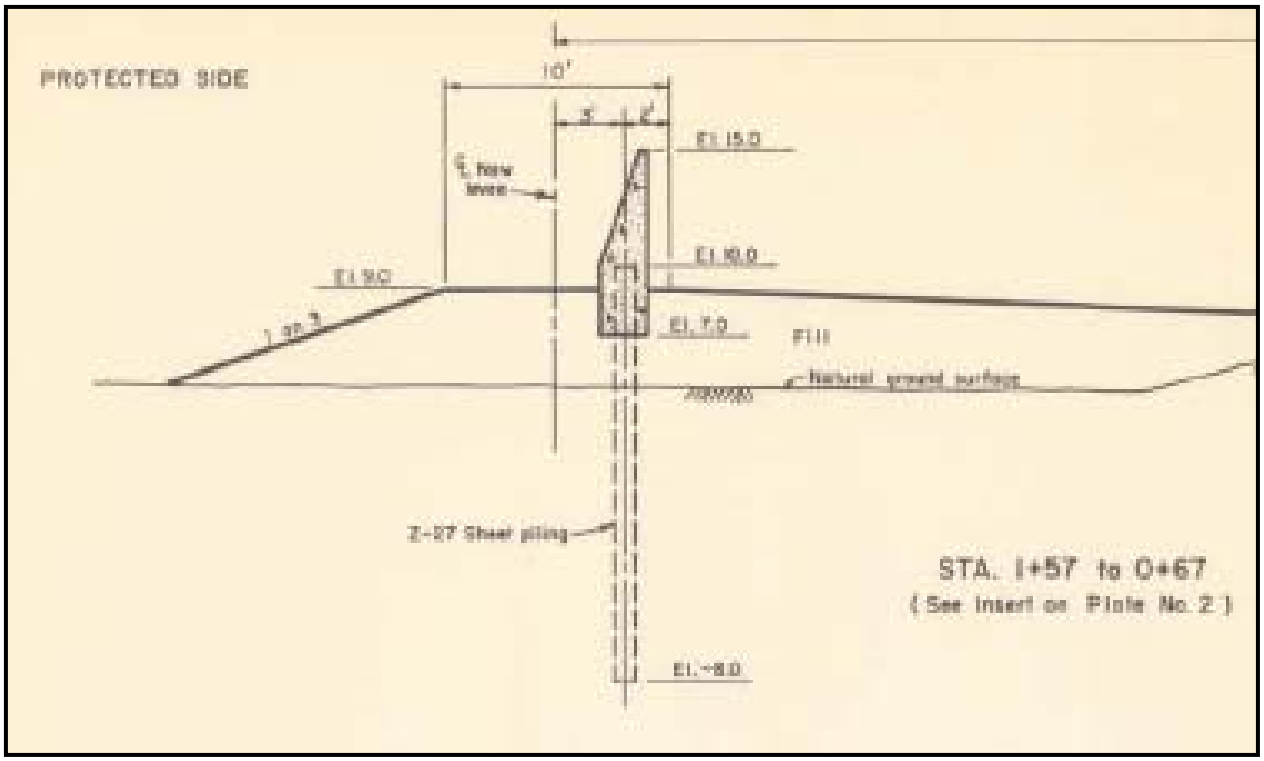

Figure STB 6. Pre-Katrina I-wall design section for Reach STB2 (depicts authorized elevations, not actual elevations)

Figure STB 7. North I-wall failure within Lower 9th Ward (Reach STB2) (Note: pipes on right side of photo are associated with Pump Station #5)

This also includes an existing T-wall that is located adjacent to the Surekote Road ramp over the floodwall. There are multiple key points within this reach including the closure gate E-1, as

shown in Figure STB 8. Closure gate S-1 at Harbor Road and Florida Avenue and railroad closure gate E-2 are also key points within this reach.

