



COLE'S BAYOU MARSH RESTORATION PROJECT (TV-63) PROJECT COMPLETION REPORT

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PROJECT COMPLETION REPORT

Project: Cole's Bayou Marsh Restoration Project

State Project No.: TV-63

By: Sellers & Associates, Inc.

Prepared: December 24, 2019

COMPANY ACRONYMS

CPRA: Coastal Protection and Restoration Authority

NOAA: National Oceanic and Atmospheric Administration

GLDD: Great Lakes Dredge and Dock

Wilco: Wilco Marsh Buggies & Draglines

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S&A: Sellers and Associates, Inc.

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1 Project Overview

The Cole's Bayou Marsh Restoration Project (TV-63) is located in the southern part of Vermilion Parish, between Little Vermilion Bay and Freshwater Bayou Canal (FWB). Wetlands within the project area are undergoing losses at -0.42%/year based on 1983 to 2011 USGS data. Altered hydrology, saltwater intrusion, subsidence/sediment deficit, and storm impacts have led to significant wetlands loss throughout the project area. The project goals and features were to 1) create and nourish 415 acres of brackish marsh within three (3) marsh creation areas of recently formed shallow open water; and, 2) construct nine (9) water control structures to increase freshwater and sediment inflow into interior wetlands and improve project area hydrology. The National Oceanic and Atmospheric Administration (NOAA) served as the project's federal sponsor with funding approved through the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA). The Louisiana Coastal Protection and Restoration Authority (CPRA) served as the local sponsor and were responsible for the engineering design services and construction management. Great Lakes Dredge & Dock Company, LLC (GLDD) was the construction contractor for the project. Sellers & Associates, Inc. (S&A) was tasked for Construction Administration & Inspection of the project.

The project's design included three separate marsh creation areas (MCA) totaling 415 acres of restored marsh. MCA 1, MCA 2, and MCA 3 contained 25 acres, 109 acres, and 281 acres, respectively. The marsh creation features of the project included the construction of earthen containment dikes (ECD) around the perimeter of each MCA to ensure that marsh fill material would be contained. The three ECDs totaled 41,707 linear feet. Due to large vessel traffic in FWB the MCA 1 & 2 ECDs along FWB were highly susceptible to scour, erosion, and failure. To mitigate potential failures and erosion, articulated concrete block mats were placed in high-risk areas identified along MCA 1 & 2 ECDs. Once ECD construction was complete, the Sandpiper Dredge hydraulically dredged 1,207,186 cubic yards of sediment from the marsh creation borrow area (MCBA) in Little Vermilion Bay and discharged the sediment into MCAs 1-3 utilizing a temporary dredge pipeline.

An additional feature of the Cole's Bayou Marsh Restoration included the construction of 9 water control structures (WCS). The WCS are intended to increase freshwater and sediment inflow into interior wetlands to improve project area hydrology. The nine WCSs were designed and constructed utilizing 42" corrugated metal piping (CMP) containing an inline check valve, timber piling and framing for pipe support, earthen fill material, and protected with articulated concrete block mats.



2 *Marsh Creation*

| TABLE 1: MCA DESIGN ELEVATIONS | | |
|--------------------------------|---|--------------------|
| AREA | CONSTRUCTED MARSH FILL TARGET ELEVATION | VERTICAL TOLERANCE |
| MCA 1 | +2.0' | -0.5' |
| MCA 2 | +2.0' | -0.5' |
| MCA 3 | +2.5' | -0.5' |

2.1 *Marsh Creation Area 1*

Construction of the ECD for MCA 1 began on September 11, 2018. The ECD was constructed with a typical section of 5' crest width at elevation +3.0' to +4.0' (armored ECD at elevation +3.5' to +4.0) with side slopes of 4:1. The material used to construct ECD 1 was not suitable to construct the dike to the target elevation in one lift. Therefore, Wilco constructed a base for the ECD and allowed it to consolidate before constructing a second lift to bring the ECD within the required vertical tolerance. Borrow material was taken from inside MCA 1 to allow for the hydraulically dredged sediment to fill the voids created from the ECD construction. ECD 1 totaled 5,887 linear feet. The ECD was protected with articulated concrete block mats and geotextile fabric from St. 23+95 to St. 35+73.



Figure 1: ECD 1 Construction



Upon completion of ECD 1, non-woven geotextile fabric and articulated concrete block mats were installed along Freshwater Bayou to protect the ECD from erosion and scour due to high vessel traffic in the project area, as shown in figure 2.



Figure 2: Articulated Concrete Block Mats placed along ECD 1

On December 6, 2018, the contractor began dredging operations and discharging marsh fill material into MCA 1. Two weir boxes were installed along the southwestern reach of the ECD for dewatering. Stop logs were added and removed as necessary to allow for dewatering, while preventing marsh fill material from exiting through the weir boxes. The decanted water was discharged into the marsh nourishment area.

On January 6, 2019 GLDD finished discharging marsh fill material into MCA 1, initiating the 30 day settlement period. The as-built survey for MCA 1 began on February 6, 2019. The total marsh fill quantity for MCA 1 was 60,740 CY, restoring approximately 25 acres of marsh. Upon completion of MCA 1 the weir boxes were removed and three areas of ECD 1 were degraded to allow for continued dewatering. The three degraded areas totaled 210 ft to approximately elevation 2.0. The location of the ECD to be degraded was determined in the field by the project team during a biweekly site inspection. Area's to be degraded were selected to maximize dewatering while preventing dredged material from escaping MCA 1. The summary of estimated quantities for MCA 1 is shown in Table 2. MCA 1 as-built surveyed marsh fill elevations are shown in Table 3.



| TABLE 2: MCA 1 AS-BUILT QUANTITIES | | |
|------------------------------------|------|--------------------|
| ITEM | UNIT | ESTIMATED QUANTITY |
| MARSH CREATION AREA 1 FILL | CY | *60,740 |
| EARTHEN CONTAINMENT DIKE | LF | *5,887 |
| ARTICULATED CONCRETE BLOCK MAT | SY | *5,353 |
| NON-WOVEN GEOTEXTILE FABRIC | SY | **5,888 |

*The Quantities shown were calculated from the after dredge as-built surveys of MCA-1 performed between February 6 through August 28, 2019. This is a fill quantity calculated using a surface differential from field surveys, cut quantities are described in Section 4.

