Coastal Protection and Restoration Authority of Louisiana

Office of Coastal Protection and Restoration

Project Completion Report

Lake Borgne Shoreline Protection Project PO-30

State Project Number PO-30
Priority Project List 10

St. Bernard Parish

Prepared by:

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PROJECT COMPLETION REPORT

PROJECT NAME: **Lake Borgne Shoreline Protection Project**
STATE PROJECT NO.: **PO-30**

Report Date: **October 2009** **By:** **Niccola D. Gill, P.E.**
Shread-Kuyrkendall & Associates, Inc.

1. ***DNR Project Managers/Engineer/ Federal Sponsor/ Construction Contractor/ Inspection Services:***

DNR Project Manager	Brad Miller	(225) 342-4122
DNR Construction Project Manager	Peter Hopkins	(504) 280-4070
DNR Monitoring Manager	Bryan Gossman	(504) 280-4061
Federal Agency Project Manager	Patty Taylor (EPA)	(214)665-6403
Federal Agency Project Officer	Sondra McDonald (EPA)	(214) 665-7187
Construction Contractor Project Manager	Danny Darnell (Choctaw Transportation Company, Inc.)	(731) 286-0012
Inspector	Chuck Burgess (Shread-Kuyrkendall & Associates, Inc.)	(731) 334-4152

2. ***Location and description of projects as approved for construction by Task Force.***

The Lake Borgne Shoreline Protection Project was approved on the 10 th Priority Project List for work at Shell Beach (PO-30). A second Lake Borgne Project for work at Bayou Dupre (PO-31) was approved on the 11th Priority Project List. In April 2002, the Task Force combined the two projects as PO-30. The Project features are located in St. Bernard Parish, Louisiana, on the shoreline of Lake Borgne approximately 3.4 miles long at Shell Beach between Fort Bayou and Doulluts Canal and approximately 1.5 miles to the west and 0.8 miles to the east of Bayou Dupre.

The objectives of this project are to halt shoreline retreat and direct marsh loss along Lake Borgne, prevent further coalescence of the lake and MRGO, re-establish a sustainable lake rim, restore saline marsh habitat, and enhance fish and wildlife habitat.

3. ***Final, as-built features, boundaries and resulting acreage (use attachments if necessary).***

The principal project features include a nearly continuous breakwater along the designated shoreline sections of Lake Borgne at Shell Beach and Bayou Dupre. At Shell Beach the rock breakwater extends from Doulluts Canal to Fort Bayou with openings at Bayou Yscloskey and the Tennessee Gas Pipeline right-of-way. The breakwater ties in with the existing rock breakwater surrounding Fort Beauregard. At the mouth of Bayou Dupre, a steel sheetpile breakwater ties into the existing MRGO rock breakwater on each side of the Bayou Dupre opening where maintenance dredging within the MRGO has created an unnatural water depth. The rock breakwater extends approximately 0.8 miles east from the eastern sheetpile breakwater and west approximately 1.5 miles from the western sheetpile breakwater.

4. Key project cost elements.

Lake Borgne Shoreline Protection (PO-30)	**CWPPRA Project Construction Cost**	**Cost Incurred during Construction**
Construction	$19,357,167	$18,217,119
Supervision & Inspection	$161,938	$176,909 (Through 1/30/09)
Administration	$154,692	$259,499
Total	$19,785,888	$18,653,527

5. Items of Work.

The following is the list of bid items and bid unit prices for the entire project:

Item	**Unit**	**Quantity**	**Unit Price**	**Total Price**
Mobilization and Demobilization	LUMP SUM	LUMP	$479,000.00	$479,000.00
Surveying	LUMP SUM	LUMP	$125,000.00	$125,000.00
Flotation Channel - Excavation	LUMP SUM	LUMP	$925,000.00	$925,000.00
Geogrid Composite	SY	80,261	$12.00	$963,132.00
250 LB Class Rock	Tons	172,432	$51.00	$8,794,032.00
Settlement Plates	EA	30	$3,000.00	$90,000.00
Permanent Warning Signs	EA	31	$5,000.00	$155,000.00
Steel Sheet Piles	SF	112,546	$34.00	$3,826,564.00
Galvanized Steel Tube Walers	LF	3,242	$92.00	$298,264.00
Galvanized Steel Waler Splices	EA	203	$245.00	$49,735.00
Galvanized Tie Rod Assemblies	EA	203	$475.00	$96,425.00
Graded Sand Fill	CY	4,650	$69.00	$320,850.00
Steel Sheet Pile, C.O. #1	SF	27,000	$30.57	$825,584.40
Galvanized Tube Walers - C.O. #1	LF	900	$80.24	$72,217.50
Galvanized Waler Splices - C.O. #1	EA	67	$207.10	$13,875.68
Tie Rod Assemblies -C.O. #1	EA	50	$414.41	$20,720.70
Warning Signs -C.O. #2	LUMP SUM	LUMP SUM	$136,054.19	$136,054.19