Figure STB 8. Existing T-wall near Florida Ave. Bridge (Reach STB3) (looking from protected side towards IHNC)

This reach also includes an I-wall that ties into the levee along the GIWW. There are no key points in this reach. This reach ends where the I-wall ties into the levee. This section of I-wall was overtopped during Katrina, but suffered no major damage. This reach is defined between the end of the IHNC I-wall and the floodwalls surrounding closure gates S-2 and S-3 near the Southern Scrap Building. There are no key points within this reach. This levee is depicted in Figure STB 9. There was no significant damage to this section from Katrina.

Figure STB 9. Beginning of Reach STB5 at end of I-wall (Note TFG improvements to Reach STB4 in foreground)

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
STB1	6,570	13.80	W	H	SB1

Reach STB2

This reach is defined by a combination of I-walls and T-walls surrounding closure gates S-2 and S-3 with T-walls located around the gate closures. These walls were overtopped during Katrina but did not fail. Reference improvements to the scour protection made by TFG in the post-Katrina reach description. The gates themselves serve as the two "key points" within this reach, stb6a and stb6b, respectively.

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
73	1,115	13.30	W	H	SB2

Reach STB3

This reach is defined by a levee along the GIWW and MRGO. There is one pipe crossing located within this reach but it does not represent a significant departure from the levee section and can be ignored for the purposes of this assessment. There was no significant damage to this section of levee from Katrina. This reach also contained a 1,016-ft stretch of concrete capped

I-walls and T-walls just west of the Paris Road overpass along the GIWW. It is often referred to as the Paris Road floodwall. There is one key point (stb8a), a gate closure, within this floodwall reach. This structure was overtopped during Katrina, but only suffered scour damage. See Figure STB 10 for a photograph depicting this wall during repairs following Katrina.

Figure STB 10. Paris Road Floodwall (Reach STB8) (looking east from the west end of the floodwall)

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
STB3	26,995	13.60	L	H	SB2

Reach STB4

This reach is defined by a levee along GIWW that goes between the Paris Road floodwall and the floodwalls just prior to reaching the Bayou Bienvenue control structure. There are no key points within this reach. There was some overtopping in this reach during Katrina, but no major damage to the levee. This reach also includes a section defined by a relatively short 229-ft stretch of floodwall located just northwest of the Bayou Bienvenue Control Structure. During original construction, this short section of wall was to serve as an access point for an industry that was to be located near the Bayou Bienvenue Control Structure. However, the industry went out of business, and it has never been utilized, and the flood gate remains permanently closed. This section of wall was overtopped during Katrina as evidenced in Figures STB 11 and STB 12. Since the gate remains permanently closed, there are no “key points” within this reach.

This reach also includes a short section of levee between the floodwall described in reach STB10 and the beginning of the floodwall leading to Bayou Bienvenue Control Structure. The levee section is only 96 feet long and received some damage during Katrina at the transitions to adjoining I-wall sections, as shown in Figure STB 12. There are no "key points" within this short reach.

Figure STB 11. Floodwall Northwest of the Bienvenue Structure (Reach STB10) (looking southeast toward Bayou Bienvenue just after Katrina)