**The Non-Woven Geotextile Fabric was calculated by adding 10% to the ACB Mat quantity

| TABLE 3: MCA 1 AS-BUILT FILL ELEVATIONS | |
|---|---------------------------------|
| CONSTRUCTED ELEVATION RANGE | ACRES CONSTRUCTED WITHIN RANGE* |
| 1.0 - 1.5 | 0.09 |
| 1.5 - 2.0 (Target Elevation) | 7.88 |
| 2.0 - 2.66 | 16.25 |

*Quantities shown are calculated from field surveys of MCA 1 with survey shots taken on material hydraulically dredged. The estimated area calculated during design (25 acres) was determined using a perimeter of the centerline of the Earthen Containment Dike. The differences between as built MCA fill areas and Design areas can be attributed to fill areas not encapsulated by the actual field survey points and half the ECD width being included in the design area calculations.

2.2 Marsh Creation Area 2

Marsh Creation Area 2 was constructed concurrently with MCA 1. MCA 2's proximity to MCA 1 allowed for the dredging operations to alternate discharging marsh fill material between MCA 1 and 2 by utilizing a Y-Valve in the dredge pipeline. The ECD 2 typical section was 5' crest width at elevation +3.0' to +4.0' with side slopes of 4:1. Original construction documents did not include ACB mats on ECD 2. However, as the project progressed large vessel traffic in Freshwater Bayou was eroding ECD 2. To protect ECD 2 and MCA 2 from further erosion, articulated concrete block mats and non-woven geotextile fabric were added in Change Order No. 4. The articulated concrete block mats and geotextile fabric were added from St. 70+87 to St. 72+26.

GLDD began discharging marsh fill material into MCA 2 on December 9, 2018. Two weir boxes were installed at MCA 2 to dewater the area. Both weir boxes were placed along the southeastern reach of ECD 2 to allow decanted water to be discharged into the marsh nourishment area. Stop logs were added and removed in the weir boxes as required to allow for dewatering while preventing marsh fill material from exiting through the weir boxes.





Figure 3: Earthen Containment Dike 2

GLDD completed MCA 2 construction on January 15, 2019. The 30 day settlement period was initiated and a final survey of MCA 2 began on February 15, 2019. The total marsh fill quantity calculated from the as-built survey for MCA 2 was 301,127 CY, restoring approximately 109 acres of marsh. Upon completion of MCA 2 the weir boxes were removed and four areas of ECD 2 were degraded to allow for dewatering. The four degraded areas totaled 200 ft to approximately elevation 2.0. The location of the ECD to be degraded was determined in the field by the engineer of record and the resident site representative. Areas to be degraded were selected to maximize dewatering while preventing dredged material from escaping MCA 2. The summary of estimated quantities for MCA 2 is shown in Table 4. MCA 2 as-built marsh surveyed fill elevations are shown in Table 5.

| TABLE 4: MCA 2 AS-BUILT QUANTITIES | | |
|------------------------------------|------|--------------------|
| ITEM | UNIT | ESTIMATED QUANTITY |
| MARSH CREATION AREA 2 FILL | CY | *301,127 |
| EARTHEN CONTAINMENT DIKE | LF | *9,613 |
| ARTICULATED CONCRETE BLOCK MAT | SY | *613 |
| NON-WOVEN GEOTEXTILE FABRIC | SY | **674 |

*The Quantities shown were calculated from the after dredge as-built surveys of MCA 2 performed between February 6 through August 28, 2019. This is a fill quantity calculated using a surface differential from field surveys, cut quantities are described in Section 4.

**The Non-Woven Geotextile Fabric was calculated by adding 10% to the ACB Mat quantity



| TABLE 5: MCA 2 AS-BUILT FILL ELEVATIONS | |
|---|--------------------------------|
| CONSTRUCTED ELEVATION RANGE | ACRES CONSTRUCTED WITHIN RANGE |
| 1.0 - 1.5 | 0 |
| 1.5 - 2.0 (Target Elevation) | 4.12 |
| 2.0 - 3.15 | 100.95 |

*Quantities shown are calculated from field surveys of MCA 2 with survey shots taken on material hydraulically dredged. The estimated area calculated during design (109 acres) was determined using a perimeter of the centerline of the Earthen Containment Dike. The differences between as built MCA fill areas and Design areas can be attributed to fill areas not encapsulated by the actual field survey points and half the ECD width being included in the design area calculations.

2.3 Marsh Creation Area 3

Marsh Creation Area 3 was the last and largest MCA constructed in the Cole's Bayou Marsh Restoration Project. ECD 3 geometries included 5' crest widths, crest heights of +3.5' to +4.5', and side slopes of 4:1. The construction of ECD 3 required borrow material to be taken from outside and inside of MCA 3 as shown on the construction plans. GLDD began discharging marsh fill material into MCA 3 on January 19, 2019.



Figure 4: MCA 3 Aerial (taken June 2019)

GLDD completed MCA 3 construction on March 9, 2019. The 30 day settlement period was initiated and a final survey of MCA 3 began on April 9, 2019. Six weir boxes were installed at MCA 3 to dewater the area. Five boxes were placed along the southwestern reach of ECD 3 and one box was placed on the eastern reach to allow for dewatering into the two marsh nourishment areas. Stop logs were added and removed as required to allow for dewatering, while preventing marsh fill material from exiting through the weir boxes. Upon completion of the 30 day settlement period the ECD's were degraded to approximately elevation 2.5. The location of the ECD to be degraded was determined in the field by project team during a biweekly site inspection. Areas to be degraded were selected to maximize dewatering while preventing dredged material from escaping MCA 1. The summary of estimated quantities for MCA 3 is shown in Table 6. MCA 3 as-built surveyed marsh fill elevations are shown in Table 7.



| ITEM | UNIT | ESTIMATED QUANTITY |
|----------------------------|-------------|---------------------------|
| MARSH CREATION AREA 2 FILL | CY | *1,090,257 |
| EARTHEN CONTAINMENT DIKE | LF | *25,818 |

*The Quantities shown were calculated from the after dredge as-built surveys of MCA 3 performed between February 6 through August 28, 2019. This is a fill quantity calculated using a surface differential from field surveys, cut quantities are described in Section 4.

| CONSTRUCTED ELEVATION RANGE | ACRES CONSTRUCTED WITHIN RANGE |
|------------------------------------|---------------------------------------|
| 0.8 - 2.0 | 23.47 |
| 2.0 - 2.5 (Target Elevation) | 142.63 |
| 2.5 - 3.4 | 79.31 |

*Quantities shown are calculated from field surveys of MCA 2 with survey shots taken on material hydraulically dredged. The estimated area calculated during design (109 acres) was determined using a perimeter of the centerline of the Earthen Containment Dike. The differences between as built MCA fill areas and Design areas can be attributed to fill areas not encapsulated by the actual field survey points and half the ECD width being included in the design area calculations.