Steel Sheet Pile C.O. #3	SF	1,260	$36.84	$46,418.40
Weld Sheet- Pile Pair Splice, C.O. #3	EA	14	$753.00	$10,542.00
Weld Walers to Sheet Pile, C.O. #3	LUMP SUM	LUMP SUM	$8,325.00	$8,325.00
Weld Sheet Pile Pair Splice, C.O. #4	EA	230	$753.00	$173,190.00
Steel Sheet Pile (Installed) (uncoated), C.O. #4	SF	17,750	$33.78	$599,683.50
Steel Sheet Pile	SF	3,150	$39.11	$123,196.50
Geogrid Composite (Installed)& Delivered), C.O. #5	SY	16,443	$12.00	$197,316.00
250 Lb. Class Rock, C.O. #5	TON	713	$51.00	($36,363.00)
Steel Sheet Pile (Installed) & Delivered), C.O. #5	SF	361	$34.00	($12,274.00)
Galvanized Steel Waler Splices, C.O. #5	EA	64	$361.15	($23,113.40)
Tie Rod Assembly, C.O. #5	EA	11	$475.00	($5,225.00)
Sand Fill, C.O. #5	2,226	CY	$69.00	$153,594.00
Weld Sheet Pile Pair Splice, C.O. #5	EA	30	$552.20	($16,566.00)
Steel Sheet Pile (Installed) (uncoated), C.O. #5	EA	22	$2,795.73	($61,506.00)
Steel Sheet Pile, C.O. #5	SF	1,800		($7,039.80)
SP Extension	LUMP SUM	LUMP SUM	$2,429.35	$2,429.35
Additional Surveying, C.O. #5	LUMP SUM	LUMP SUM	$28,056.97	$28,056.97

6. Construction and construction oversight.

Item	**Lake Borgne Shoreline Protection Project PO-30**
Prime Construction Contractor	Choctaw Transportation Company, Inc.
Original Construction Contract	$16,123,002
Change Orders	$2,094,117
Overrun/Underrun	Overrun
Total Construction Contract Cost	$18,217,119
Supervision & Inspection Cost	$176,909 (Through 1/30/09)

7. Major equipment used.

(4) Tug Boats
(2) Crew Boats
(4) Track Hoes with Spud Barge
(3) Dragline with Barge
(1) Mini Front End Loader
(2) Survey Work Boats
(2) Spud Barges with Mobile Home / Quarters
(2) Clam Bucket Dredges with Quarters
(2) Volvo Articulated End Dumps

8. Discuss construction sequences and activities, problems encountered, solutions to problems, etc.

Project Site

The project site was divided into four (4) Reaches with Reaches 1 and 2 separated by Bayou Dupree, and Reaches 3 and 4 separated by Bayou Yscloskey at Shell Beach. The Bayou Dupre Reaches and the Shell Beach Reaches are approximately 11 miles apart. The Shell Beach area is the site of a former Navy Antiaircraft Training Facility and due to the possible presence of unexploded ordinance in the area, care had to be taken not to disturb any suspicious objects that may be encountered. Guidance for precautions was provided by the Department of Defense. Additional precautions were taken as prescribed by the Environmental Protection Agency to protect Manatees and Gulf Sturgeon from construction activities. Cultural Resource sites that were identified during planning and design were removed from the project and declared off limits. Oyster leases that could be affected by construction were bought back by the State from the lessees.

Reach 1 begins at Bayou Mercier and continues past Bayou Pollett to the northwest side Bayou Dupre where it ties into an existing USACE rock breakwater. A rock breakwater was constructed along the shoreline from Bayou Mercier to the Bayou Pollett channel where a double Sheetpile wall was constructed and tied into the existing USACE breakwater. This Reach is considered to have a "weak" soil profile and its' shoreline was severely affected by hurricane Katrina between the time of the design survey and the start of construction requiring substantial realignment of the breakwater and extension of the double sheetpile wall.

Reach 2 begins at the southeast side of Bayou Dupre at the existing USACE breakwater and extends southwest along the shoreline where it terminates at a cultural resourse site that is off limits for construction. A double sheetpile wall was constructed beginning with a tie-in to the existing USACE breakwater and extending across open water to the shoreline where it ties into rock breakwater construction through the rest of the Reach. This Reach is considered to have a "strong" soil profile and its' shoreline was affected by hurricane Katrina between the design survey and construction requiring realignment of the breakwater.

Reach 3 begins at Fort Bayou and continues past a Tennessee Gas Pipeline Canal and old Fort Beauregard to the west side of Bayou Yscloskey at Shell Beach. This Reach was constructed entirely of rock breakwater except for a no work zone at the Tennessee gas pipeline. From Fort Bayou to the Tennessee Gas Pipeline is considered to have a "strong" soil profile and from the Tennessee gas pipeline to Bayou Yscloskey is considered to have a "weak" soil profile. This Reach was affected by hurricane Katrina between the design survey and construction requiring realignment of the breakwater.