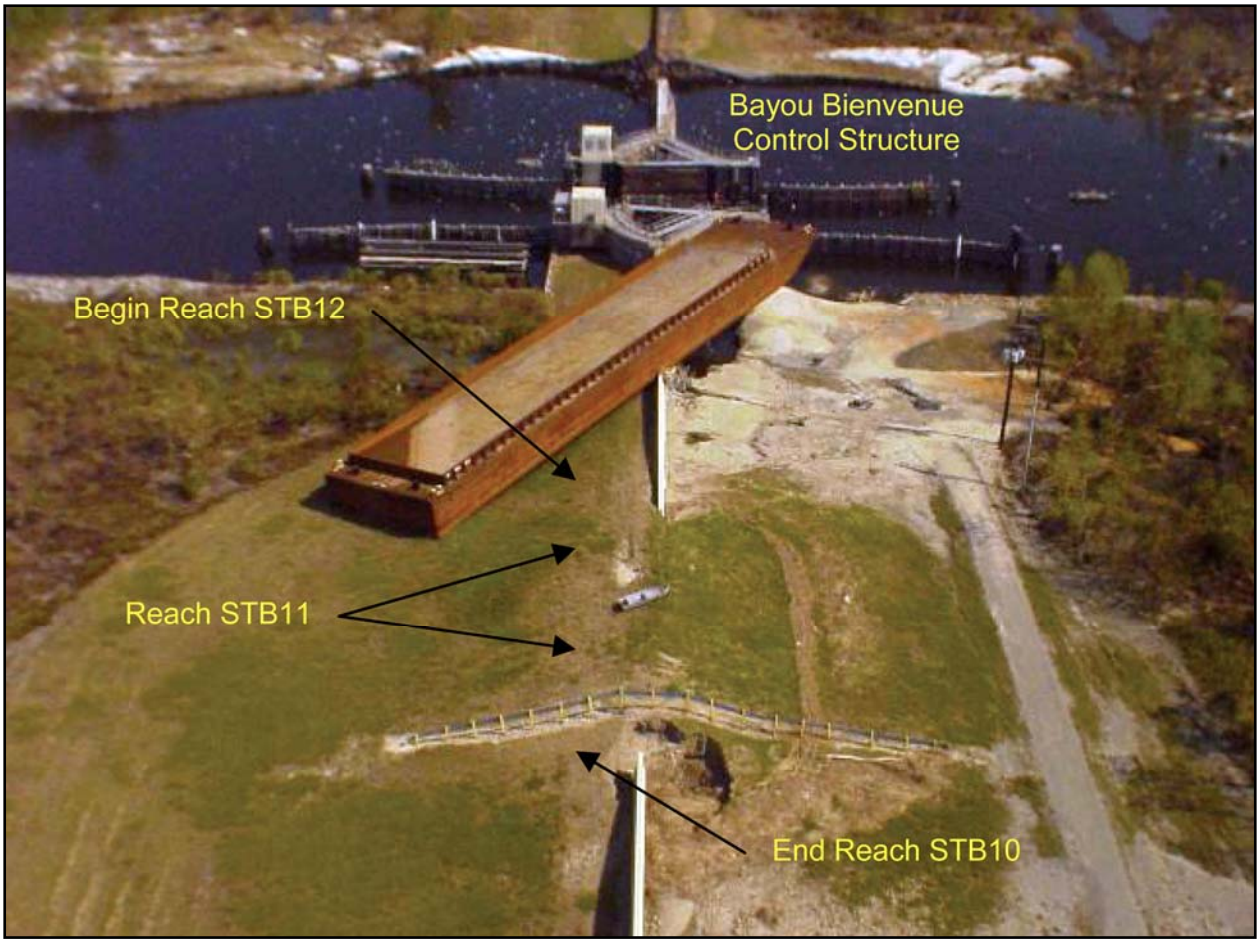

Figure STB 12. Short levee section between floodwalls (Reach STB11)

This reach also contains the Bayou Bienvenue Control Structure and surrounding floodwalls on either side of it. Prior to Katrina, this reach was made up of 77 feet of concrete capped I-wall, 187 feet of T-wall surrounding the control structure itself and an uncapped, sheet pile I-wall). As shown in Figures STB12, 13, and 14, the surrounding floodwalls received heavy damage and the uncapped I-wall section breached during Katrina. The sector gate closure itself serves as the only "key point" (stb12a) within this reach.

Figure STB 13. Uncapped I-wall Section on Southeast side of Bayou Bienvenue Control Structure (looking southeast along the MRGO)

Figure STB 14. Picture of breached Bienvenue I-wall from Protected Side

This reach is also composed of a 19,858 linear feet stretch of levee. Prior to Katrina, it began at the end of the uncapped sheetpile I-wall on the southeast side of the Bayou Bienvenue Control Structure and continued up to the beginning of an embedded, uncapped I-wall section along the

MRGO. This section of levee was overtopped during Katrina and was heavily damaged. There was one section of embedded uncapped, sheetpile I-wall in about the middle of this reach, but the top of the wall essentially was at the top of the levee. Due to this fact, this section of I-wall will not be included separately in the analysis and is included as part of the overall reach characteristics.