3 Water Control Structures

The Water Control Structures constructed in the Cole's Bayou Marsh Restoration Project were primarily constructed by Wilco, a subcontractor to Great Lakes Dredge and Dock. One of the major challenges encountered in construction were the differences in the field conditions observed in the pre-construction survey compared to the design survey and construction plans. The changes in site conditions at WCS 3, 5, and 7 required a substantial change in the contractor's dewatering efforts. As part of the work plan, the contractor proposed to construct temporary earthen dams and dewater the sites for water control structure construction. However, erosion and scour at WCS 3, 5, and 7 made the construction of earthen dams impractical. In lieu of earthen dams, alternative solutions including divers constructing the structure underwater and steel sheet pile wall cofferdams were considered. It was determined that the most practical and cost effective solution to construct WCS 3, 5, and 7 would be utilizing steel sheet pile cofferdams. Compensation for the additional effort to dewater the sites and additional earthwork was included in Change Order No. 3. In addition to increasing the compensation for required earthwork, Change Order increased the number of timber joists that would support to the CMP to prevent sagging and include CMP collars to prevent uplift in the CMPs, this change order is further described in section 10.3 and included with all back up documentation in Appendix B. Change Order No. 4 included an increase in contract quantity in non-woven Geotextile fabric at EP 3 and EP 6 to prevent the earthen plugs from eroding and washing out.

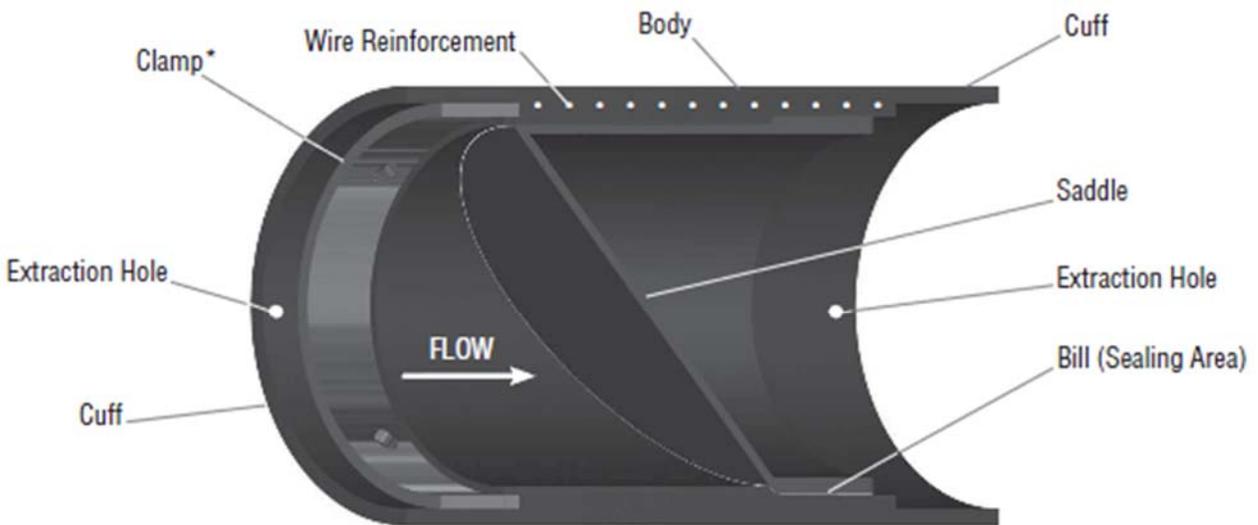
Water Control Structures 1-3 and 5-9 included the installation of 42" corrugated metal pipes, each containing a Red-Valve inline check valve (shown in Figure 5). WCS 4 did not include an inline check valve. The check valves are located on the channel-side end of the WCS to allow access for any future



maintenance that may be required. The required check valves were installed in the CMPs at the Intracoastal City staging area prior to being mobilized to each WCS site.

The construction of the various water control structures included driving 8" timber piles, installing 4"x 12" timber joists, installing CMPs, backfilling, and placing non-woven geotextile fabric and ACB mats to protect the structure. The CMPs at each WCS were designed to have both intake and outfall elevations at exactly -2.0 with zero vertical tolerance, actual as-built elevations are shown in the table below. The WCS were tied into existing bank lines on either side of the structure.

The installation process for the Red Valve inline check valve shown below required the valve to be fastened inside the pipe using a minimum of two 304 stainless steel expansion clamps. Corrugations in the CMP around the inline check valve were then filled with grout to create a seal between the valve and the pipe. In occasional instances when the expansion clamps could not be secured in the CMP, they were allowed to be through bolted.



*Clamps are installed in the upstream or downstream cuff, depending upon the application. The illustration above is shown clamped upstream.