Reach 4 begins on the east side of Bayou Yscloskey, though an abandoned Naval Antiaircraft Training Facility and continues to Doulluts Canal. End-on breakwater construction was used through the

abandoned Naval Antiaircraft Training Facility due to inaccessibility for barges and conventional breakwater construction was used from there to Dolluots Canal. This Reach is considered to have a "strong" soil profile and its' shoreline was affected by hurricane Katrina between the design survey and construction requiring realignment of the breakwater.

Pre-construction Survey

While staking out the breakwater alignment as part of the Pre-construction Survey, the Contractor reported that the location of the planned breakwater alignment in relation to the shoreline was not as intended in the plans. Further investigation determined that the shoreline had been impacted by Hurricane Katrina and wave action since the design surveys were performed. A new breakwater alignment was staked out in the field to conform to the existing shoreline while taking into consideration rock placement criteria and the irregularities of the shoreline. The Contractors' survey for determining quantities of geotextile composite at 100 foot intervals was used for computing rock quantities instead of the 1000 foot interval survey specified in the Pre-construction survey because the Pre-construction survey was no longer applicable due to the realignment and the closer spacing of the Contractors' sections made them more useful than redoing the preconstruction survey at extra cost.

Access and Flotation Channels

Flotation channels, 80 feet wide at -6.0 foot elevation, were excavated at an offset from the rock breakwater alignment. No flotation channels were required for the double sheetpile wall or end-on construction areas. Access channels, 120 feet wide at -6.0 foot elevation, were excavated from the -6.0 foot contour to the flotation channels. Temporary spoil banks held the excavated material along the lake side of the channels. After construction of the rock breakwaters the access and flotation channels were backfilled using the material from the temporary spoil banks. Dredges consisting of barge mounted cranes with clamshell buckets were used for excavation and backfilling. Warning signs per the USCG requirements for temporary spoil banks were placed prior to excavation and removed after backfilling. Precautions were taken as prescribed by the Environmental Protection Agency to protect Manatees and Gulf Sturgeon from these construction activities.

Double Sheetpile Wall

The Pre-construction Survey revealed that the water depth near the old Bayou Paulette channel beyond the planned double sheetpile structure was too deep for the rock breakwater design section due to hurricane Katrina related scour of the water bottom. The length of the Reach 1 double sheetpile structure was increased by 400 feet to extend into this area that was too deep for the rock breakwater design section by change order.

Sheetpiling was sandblasted and coated by the supplier at their facility in Alabama and trucked to the Contractors staging yard located on the Michoud Canal. Sheetpile installation began in Reach 2 at the tie-in point with the new rock breakwater on November 29, 2007 from barges utilizing a field fabricated template to assure proper alignment. The weight of the 30 foot long sheetpile pairs was sufficient to bring them almost to grade and the weight of the vibratory hammer was generally enough to set them to grade without vibrating because of the soft soil conditions.

As the sheetpiling installation progressed toward the deeper water at the tie-in point with the existing USACE breakwater, the sheetpile pairs were no longer able to support their own weight with the reduced embedment length. To provide additional embedment a change order was issued to weld 30 foot extensions to every fourth pair of sheets in the deeper water. This additional embedment was sufficient to support the wall. Because of the increased depth of the water bottom in the Reach 1 sheetpile site, this

solution was applied to the entire length on the Reach 1 sheetpile wall except where continuous 60 foot long sheets were called for in the original design.

After the sheetpiling was installed, tie rods and walers were installed to provide support for the walls to contain the fill. Rock scour protection was placed around the perimeter of the double sheetpile structure followed by sand fill up to elevation 0.0 ft. After a 28 day minimum settling period the sand fill was topped off where needed, geogrid was placed on top of the sand and a stone cap was placed on the geogrid composite to the top of the sheetpile. Rock was then placed to close the gap between the double sheetpile structure and the existing USACE breakwater. This sequence was repeated for the Reach 1 sheetpile structure. Permanent warning signs were placed at the double sheetpile structures.

End-on Breakwater Construction

Ruins of an abandoned former Naval Antiaircraft Training Facility at Bayou Yscloskey prevented the use of the conventional breakwater construction sequence because it was unfeasible to excavate access and flotation channels for the length of that segment of the breakwater at the west end of Reach 4. Access was available at the Bayou Yscloskey for barges to offload geogrid composite, trucks, and rock by crane. Rock was loaded into articulated dump trucks for distribution along the alignment where it was shaped by trackhoe. The design section of this area of breakwater has a 10 foot wide crown to accommodate the trucks at elevation +4.0 feet +/- 0.5 feet and side slopes at 3 horizontal to 1 vertical to existing grade.