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
STB4	84,195	15.50	L	H	SB5

Reach STB5

This reach includes an uncapped I-wall embedded within the levee. The sheetpile I-wall was installed in 1992 as part of USACE repairs along the MRGO. This section of wall was heavily damaged during Katrina, as evidenced in Figure STB 15. As shown in the photo, there are pipe crossings along this reach, but they extend over the levee and do not represent a major change in design or performance parameters; therefore, they are ignored in the risk assessment for this purpose.

Figure STB 15. Breached I-wall along MRGO

This reach also consists of a stretch of levee between uncapped, sheetpile I-wall reaches. This section was overtopped and heavily damaged during Katrina. There are no “key points” within this reach. This reach consisted of an uncapped, sheet pile I-wall that was installed in 1992 as part of USACE repairs along the MRGO. This section also was overtopped and heavily damaged during Katrina. There are no “key points” within this reach. This reach consists of a levee between uncapped, sheetpile I-wall reaches. This section of levee was overtopped during Katrina and heavily damaged. There are no “key points” within this reach. This reach also consisted an uncapped, sheet pile I-wall installed in 1992 as part of USACE repairs along the MRGO. It was overtopped and heavily damaged during Katrina. There are no “key points” within this reach.

This stretch of levee runs from the end of the uncapped I-wall to the northwest transition wall leading to the Bayou Dupre Control Structure. This reach includes the Bayou Dupree Control Structure and the adjoining transition flood walls. Prior to Katrina, the reach started with 92 linear feet of precast concrete sheetpile wall on the northwest side of the gate structure, 69 feet of T-wall on the northwest side of the gate closure, 134 feet across the closure structure, 69 feet of T-wall on the southeast side of the closure structure, and 92 feet of precast concrete sheetpile wall on the southeast side of the closure structure. shown in Figure STB 16, the northwest precast concrete sheet pile I-wall failed during Katrina. The only “key point” in this reach is the closure structure itself.

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
STB5	44,650	15.70	L	H	SB4

Reach STB6

This reach is as a levee along the Caernarvon Canal. It starts on the east side at the where it ties into the west end of the Pump Station #8 floodwall and continues until it ties into a sheetpile wall near the Caernarvon Freshwater Diversion Structure. This section received little or no damage during Katrina. There are several utility crossings along this reach, but none significant enough to warrant as a “key point.” This reach consists an uncapped, sheet pile I-wall near the Caernarvon Freshwater Diversion Structure. There are no “key points” within this reach. It received little or no damage from Katrina. The reach has a weighted average top elevation of 12.8 (NAVD88) taken from a physical survey following Katrina. See Figure STB 18 for a photograph of this reach.

Figure STB 18. Uncapped Sheetpile I-wall near Caernarvon Canal (building on left side is on flood side)

This reach consists of concrete capped I-walls that extend from the end of the sheetpile wall to the where the Caernarvon section ties into the Mississippi River levee. There are two "key" points within this reach, and both are closure gates; one for a rail line and the other for Highway 39. The location where the floodwall ties into the higher Mississippi River levee is shown in Figure STB 19.

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference (3)
STB6	25,545	22.00	L	H	SB4

Reach STB7

This reach starts with the levee tie-in to the southeast side of the Bayou Dupre Control Structure adjoining floodwall. The reach has no "key points" within the reach. The reach was heavily damaged during Katrina from overtopping.