Figure 5: Red Valve inline check valve

| TABLE 8: WCS LOCATIONS AND ELEVATIONS | | | | |
|---------------------------------------|------------|--------------|---------------------|---------------------|
| ITEM | NORTHING | EASTING | INTAKE EL. | OUTFALL EL. |
| WCS 1 | 449,238.14 | 2,997,325.96 | -1.84, -1.94, -1.74 | -2.15, -2.10, -2.13 |
| WCS 2 | 449,498.18 | 2,997,441.70 | -1.79, -2.11 | -1.84, -1.64 |
| WCS 3 | 448,119.02 | 2,999,008.74 | -1.84 | -2.10 |
| WCS 4 | 449,367.65 | 2,999,736.15 | -2.10 | -2.02 |
| WCS 5 | 449,051.89 | 3,002,306.92 | -1.93, -2.10, -1.99 | -2.28, -2.21, -2.19 |
| WCS 6 | 441,509.19 | 3,005,143.51 | -2.39, -2.38, -2.30 | -2.26, -2.15, -2.16 |
| WCS 7 | 439,098.37 | 3,003,917.01 | -2.56, -2.54, -2.49 | -2.49, -2.51, -2.44 |
| WCS 8 | 437,737.47 | 2,999,656.73 | -1.85, -1.85, -1.89 | -1.88, -1.86, -1.95 |
| WCS 9 | 437,652.73 | 2,998,160.90 | -1.72, -1.80, -1.77 | -1.85, -1.82, -1.91 |



| TABLE 9: DESIGN VS. CONSTRUCTED EARTHWORK QUANTITIES (CY) | | | | |
|---|-----------|------|-------------|------|
| STRUCTURE | DESIGN | | CONSTRUCTED | |
| | EXCAVATED | FILL | EXCAVATED | FILL |
| WCS 1 | 494 | 357 | 600 | 500 |
| WCS 2 | 307 | 215 | 250 | 475 |
| WCS 3 | 59 | 72 | 50 | 250 |
| EP 3 | 0 | 164 | 350 | 50 |
| WCS 4 | 22 | 206 | 200 | 300 |
| WCS 5 | 23 | 353 | 50 | 353 |
| WCS 6 | 423 | 219 | 450 | 400 |
| EP 6 | 0 | 166 | 540 | 1047 |
| WCS 7 | 284 | 251 | 208 | 482 |
| WCS 8 | 580 | 173 | 968 | 641 |
| WCS 9 | 401 | 173 | 743 | 793 |

3.1 Water Control Structure 1

Water Control Structure 1 included the installation of three 42" corrugated metal pipes, each containing a Red Valve inline check valve. The check valves are located at the intake of WCS 1. An earthen dam was constructed around the perimeter of WCS 1 to dewater the area. Fill material used in the construction of WCS 1 was taken from the pre-existing earthen berm located at WCS 1. The sequence of construction for WCS 1 is depicted in Figures 6 – 9.



Figure 6: WCS 1 Construction (3/19/2019)





Figure 7: WCS 1 Construction (3/25/2019)



Figure 8: WCS 1 Construction (5/7/2019)



Figure 9: WCS 1 (8/20/2019)

3.2 Water Control Structure 2

Water Control Structure 2 included the installation of two 42" corrugated metal pipes, each containing a Red Valve inline check valve. To dewater the area an earthen dam was constructed around the perimeter of WCS 2. Fill material used in the construction of WCS 2 was taken from the pre-existing earthen berm located at WCS 2. The sequence of construction for WCS 2 is depicted in Figures 10 – 15.





Figure 10: WCS 2 Construction (3/30/2019)



Figure 11: WCS 2 Construction (4/1/2019)



Figure 12: WCS 2 Construction (4/2/2019)



Figure 13: WCS 2 Construction (4/3/2019)



Figure 14: WCS 2 Construction (5/7/2019)



Figure 15: WCS 2 (8/20/2019)

3.3 Water Control Structure 3 and Earthen Plug 3

Water Control Structure 3 included the installation of one 42" corrugated metal pipe containing a Red Valve inline check valve. The check valve is located at the intake of WCS 3. Steel sheet piles were erected around WCS 3 to dewater the area. The change in site conditions between the design survey and pre-construction survey required Wilco to use the steel sheet piles in lieu of an earthen dam to effectively dewater the construction area.

In addition to the WCS an earthen plug (EP 3) was constructed. The earthen plug was located south of WCS 3 and was designed with a target as-built elevation of 2.5'. WCS and EP 3 were constructed using borrow material excavated from the adjacent canal. The original construction plans did not include ACB mats to be installed at EP3. The layout of the WCS 3 ACB mats was expanded to encapsulate EP 3 to mitigate concerns of the EP washing out. The maximum as-built constructed elevation of EP 3 is 4.3'. The sequence of construction for WCS 3 and EP 3 is depicted in Figures 16 – 21.



Figure 16: Steel Sheet Piles being set at WCS 3 (5/14/2019)



Figure 17: Steel Sheet Piles being set at WCS 3 (5/15/2019)



Figure 18: WCS 3 Construction (5/27/2019)



Figure 19: WCS 3 (6/12/2019)



Figure 20: WCS 3 and EP 3 (8/21/2019)





Figure 21: WCS 3 and EP 3 (8/20/2019)

3.4 *Water Control Structure 4*

Water Control Structure 4 construction included the installation of one 42" corrugated metal pipe. To dewater the construction area an earthen dam was constructed around the perimeter of WCS 4. Fill material used in the construction of WCS 4 was taken from the adjacent canal at a minimum of 25' from existing marsh. The sequence of construction for WCS 4 is depicted in Figures 22 – 26.



Figure 22: WCS 4 Construction (4/8/2019)





Figure 23: WCS 4 Construction (4/10/2019)



Figure 24: WCS 4 Construction (4/11/2019)





Figure 25: WCS 4 Construction (5/7/2019)



Figure 26: WCS 4 (8/20/2019)

3.5 Water Control Structure 5

Water Control Structure 5 included the installation of three 42" corrugated metal pipes, each containing a Red Valve in-line check valve. Design surveys depicted a water bottom elevation of approximately -6.0'. Preconstruction surveys showed a water bottom elevation of approximately -11.0', making backfill and dewatering construction considerably more difficult. To dewater the area a steel sheet pile cofferdam was erected around the perimeter of WCS 5. Wilco attempted to drive the sheet piles without using a vibratory hammer to fully embed the sheet piles. As Wilco began pumping out the work area, the sheet piles on the marsh side failed and caved in from the exterior hydrostatic pressure. The sheets were damaged in the process and Wilco had to remove and replace the damaged sheet piles,



delaying the construction of WCS 5. Fill material used in the construction of WCS 5 was taken from the adjacent canal, a minimum of 25' from pre-existing spoil banks. The sequence of construction for WCS 5 is depicted in Figures 27 – 32.