Conventional Rock Breakwater Construction

The project reaches were designated as “strong” or “weak” sections based on the strength of the existing soil profile. Different design sections were used for the “strong” and “weak” sections. The “strong” design section has a 4 foot wide crown at elevation +4.0 feet +/- 0.5 feet and side slopes at 3 horizontal to 1 vertical to existing grade and was placed in a single lift. The “weak” design section was intended to be placed in 2 lifts in this project with a third lift to be placed in a separate maintenance project. The first lift had an 8 foot wide crown at elevation +3.0 feet +/- 0.5 feet and side slopes at 3 horizontal to 1 vertical to existing grade. After a 30 day period for initial settlement the second lift was placed to bring the crown to 7 feet wide at elevation +3.25 feet +/- 0.5 feet and side slopes at 3 horizontal to 1 vertical to existing grade. 250 pound class rock was used for the entire project.

During placement of the reach 1 first lift, mud waves, indicating bearing failure appeared at several locations, most notably near settlement plate 5. An attempt was made in this area to stabilize the area with a thin layer of stone and geotextile composite over the mud wave, which met with limited success.

Geotextile Composite

The geotextile composite consisted of a woven separator fabric reinforced by a geogrid on top. These were assembled off-site into panels generally 105 feet long by the width required to extend a minimum of 3 feet beyond the toe of the rock breakwater. The widths were determined by the Contractors’ survey along the alignment at 100 foot intervals. The panels were oriented so that the strong direction was perpendicular to the alignment. The transverse seams of the woven separator fabric were machine stitched and the transverse seams of the geogrid were manually double stitched. The edges were then machine stitched together longitudinally. Panels were then rolled and tagged with their intended locations.

The geogrid composite was unrolled from the pre-assembled rolls along the alignment. Transverse field seams were accomplished with a 5 foot overlap of the woven separator fabric and manual double stitching of the geogrid. After placement of the geotextile composite in the dry end-on construction area,

a change was made to allow the transverse seam in the geogrid to be made with polyethylene bodkin bars to simplify and speed construction in the rest of the rock breakwater which had long segments in the water. After some experimentation with methods for holding the geotextile composite in place, pinning the geotextile composite with rock around the perimeter, followed by a layer of rock over the entire panel, and then building rock to section and grade was found to work best.

Settlement Plates

Settlement plates consisting of a 4 foot by 4 foot plate with a 9 foot long, 3 inch diameter riser pipe were place approximately every 1000 feet along the rock breakwater and end-on construction alignment. Elevations for the top of the pipe were recorded when installed and at intervals thereafter when weather and sea conditions allowed. Excessive settlement of some plates where the top of pipe was no longer visible in the "weak" sections resulted in the loss of those settlement plates. One settlement plate riser pipe in Reach 1, settlement plate 5, was extended by adding a 5.3 foot extension to the riser pipe on 8/8/08, to maintain its' functionality. Settlement plates 6 and 18 submerged and were no longer measurable after 8/2/08 and 8/11/08 respectively. The last settlement plate surveys for Reaches 1, 2, and 3 were on 8/26/08 and for Reach 4 on 6/3/08.

Process and As-built Surveys

Process and As-built Surveys were conducted for the settlement plates, rock breakwater, sand fill, scour protection, rock protection layer, and steel sheetpile. Additionally, an as-built survey was done on the access and flotation channels. Following Hurricanes Gustav and Ike in August and September, 2008, Reach 1 was re-surveyed when the water and weather conditions were suitable in November, 2008.