Figure STB 16. Damage at Bayou Dupre Control Structure (note breached section of precast concrete pile wall)

This reach was defined by an uncapped, sheet pile I-wall that was installed during 1992 USACE repairs along the MRGO. There were no "key points" within this reach. There was scour damage in this area as a result of Katrina. This reach is defined by the remaining levee along the MRGO between the end of the wall and where it turns away from along the Caernarvon Canal. There are no "key points" within this reach. Sections of this reach did receive damage during Katrina. This reach consists of a levee that begins at the MRGO and continues to the intersection point with the interior local levee. Although the levee along the Caernarvon Canal continues, a new reach had to be defined because of the potential for varying consequences due to the presence of the interior local levee. This area of levee received minor damage during Katrina. There are two basic areas along this reach where repairs are different. There is one "key point" within this reach (stb23bd), which is the Bayou Road closure gate. This section of levee and goes from the interior local levee to the beginning of the east side floodwall surrounding Pump Station #8. There was minimal scour damage along this stretch during Katrina. This reach consists of a flood wall around the discharge pipes for Pump Station #8. There are roughly 45 feet of I-walls on both sides of the middle T-wall for the discharge pipes. The T-wall length is approximately 141 feet long. The top of the I-walls are elevation 17.0 (NAVD88) and the T-wall is at 16.5 (NAVD88). The weighted average top of wall elevation is 16.7 (NAVD88). This wall

was not damaged or overtopped during Katrina. There are no “key points” within this reach. For a view of this reach, please refer to Figure STB 17.

Figure STB 17. Floodwalls surrounding Pump Station #8 pipes (viewed Looking West Along Caernarvon Canal)

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference (3)
STB7	26,950	21.20	L	H	SB3

Reach STB8

This reach is the most southern section of levee within the STB basin, as reflected as the higher ground area of Figure STB 19. Refer to Figure STB 2 for reference to the reach location relative to the entire basin. The reach consists of a levee, and it ends at the southern end of the concrete capped I-wall near the Battlefield site along the Mississippi River. This reach consists of concrete capped I-wall near the Battlefield site. There is one key point with this reach, and it is a small access closure gate. A typical stretch of this wall along with the access closure gate is shown in Figure STB 20.

Figure STB 19. Caernarvon Canal Floodwall tie-in to higher MRL (gate is for Highway 39 closure)

Figure STB 20. Concrete capped I-wall along Miss. River near Battlefield (access closure gate is key point within this reach)

This reach consists of a levee along the Mississippi River in and around the Rodriguez Canal. There are four key points within this reach, all gated closures near the Rodriguez Canal. The reach ends where the levee ties into a floodwall near the Domino Sugar Plant. This reach is

defined by of a concrete capped I-wall that begins near the Domino Sugar Plant. There are three key points within this reach, all of them closure gates. One is located at the Domino Plant, one at the Port Ship Service Dock, and the last one at Mehle Avenue. One of the closure areas and typical I-wall along this stretch is shown in Figure STB 21.

Figure STB 21. Concrete capped I-wall near Domino Sugar Plant (closure represents key point within this reach)

This reach consists of a evee that is primarily covered with paved slopes and roads. It begins near the Jackson Barracks and ends at the warehouse and dock area near Flood Street. There are no key points within this reach, although there are some pipe crossings noted but not considered significant enough to effect the overall reliability of the reach. The end of this reach (viewed from the Reach STB30 side) is shown in Figure STB 22.

This reach consists of a levee along the Mississippi River and southeast side of the Inner Harbor Navigation Canal. It begins at the warehouse/dock facilities on the levee near Flood Street and ends at the southeast side of the Inner Harbor Navigation Canal Lock.

Figure STB 22. End Reach STB31 where levee ties into Dock Facility (Viewed from Reach STB30 side)

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
STB8	15,885	20.50	L	H	SB1

Reach STB9

This reach is defined as the east side of the INHC Lock structure.

Reach	Length (ft)	Final 2005 (NAVD88 2004.65)	Reach Type	Foundation Material Type (H, C, P)	Subpolder Reference
80	870	22.00	W	H	SB1