Figure 27: WCS 5 Construction (6/11/2019)



Figure 28: WCS 5 Construction (6/13/2019)



Figure 29: WCS 5 Backfilling (6/14/2019)



Figure 30: WCS 5 (6/19/2019)



Figure 31: WCS 5 (8/20/2019)



Figure 32: WCS 6 (8/20/2019)

3.6 *Water Control Structure 6 and Earthen Plug 6*

Water Control Structure 6 included the installation of three 42" corrugated metal pipes, each containing a Red Valve in-line check valve. An existing culvert and wooden piles were removed prior to the construction of WCS 6. Pre-Construction surveys for WCS 6 showed differing site conditions within the existing canal, particularly near the channel side (east side) of the WCS where the water bottom was deeper than shown in the construction plans. To avoid sheet pile construction WCS 6 was moved approximately 15' westward from Belle Isle Bayou which allowed earthen dam construction for dewatering. WCS 6 construction utilized fill material excavated from the pre-existing spoil bank at WCS 6. The sequence of construction for WCS 6 and EP 6 is depicted in Figures 33 – 44.

EP 6 presented various challenges, similar to EP 3. EP 6 continuously settled and degraded after initial construction was complete (degradation shown in Figure 37). Animals (alligators crossing), Hurricane Barry, boats crossing, water level fluctuation and tidal flushing contributed to the erosion and degradation of the plug. To ensure the structural stability of EP 6, it was rebuilt and protected with geotextile fabric and ACB mats through Change Order No. 4. The design target elevation of EP 6 was 2.5', while the as-built elevation varies from 2.5' – 3.3'. EP 6 was constructed using material excavated from the adjacent canal.



Figure 33: EP 6 Construction (2/13/2019)



Figure 34: EP 6 (2/14/2019)



Figure 35: EP 6 (2/19/2019)



Figure 36: EP 6 (2/26/2019)



Figure 37: EP 6 (6/14/2019)



Figure 38: EP 6 (8/8/2019)



Figure 39: Existing Wooden Piles to be removed at WCS 6 (4/15/2019)



Figure 40: WCS 6 Construction (4/17/2019)



Figure 41: WCS 6 Construction (4/23/2019)



Figure 42: WCS 6 Construction (4/28/2019)



Figure 43: WCS 6 (8/20/2019)



Figure 44: EP6 (8/20/2019)

3.7 Water Control Structure 7

Preconstruction surveys for WCS 7 depicted very different site conditions than the construction plans. Construction plans for WCS 7 showed the existing water bottom at elevation -3.0'. Preconstruction surveys profiled the existing water bottom below elevation -7.0'. Therefore, a steel sheet pile cofferdam was erected for dewatering WCS 7. WCS 7 construction included the installation of three 42" corrugated metal pipes, each containing a Red Valve in-line check valve. WCS 7 was constructed using material excavated from the adjacent canal. The sequence of construction for WCS 7 is depicted in Figures 45 - 49.





Figure 45: WCS 7 Construction (7/3/2019)



Figure 46: WCS 7 Construction (7/5/2019)



Figure 47: WCS 7 Construction (7/6/2019)



Figure 48: WCS 7 (7/31/2019)



Figure 49: WCS 7 (8/20/2019)

3.8 Water Control Structure 8

Water Control Structure 8 included the installation of three 42" corrugated metal pipes, each containing a Red Valve in-line check valve. An existing wooden observation tower was in the vicinity of WCS 8 and remained without interference by construction activities. During the construction of WCS 8, the project team observed sediment north of WCS 8 affecting the inflow through the structure. To allow the WCS to function as designed, the limits of the work area were expanded to allow the sediment to be relocated. The cabling described in section 3.9 to prevent uplift of the CMPs was also utilized at WCS 8. To dewater the area and earthen dam was constructed around the perimeter of WCS 8. WCS 8 was constructed using material excavated from the pre-existing spoil bank at WCS 8. The sequence of construction for WCS 8 is depicted in Figures 50 – 55.



Figure 50: WCS 8 Prior to Construction (1/22/2019)



Figure 51: WCS 8 Construction (1/30/2019)



Figure 52: WCS 8 Construction (1/31/2019)



Figure 53: WCS 8 (2/13/2019)



Figure 54: WCS 8 (3/6/2019)



Figure 55: WCS 8 (9/1/2019)

3.9 Water Control Structure 9

Water Control Structure 9 included the installation of three 42" corrugated metal pipes, each containing a Red Valve in-line check valve. WCS 9 was the first WCS constructed in the Cole's Bayou Marsh Restoration Project. During the construction of WCS 9, it was observed that the end of the CMPs without the check valve experienced an uplift causing the invert of the intake to be above the required elevation. It is suspected that the uplift was caused by inadequate bedding and support under the pipe, the weight of the earthen embankment and ACB mats on top of the pipe, and movement/pumping of earthen material below the pipe. To compensate for the uplifting forces a new bid item, "CMP Collars," was included in Change Order No. 3 to secure the ends of the CMPs to the timber joists. The CMP collars are shown in Figure 56. Prior to CMP collar fabrication, an alternative solution was required at WCS 9 to allow construction to proceed while preventing uplift in the culverts. A steel cable was used to secure the pipe to the timber joist below. This method was approved and utilized only at WCS 8 and 9.

The contract quantity for "Treated Timber Piles (TS-950)" was increased by 38 piles in Change Order No. 3. The CMPs installed at WCS 9 were manufactured in lengths of 40' and 20'. The two joints of pipe were joined utilizing coupling bands specified in TS 510.4. In order to properly support both ends of the joint and coupling bands, additional timber piles and joists were added through Change Order No. 3.

WCS 9 was constructed using material excavated from the pre-existing spoil bank. The sequence of construction for WCS 9 is depicted in Figures 56 – 64.



Figure 56: CMP Collars



Figure 57: WCS 9 prior to Construction (1/8/2019)



Figure 58: WCS 9 Construction (1/11/2019)



Figure 59: WCS 9 Construction (1/14/2019)



Figure 60: WCS 9 (1/17/2019)



Figure 61: WCS 9 (1/24/2019)



Figure 62: WCS 9 showing intake of "pipe A" a higher elevation than the other two (1/22/2019)





Figure 63: WCS 9 Construction (2/23/2019)



Figure 64: WCS 9 (9/1/2019)

4 Marsh Creation Borrow Area and Dredge Pipeline

4.1 Marsh Creation Borrow Area

The Marsh Creation Borrow Area (MCBA) for the Cole's Bayou Marsh Restoration Project consisted of 184 acres and 2,729,463 CY of available marsh fill material. The contractor, Great Lakes Dredge and Dock, dredged 1,207,186 cubic yards of marsh fill material from Little Vermilion Bay. At no point in the project did GLDD perform any dredging activities outside of the limits of the MCBA.