Construction Progress by Feature

Reach	Feature	Comment	Date		Contract Day		
			Begin	Complete	Begin	Duration	Complete
	Notice to Proceed		8/1/2007				
4	Flotation	Dredge	4/5/2008	4/26/2008	247	21	268
3	Flotation	Dredge	4/26/2008	5/25/2008	268	29	297
2	Flotation	Dredge	5/25/2008	6/10/2008	297	16	313
1	Flotation	Dredge	5/21/2008	6/4/2008	293	14	307
4	Flotation	Backfill, Partial	6/10/2008	7/1/2008	313	21	334
4	Flotation	Backfill, Complete	10/6/2008	10/14/2008	431	8	439
3	Flotation	Backfill	10/15/2008	11/7/2008	440	23	463
2	Flotation	Backfill	11/8/2008	11/22/2008	464	14	478
1	Flotation	Backfill	11/22/2008	12/16/2008	478	24	502
4	Breakwater	End-on	3/21/2008	3/27/2008	232	6	238
4	Breakwater	Strong	4/7/2008	5/1/2008	249	24	273
3	Breakwater	Strong	5/24/2008	6/16/2008	296	23	319
3	Breakwater	Weak 1st lift	5/6/2008	5/23/2008	278	17	295
3	Breakwater	Weak 2nd lift	8/5/2008	8/16/2008	369	11	380
2	Breakwater	Strong	7/8/2008	8/1/2008	341	24	365
1	Breakwater	Weak 1st lift	6/10/2008	7/14/2008	313	34	347
1	Breakwater	Weak 2nd lift	8/12/2008	8/18/2008	376	6	382
2	Double Wall	Sheetpile	11/29/2007	1/31/2008	119	63	182
2	Double Wall	Sand Fill 1st lift	2/18/2008	2/18/2008	200	0	200
2	Double Wall	Sand Fill 2nd Lift	6/13/2008	6/13/2008	316	0	316
2	Double Wall	Stone cap	8/2/2008	8/3/2008	366	1	367
2	Double Wall	Scour Protection 1st lift	2/15/2008	2/15/2008	197	0	197
2	Double Wall	Scour Protection 2nd lift	8/1/2008	8/3/2008	365	2	367
1	Double Wall	Sheetpile	2/11/2008	5/22/2008	193	101	294
1	Double Wall	Sand Fill 1st lift	6/10/2008	6/10/2008	313	0	313
1	Double Wall	Stone cap	7/30/2008	8/2/2008	363	3	366
1	Double Wall	Scour Protection 1st lift	6/1/2008	6/10/2008	304	9	313
1	Double Wall	Scour Protection 2nd lift	8/2/2008	8/6/2008	366	4	370
1	Double Wall	Final Coating Repair	3/9/2009	3/10/2009	585	1	586
1	Temp. Spoil Signs	Install	3/21/2008	3/21/2008	232	0	232
2	Temp. Spoil Signs	Install	3/20/2008	3/20/2008	231	0	231
3	Temp. Spoil Signs	Install	3/25/2008	3/25/2008	236	0	236
4	Temp. Spoil Signs	Install	3/12/2008	3/12/2008	223	0	223
1	Perm. Warning Signs	Install, Partial	5/23/2008	5/23/2008	295	0	295
1	Perm. Warning Signs	Install, Complete	8/6/2008	8/6/2008	370	0	370
2	Perm. Warning Signs	Install	5/23/2008	5/23/2008	295	0	295
1	Temp. Spoil Signs	Remove	12/14/2008	12/14/2008	500	0	500
2	Temp. Spoil Signs	Remove	12/14/2008	12/14/2008	500	0	500
3	Temp. Spoil Signs	Remove	11/8/2008	11/8/2008	464	0	464
4	Temp. Spoil Signs	Remove	11/8/2008	11/8/2008	464	0	464
	No Work	T.S. Eduardo	8/4/2008	8/4/2008	368	0	368
	Evac Marine Equip	Hurricane Gustav	8/27/2008	9/5/2008	391	9	400
	Evac Marine Equip	Hurricane Ike	9/6/2008	9/27/2008	401	21	422
	Final Inspection		3/11/2009		587		