Payment for Bid Item No. 11 "Hydraulic Dredging and Marsh Fill (TS-400)" was quantified by a volume differential of MCBA pre-construction and post-construction surveys or "payment on the cut." Monthly process surveys were performed by Tice Engineering to calculate dredged volumes to be included on monthly invoicing. Due to GLDD's dredging approach alternative transects from the construction survey layout were proposed through RFI 4. GLDD requested to collect data in 100' cross sections in the MCBA perpendicular to the previously collected transects shown in the construction survey layout. GLDD requested this in an effort to more accurately collect data to fully encapsulate the quantity of material dredged for monthly and final pay applications. The summary of estimated quantities included in the MCBA as-built survey is shown in Table 10.

The final cut to fill ratio observed was 0.83. The differences in the excavated and placed quantities can be attributed to the turbulent behavior observed by the sediment from the dredge cutter head to the dredge pipe discharge. As material is transported to each MCA, the soil's dry density is expected to be lower when compared to the in situ dry density of the soil prior to construction. As the hydraulically dredged material continues to settle, compress, and consolidate in the MCAs we expect the cut to fill ratio to continue to approach and potentially surpass 1.0.

| PROCESS SURVEY NO. | DATE | ESTIMATED QUANTITY |
|--|------------------------|---------------------------|
| PR-AB-01 | DECEMBER 10, 2018 | 17,281 |
| PR-AB-02 | JANUARY 11, 2019 | 288,250 |
| PR-AB-03 | FEBRUARY 11 & 12, 2019 | 578,963 |
| PR-AB-04 | MARCH 11, 2019 | 322,692 |
| TOTAL | | 1,207,186 |
| PRE-CONSTRUCTION ESTIMATED QUANTITY | | 1,190,689 |

Summaries of MCA fill volumes based on as-built survey data for each MCA are shown below in Table 11 and the cut-to-fill ratio is shown in Table 12.

| MARSH CREATION AREA | VOLUME PLACED (CY) |
|----------------------------|---------------------------|
| MCA 1 | 60,740 |
| MCA 2 | 301,127 |
| MCA 3 | 1,090,257 |
| Total | 1,452,124 |



| TABLE 12: CUT TO FILL RATIO | | |
|-----------------------------|--------------------|-------------------|
| VOLUME EXCAVATED (CY) | VOLUME PLACED (CY) | CUT-TO-FILL RATIO |
| 1,207,186 | 1,452,124 | 0.83 |

4.2 Dredge Pipeline

To transport fill material from the Marsh Creation Borrow Area (MCBA) to each marsh creation area, GLDD constructed a 24" dredge pipeline. The dredge pipeline was constructed by connecting the pipeline segment, end-to-end, and floating the pipeline segments to the desired location through the dredge pipe corridor. The dredge pipeline consisted of both steel and high density polyethylene pipe. To minimize impacts on existing marsh, the plans required the use of wooden board mats to support the dredge pipe in areas with existing marsh. The board mats were utilized to distribute the weight of the dredge pipeline over a larger area. The use of board mats allowed for the marsh to return to pre-project conditions.

During the project, a potential hazard was observed at the intersection of the dredge pipe corridor and the equipment access corridor to the McIlhenny Canal. As the pipe went from the MCBA Access Corridor channel to the natural bottom of Vermilion Bay, the clearance between the top of the dredge discharge pipe and the water surface was reduced, presenting a safety hazard for boaters that use the existing channel and area. To avoid the hazard, it was determined that the Contractor should dredge an additional reach from the MCBA Access Corridor Channel to provide additional clearance above the pipe until the dredge discharge pipe cleared the existing channel and main path for boaters in the area. To prevent the pipe from floating when dredged material was not present in the pipeline, the pipe was pinned to the bottom of Vermilion Bay using wooden piles. This additional work was approved in Change Order No. 2 and is further described in Section 9.3.



5 MCBA Access Corridor Dredging

Access corridor dredging was required in order for the GLDD Sandpiper Dredge to access the MCBA. GLDD subcontracted Berry Brothers General Contractors, Inc. to dredge the MCBA access corridor to an elevation of -6.0' with a bottom width of 70' (max). The Construction Plans allowed a bottom elevation of -9.0 and 70' bottom width, however GLDD minimized the excavated channel since the Sandpiper's draft requirements did not require a bottom elevation of -9.0'. Berry Bros. utilized the Capt. Leonard bucket dredge to dredge the access corridor and provide access for the Sandpiper dredge. Spoil material was placed on both sides of the MCBA access corridor in temporary placement areas. Upon completion of the project, the spoil material was raked and returned to the MCBA access corridor. The final elevation of the temporary spoil placement area was a maximum of +0.5' above the pre-construction template, as measured in the final as-built survey.



Figure 65: Captain Leonard Bucket Dredge

5.1 TransCanada Pipeline Crossing

On October 16, 2018 the Captain Leonard Dredge crossed the TransCanada pipeline while clearing the MCBA access corridor to -6.0'. Minutes from the meeting aboard the Captain Leonard dredge follow:

10/16/2018 - 7:30 am

Aboard Captain Leonard Dredge

Attendees:

GLDD – Brad Hahn, Mike (Safety Coordinator)

Sellers – Kelly Richard

Enterprise – Sully Bourgeois, Terral Duplechain

Berry Brothers – Dredge Captain, Deckhand

Minutes:

The meeting began aboard the Captain Leonard Dredge at 7:30 am the morning Berry Brothers intended to cross the Acadian Pipeline. Representatives from Enterprise Products informed everyone the "Acadian Pipeline" was a 10" Natural Gas pipeline operating under 850-900 psi. Construction staking was marked to show a gap of approximately 50' (25' on each side of the pipeline) with blue flagging where Berry Brothers would not drop the dredge bucket or spud down. The general procedure for crossing the pipeline was discussed as provided in GLDD's Utility Protection Plan.