Construction Progress by Chronology

Reach	Feature	Comment	Date		Contract Day		
			Begin	Complete	Begin	Duration	Complete
	Notice to Proceed		8/1/2007				
2	Double Wall	Sheetpile	11/29/2007	1/31/2008	119	63	182
1	Double Wall	Sheetpile	2/11/2008	5/22/2008	193	101	294
2	Double Wall	Scour Protection 1st lift	2/15/2008	2/15/2008	197	0	197
2	Double Wall	Sand Fill 1st lift	2/18/2008	2/18/2008	200	0	200
4	Temp. Spoil Signs	Install	3/12/2008	3/12/2008	223	0	223
2	Temp. Spoil Signs	Install	3/20/2008	3/20/2008	231	0	231
4	Breakwater	End-on	3/21/2008	3/27/2008	232	6	238
1	Temp. Spoil Signs	Install	3/21/2008	3/21/2008	232	0	232
3	Temp. Spoil Signs	Install	3/25/2008	3/25/2008	236	0	236
4	Flotation	Dredge	4/5/2008	4/26/2008	247	21	268
4	Breakwater	Strong	4/7/2008	5/1/2008	249	24	273
3	Flotation	Dredge	4/26/2008	5/25/2008	268	29	297
3	Breakwater	Weak 1st lift	5/6/2008	5/23/2008	278	17	295
1	Flotation	Dredge	5/21/2008	6/4/2008	293	14	307
1	Perm. Warning Signs	Install, Partial	5/23/2008	5/23/2008	295	0	295
2	Perm. Warning Signs	Install	5/23/2008	5/23/2008	295	0	295
3	Breakwater	Strong	5/24/2008	6/16/2008	296	23	319
2	Flotation	Dredge	5/25/2008	6/10/2008	297	16	313
1	Double Wall	Scour Protection 1st lift	6/1/2008	6/10/2008	304	9	313
1	Breakwater	Weak 1st lift	6/10/2008	7/14/2008	313	34	347
1	Double Wall	Sand Fill 1st lift	6/10/2008	6/10/2008	313	0	313
4	Flotation	Backfill, Partial	6/10/2008	7/1/2008	313	21	334
2	Double Wall	Sand Fill 2nd Lift	6/13/2008	6/13/2008	316	0	316
2	Breakwater	Strong	7/8/2008	8/1/2008	341	24	365
1	Double Wall	Stone cap	7/30/2008	8/2/2008	363	3	366
2	Double Wall	Scour Protection 2nd lift	8/1/2008	8/3/2008	365	2	367
2	Double Wall	Stone cap	8/2/2008	8/3/2008	366	1	367
1	Double Wall	Scour Protection 2nd lift	8/2/2008	8/6/2008	366	4	370
	No Work	T.S. Eduardo	8/4/2008	8/4/2008	368	0	368
3	Breakwater	Weak 2nd lift	8/5/2008	8/16/2008	369	11	380
1	Perm. Warning Signs	Install, Complete	8/6/2008	8/6/2008	370	0	370
1	Breakwater	Weak 2nd lift	8/12/2008	8/18/2008	376	6	382
	Evac Marine Equip	Hurricane Gustav	8/27/2008	9/5/2008	391	9	400
	Evac Marine Equip	Hurricane Ike	9/6/2008	9/27/2008	401	21	422
4	Flotation	Backfill, Complete	10/6/2008	10/14/2008	431	8	439
3	Flotation	Backfill	10/15/2008	11/7/2008	440	23	463
2	Flotation	Backfill	11/8/2008	11/22/2008	464	14	478
3	Temp. Spoil Signs	Remove	11/8/2008	11/8/2008	464	0	464
4	Temp. Spoil Signs	Remove	11/8/2008	11/8/2008	464	0	464
1	Flotation	Backfill	11/22/2008	12/16/2008	478	24	502
1	Temp. Spoil Signs	Remove	12/14/2008	12/14/2008	500	0	500
2	Temp. Spoil Signs	Remove	12/14/2008	12/14/2008	500	0	500
1	Double Wall	Final Coating Repair	3/9/2009	3/10/2009	585	1	586
	Final Inspection		3/11/2009		587		

9. Construction change orders and field changes.

- Change Order #1 :
    a. Bid Item No. 13 – Steel Sheet Pile – Added 27,000 SF to adjust quantity to that required by change in the length of double sheet pile wall due to changed field conditions.
    b. Bid Item No. 14 – Galvanized Steel Tube Walers – Added 900 LF to adjust quantity to that required by change in the length of double sheet pile wall due to changed field conditions.
    c. Bid Item No. 15 – Galvanized Steel Waler Splices – Add 67 EA to adjust the quantity to that required by change in he length of double sheet pile wall due to changed field conditions.
    d. Bid Item No. 16 – Tie Rod Assemblies – Add 50 EA to adjust quantity to that required by change in the length of double sheet pile wall due to changed field conditions.
- Change Order #2 :
    a. Bid Item No. 7 – Permanent Warning Signs – Delete 31 EA to reduce quantity of this item to zero. These signs are replaced by Spoil Bank Warning Signs and Lights in new Bid Item No. 17
    b. Bid Item No. 17 – Spoil Bank Warning Signs and Lights – Added 1 LUMP SUM to add an item of work not covered by an original bid item. This new item of work is required to comply with United States Coast Guard regulations regarding marking temporary spoil banks.
- Change Order #3
    a. Bid Item No. 13 – Steel Sheet Pile – Added 1260 SF to provide for additional embedment of the Sheet Pile Wall for stability.
    b. Bid Item No. 18 – Transport Sheet Pile Pairs and Weld Sheet Pile Pair Splice – Added 14 EA to add an item of work not covered by an original bid item. This new item provides for welding splices in Sheet Pile sections to add length to sheets already installed.
    c. Bid Item No. 19 – Weld Walers to Sheet Pile East of Bayou Dupre – LUMP SUM is required to add an item of work not covered by an original bid item. This item provides for welding walers to Sheet Pile sections to increase rigidity.
- Change Order #4
    a. Bid Item No. 18 – Transport Sheet Pile Pairs and Weld Sheet Pile Splice – Added 230 EA
    b. Bid Item No. 20 – Steel Sheet Pile (uncoated) – Added 17,750 SF - This item is necessary to provide for additional embedment of the Sheet Pile wall for stability. This new bid item is required to add an item of work not covered by an original bid item. This new item provides for uncoated Sheet Pile sections to add length to Sheet Pile and reflects the current price of steel.
    c. Bid Item No. 21 – Steel Sheet Pile – Added 3,150 SF to provide additional embedment of the Sheet Pile wall for stability. This new bid item is required to add an item of work not covered by an original bid item. This new item provides for coated Sheet Pile sections to replace on site material used to add length to Sheet Pile and reflects the current price of steel.
- Change Order #5
    a. Bid Item No. 4 – Geogrid Composite – Added 16,443 SY to adjust quantity to that required by change to alignment due to changed field conditions.
    b. Bid Item No. 5 – 250 LB Class Rock – Deduct 713 TONS to adjust quantity to that actually placed.

c. Bid Item No. 8 – Steel Sheet Pile – Deduct 361 SF to adjust quantity to that actually placed.
d. Bid Item No. 10 – Galvanized Steel Waler Splices – Deduct 64 EA to adjust quantity to that actually placed.
e. Bid Item No. 11 – Tie Rod Assembly – Deduct 11 EA to adjust quantity to that actually placed.
f. Bid Item No. 12 – Sand Fill – Added 2226 CY to adjust quantity to that actually placed and as required by the extension of Western Sheet Pile Wall due to the realignment.
g. Bid Item No. 15 – Galvanized Steel Waler Splices – Deduct 30 EA to adjust quantity to that actually placed.
h. Bid Item No. 18 – Transport and Weld Steel Sheet Splice – Deduct 22 EA to adjust quantity to that actually placed.
i. Bid Item No. 20 – Steel Sheet Pile Uncoated – Deduct 1800 SF to adjust quantity to that actually placed.
j. Bid Item No. 22 – Settlement Plate Extension 3 inch diameter – Add 1 Lump Sum. This new bid item is required to add an item of work not covered by the original bid item. This new item of work is required due to unanticipated settlement of the breakwater.
k. Bid Item No. 23 – Surveying – Added 1 Lump Sum. This new bid item is required to add an item of work not covered by an original bid item. Additional surveying and stakeout as required by changes to the alignment due to changed field conditions.

10. Pipeline and other utility crossings.

The following pipeline/utility companies have pipeline/utilities located within the vicinity of the project:

Tennessee Gas Pipeline (TGP)
Houma, Louisiana

The contractor notified LA One Call of the proposed work and these companies were contacted specifically to ensure the proper location of their respective pipelines.

11. Safety and Accidents.

Very good safety record with one accidents reported by a subcontractor. An employee of Manson Gulf was injured on 4/21/08 and was discharged from treatment on 4/23/08 to return to work.

12. Additional comments pertaining to construction, completed project, etc.

The following comments were developed from the "Lessons Learned Meetings".

General

- Beginning the flotation dredging in February worked out well as far as timing the work with the weather. The best water and wind conditions for the breakwater work were in the summer, next best was spring. December to March should be avoided for breakwater work.
- Spirit of cooperation between the Federal Sponsor, Contractor and DNR was crucial to success of project.
- Reducing abrupt changes in profile and more closely following contours with the breakwater alignment will reduce abrupt changes in width of adjoining lengths of pre-assembled geotextile

fabric and waste. Provide for degrading of existing high spots along the alignment to avoid unnecessarily bending the alignment around them.

Pre-construction

- Mandatory Pre-bid Site Visit for bidders serves to acquaint all bidders with site conditions and reduces the possibility of bidding errors.
- When the Contractor contacted the property owners at the start of construction, some owners said they did not know about the project and some of the oyster fishermen who worked the leases and were not necessarily the lease holders claimed not to know about the acquisition of the leases. It would be helpful for the State to contact the property owners and lessees before construction and remind them about the project and to notify any others on their property and leases before the Contractor notification.

Surveying

- Staking the work limits would have helped delineate the oyster lease boundaries and made it easier for the Contractor to stand their ground when challenged by oyster fishermen. "Work Limits" is the preferred terminology over "Lease Limits" because there are legal implications for property surveys when staking leases.
- Consider using buoys instead of stakes for locations in deeper water for work limits. Factors such as risk of their mooring lines fouling workboat propellers, their expense and visibility are some issues for evaluation of their use.
- Limit survey areas to what is actually required for the work, so that survey effort is not expended on areas not used.
- The Secondary Monuments provided were well placed for control.
- Require deep rods with static survey where TBM locations for daily work are likely to experience movement. TBM 3 (4' long rebar) was located in a shell bank and it was subject to elevation differences of +/- 0.2' from day to day.
- Recommend that pre-bid and post construction surveys use the same stations for sections. Also, a survey should be done of the dredged channels and spoil bank at the same stations to document their constructed sections and locations.
- Require closer spaced surveys for expensive structures like breakwaters and a survey of the shoreline. For areas of complex features use a grid within a block and pick up any features that fall between gridlines.
- For process surveys, a centerline profile defines a more true as-built alignment and grade.

Access and Flotation Channels

- The Flotation and Access channels were well suited to the equipment used. The 140' dragline boom had a 100' reach (at 43 degrees from horizontal) from the center of the 50'wide dredge barge.
- For flotation channel layout, 500' segments are not too short as long as intersecting angles are not too sharp for maneuvering equipment.