Berry Brothers will dig to within 25' of the pipeline that is staked and has been probed. The dredge will dig a bell hole leading up to the pipeline to provide a sump area to a maximum depth of -9.0 NAVD 88. After completing the Northern sump area the dredge will start digging on the southern side of the pipeline at 25' from the staked area to provide another sump area. The dredge will then, with a bucket full of material, drag the closed bucket across the pipeline pulling any material over the pipeline into the northern sump area. Material over the pipeline will be cleared to -6.0' NAVD88. Berry Brothers dredge barge will then transit across the pipeline. To insure that the proposed template has been cleared, Berry Brothers will perform a bucket sweeping technique from the southern side of the pipeline.

Representatives from Enterprise Products granted permission to begin the process for crossing the pipeline at approximately 8:30 am. Berry Brothers began by digging the two sump areas, then, dragging the full closed bucket across the 50' flagged area to clear to -6.0' NAVD88. Berry Brothers completed the digging at approximately 12:00 pm. At 1:00 pm the Captain Leonard successfully crossed the pipeline without incident.



6 Marsh Creation Area Monitoring

6.1 Instrumented Settlement Plates

A total of four instrumented settlement plates (ISPs) were installed in the Cole's Bayou Marsh Restoration Project to monitor the settlement and consolidation of the marsh fill material. All four ISPs were installed in MCA 3. The four ISPs were installed prior to fill material being deposited into MCA 3. ISPs were monitored occasionally within and outside biweekly inspections and will continue to be monitored by CPRA. ISPs were surveyed on January 30, 2019. ISP locations are shown in Appendix I.

6.2 Settlement Plates

A total of eight settlement plates were installed in the MCAs. Two were installed in MCA 1, two in MCA 2, and four in MCA 3. Settlement plates were monitored frequently, in conjunction with grade stake readings. The settlement plates were installed to monitor and correlate settlement rates. The settlement plates in the MCAs remained mostly undisturbed, SP6 was knocked over and reset on 1/31/2019-2/1/2019. Settlement plate locations are shown in Appendix I, and settlement plate readings are shown in GLDD Daily Progress Reports, Appendix E.

6.3 Grade Stakes

Wooden grade stakes were installed throughout the three MCAs to monitor fill material and elevations in the marsh creation areas. Grade stakes were read frequently by the project inspector and contractor. The project inspector and contractor measured the fill elevation by measuring the differential between the top of the marsh fill slurry to the known elevation of the top of the grade stake. Throughout the project, grade stakes were disturbed by the fill material spreading throughout the MCAs and airboat traffic. GLDD performed routine surveys to adjust grade stakes and ensure their accuracy. Tables showing readings from the grade stakes are included in Appendix H.



7 Items of Work, Final Quantities, and Monetary Amounts

TABLE 13: AS-BUILT QUANTITIES

| Item No. | Description of Work | Contract Quantity | Unit | Unit Cost (\$) | Total Cost (\$) |
|--------------|--|-------------------|---------|-------------------------|-----------------|
| 0001 | Hydraulic Dredge Mob & Demob | 1 | LS | \$ 720,000.00 | \$ 720,000.00 |
| 0002 | Dredge Pipeline Mob, Installation & Demob | 1 | LS | \$ 2,065,000.00 | \$ 2,065,000.00 |
| 0003 | General Mob & Demob | 1 | LS | \$ 2,315,000.00 | \$ 2,315,000.00 |
| 0004 | Surveys | 1 | LS | \$ 475,000.00 | \$ 475,000.00 |
| 0005 | Grade Stakes | 87 | EA | \$ 50.00 | \$ 4,350.00 |
| 0006 | Settlement Plates | 8 | EA | \$ 950.00 | \$ 7,600.00 |
| 0007 | Instrumented Settlement Plates | 1 | LS | \$ 40,500.00 | \$ 40,500.00 |
| 0008 | Earthen Containment Dikes | 41,707 | LF | \$ 18.00 | \$ 750,726.00 |
| 0009 | Earth Work | 1 | LS | \$ 135,000.00 | \$ 135,000.00 |
| 0010 | Marsh Creation Borrow Area Access Corridor | 1 | LS | \$ 110,000.00 | \$ 110,000.00 |
| 0011 | Hydraulic Dredging & Marsh Fill | 1,207,186 | CY | \$ 3.50 | \$ 4,225,151.00 |
| 0012 | Corrugated Metal Plate | 1,240 | LF | \$ 150.00 | \$ 186,000.00 |
| 0013 | Inline Check Valve | 21 | EA | \$ 18,200.00 | \$ 382,200.00 |
| 0014 | Non-Woven Geotextile | 10,261 | SY | \$ 9.00 | \$ 92,349.00 |
| 0015 | Articulated Concrete Block Mat | 9,337 | SY | \$ 97.00 | \$ 905,689.00 |
| 0016 | Treated Timber Piles | 258 | LS | \$ 600.00 | \$ 154,800.00 |
| 0017 | Treated Timber | 9.3 | MBFM | \$ 14,000.00 | \$ 130,200.00 |
| 0018 | Dredge Pipeline Trench | 2 | 1/2 day | \$ 5,336.10 | \$ 10,672.20 |
| 0021 | CMP Collars | 23 | EA | \$ 1,265.00 | \$ 29,095.00 |
| 0022 | WCS Dewatering | 1 | LS | \$ 532,485.46 | \$ 532,485.46 |
| 0023 | Additional WCS Earthwork | 1 | LS | \$ 105,936.16 | \$ 105,936.16 |
| 0025 | Wilco Mobilization and Demobilization | 1 | LS | \$ 37,047.30 | \$ 37,047.30 |
| 0026 | Surveys (Verification & Acceptance) | 1 | LS | \$ 9,947.20 | \$ 9,947.20 |
| 0027 | Reconstruct EP 6 | 1 | LS | \$ 14,447.20 | \$ 14,447.20 |
| TOTAL | | | | \$ 13,439,195.52 | |