Geogrid Composite

- In-place measurement of geogrid placed in water is impractical; measurement based on plan dimensions was workable.
- Typical sewing machine capability for sewing "J" seams in geogrid fabric are a throat depth of 4" and thickness of ½ ".
- For geogrid seams the bodkin bars worked well, but the Double Stitch Seam took 45 minutes to do in the field on land vs. 5 minutes for bodkin bars. They would have been much more difficult in the

water. It was recommended that Bodkin bars be used for all geogrid seams instead of the Double Stitch Seam and that they be installed in field since the bodkin bars might be moved out of place during folding of the rolls for shipment to field. The assembled panels would be held together by the stitched geotextile fabric with a few zip ties for the geogrid.

250 Lb. Class Rock

- Placement of the breakwater near the intended +0.5' contour at the shoreline was easier that placement in the water.
- Suggest smaller stone be used for armoring the fill within the sheetpile wall to ease installation and reduce damage to structure, tie rods, and coating.
- Specify rock lift thicknesses at least as thick as the rock size.
- Allow use of COE Barge Tables for barges included in that list in lieu of individual measurement by registered engineer.
- For this project rock was placed using a barge mounted 2 CY trackhoe with a 65' reach from a 75' boom and 5 CY dragline with 100' reach from a 120' boom. Draglines have more reach but more impact when placing and dressing. Trackhoe has more precision. Both are capable of producing acceptable rock placement. Reaches 3 & 4 were placed with a dragline and Reaches 1 & 2 were placed about 75% by trackhoe and the rest by dragline.

Settlement Plates

- Require Settlement Plate pipe threads to be masked before hot dip galvanizing and then use a cold galvanizing paint like "galvalox". Investigate alternative methods for capping and extending settlement plate pipes.
- Settlement plate survey frequency should be daily to capture initial settlement data, then extended to weekly.
- Tack weld the caps to the tops of the settlement plate pipes. (breakwater issue)

Warning Signs

- Suggest using buoys instead of piling mounted signs for spoil bank warning signs. Piling mounted sign locations must consider accessibility for installation equipment.
- Pile lengths must be based on soil conditions, depth of water and sign height requirements.

Sand Fill

- The LaDOTD specification for sand fill used was reported to be unattainable by local sources of sand because of the requirements for fines.

Steel Sheet Pile and associated items

- Consider using a higher elevation for the top of sheet pile wall. Seasonal tide range variations have resulted in extended periods of waves over washing the structure making conditions unsuitable for coating repair. Also, visibility of structure is low during these high tide periods.
- The combination of deep water and soft soil led to the decision to use a sheet pile structure instead of rock in the area of Bayou Dupre and Bayou Pollet. Vibration was initially prohibited because of the risk of liquifying the soil. The water bottom was significantly changed by Hurricane Katrina between the design investigations and construction.
- Tack weld each sheet to the previous sheet to prevent the next sheet from dragging it down through interlock friction.

- Use vibration sparingly to overcome interlock friction but not enough to liquefy the soil.
- Suggest additional geotechnical investigation with more and deeper borings for future designs of structures of this nature.
- In the layout of the sheets during preparation of shop drawings set sheets so that the flat side of the paired sheets (with interlock) is on the waler side.
- For deeper sheets, tack the bottom of the paired sheet interlocks to prevent splaying of the bottom of the sheets as they are driven to depth.
- Suggest making placement of sand a milestone because the sand adds stability to the double sheet pile structure. The timing of this must be carefully considered along with the placement of the scour protection rock from a geotechnical standpoint. Careful coordination by the Contractor of the sand and rock placement with pile driving will be required.
- Allow field fitting of walers and field location of tie rod penetrations. Revisit the associated plan details to facilitate field construction conditions such as utilizing slotted holes in walers for tie rods.
- Revisit specifications for field applied coatings and coating touch-up.
- Clarify method of measurement for payment. Measurement based on the linear feet of wall encourages stretching out the wall resulting in less section modulus per foot of wall. Measurement based on number of sheets better assures provision of the required section modulus per foot of wall.
- Include lockwashers for splice plate bolts.
- The Contractor experienced the theft of almost all of their safety lights which were clamped to the sheet piles. These were clamped in order to avoid damage to the sheet pile coating. Consider allowing alternate methods of securing these lights to make theft more difficult.
- The available pile driving equipment required 4.5’ draft. The shallower locations were accessible at higher tides. Consider extending flotation channels to the pile driving areas.

13. Significant construction dates.

ACTION	**DATE**
Bid I.D. (Const., Veg., etc.)	Shoreline Protection
Bid Opening	5/15/2007
Construction Contract Award	6/28/2007
Preconstruction Conference	8/9/2007
Notice to Proceed	8/1/2007
Mobilization	9/4/2007
Construction Start	9/4/2007
Construction Completion	12/16/2008
Final Acceptance	6/18/2009