TABLE 14: SUMMARY OF CONTRACT CHANGE ORDERS

| CONSTRUCTION CONTRACT ADJUSTMENTS | AMOUNT | DAYS |
|--|-------------------------|------------|
| Original Construction Bid | \$ 12,387,446.00 | 342 |
| Change Order No. 1 | \$ 42,760.00 | 0 |
| Change Order No. 2 | \$ 10,672.20 | 0 |
| Change Order No. 3 | \$ 769,059.62 | 45 |
| Change Order No. 4 | \$ 229,257.70 | 40 |
| Final Construction Contract Costs | \$ 13,439,195.52 | 427 |



| TABLE 15: RATIO OF EFFORT | | | |
|---------------------------|---|-----------------|---|
| Item | Description | Ratio of Effort | |
| TS-100 | Hydraulic Dredge Mobilization and Demobilization | 60% | Mobilization of the hydraulic dredge and 500+ feet cubic yards of material dredged |
| | | 40% | Hydraulic dredge removal |
| TS-101 | Dredge Pipeline Mobilization, Installation and Demobilization | 45% | Mobilization of all dredge pipeline to the Project Site |
| | | 45% | Installation of all dredge pipeline at the Project Site |
| | | 10% | Removal of the dredge pipeline and acceptance of the marsh creation fill areas |
| TS-102 | General Mobilization and Demobilization | 60% | Mobilization of equipment/materials other than specified in TS-100 and TS-101 |
| | | 40% | Acceptance of fill areas, water control structures, and earth plugs and removal of equipment/unused materials |
| TS-210 | Surveys | 40% | Acceptance of the Pre-Construction Survey |
| | | 40% | Acceptance of all Process Surveys |
| | | 20% | Acceptance of the As-Built Survey |
| TS-220 | Grade Stakes | 50% | Installation and initial inspection of grade stakes |
| | | 50% | Acceptance of marsh creation fill areas |
| TS-250 | Settlement Plates | 50% | Installation of the settlement plates |
| | | 50% | Acceptance of marsh creation fill areas |
| TS-251 | Instrumented Settlement Plates | 50% | Installation of the instrumented settlement plates |
| | | 50% | Acceptance of marsh creation fill areas |
| TS-300 | Earthen Containment Dikes | 90% | Construction of the dikes |
| | | 10% | Acceptance of associated marsh creation fill area and As-Built Survey of dikes |
| TS-330 | Marsh Creation Borrow Area Access Corridor | 50% | Excavation of the marsh creation borrow area access corridor |
| | | 50% | Completion of backfilling and the As-Built Survey of the marsh creation borrow area access corridor |
| TS-400 | Hydraulic Dredging and Marsh Fill | 80% | Acceptance of the marsh creation fill areas |
| | | 20% | Acceptance of the As-Built Survey of the marsh creation fill areas |
| TS-640 | Non-Woven Geotextile | 45% | Installation of the non-woven geotextile on containment dike at Marsh Creation Area 1 |
| | | 45% | Installation of the non-woven geotextile at all earthen berms |
| | | 10% | Acceptance of Marsh Creation Area 1 and all earthen berms |
| TS-750 | Articulated Concrete Mats | 45% | Installation of the ACBs on the containment dike at Marsh Creation Area 1 |
| | | 45% | Installation of the ACBs at all earthen berms |
| | | 10% | Acceptance of Marsh Creation Area 1 and all earthen berms |



8 Construction and Construction Oversight

8.1 Construction

Prime Construction Contractor
Subcontractor (Surveying)
Subcontractor (ECD and WCS Construction)
Subcontractor (MCBA Access Dredging)

Great Lakes Dredge and Dock, LLC.
Tice Engineering, Inc.
Wilco Marsh Buggies & Draglines, Inc.
Berry Brothers General Contractors, Inc.

8.2 Construction Oversight

Construction Oversight
Final contracted Amount

Sellers & Associates, Inc.
\$566,855.00

8.2 Major Equipment Used

Cutter Head Dredge Sandpiper
Bucket Dredge Captain Leonard (Shown below in Figures 66 and 67)
Tug Vessels
Crane Barge & Anchor Barge
Fuel barge, Crane Barge, Anchor Barge, Spud / Ramp Barge
Mantis Crane
Crew Boat & Survey Skiff
Air Boats
Fusing Machine
Excavator 325
Two CAT 345 LR Wilco Amphibious Excavators
Two CAT 330 LR Amphibious Excavators





Figure 66: Sandpiper Dredge prior to mobilization



Figure 67: Sandpiper Dredge

9 Construction Issues and Design Modifications

9.1 Water Control Structure Change in Site Conditions

The WCS Pre-Construction Surveys showed varying site conditions from the Design Surveys and field conditions indicated in the Construction Plan Drawings. Particularly, WCSs 3, 5, 6 & 7 experienced significant erosion prior to construction. The intent of the contract documents was to construct earthen dikes from onsite borrow material for dewatering the site to construct the WCSs in the dry. The decision to construct the WCS was made by the contractor; the method of construction (wet or dry) was not specified. The erosion at the WCSs between the design surveys and time of construction made this method of dewatering prohibitive due to the additional material and effort that would have been required to construct earthen ring levees to dewater the sites. This change in site conditions at WCSs 3, 5 & 7 required the Contractor to modify the dewatering method by utilizing steel sheet piles to construct cofferdams around the sites. The change in site conditions at WCS 6 required minor modifications to the layout and position of the structure to allow the Contractor to construct earthen levees with available onsite material for dewatering.

9.2 Water Control Structure Movement During Construction

The WCSs included 42" corrugated metal pipes supported by timber piles and framing. During construction, the pipes experienced significant movement caused by the placement of earthen embankment below and above the pipes. In an effort to restrict movement of the pipes, collars were placed at the ends of the pipes that did not have inline check valves. The vertical movement of the CMPs was observed during the construction of WCS 9. In lieu of collars, cabling was used to secure CMPs at WCS 8 and 9 to allow construction to continue without downtime while the collars were fabricated. Collars were not placed on the end of the pipe with the check valve since the weight of the check valve was sufficient to prevent upward movement. The collars assisted in preventing the 42" CMPs from moving following installation and throughout the backfill and placement of the ACB mats.

The 42" corrugated metal pipe was supplied in lengths of 10', 20' and 40' joints. The Contractor combined the 40' joints with the 10' or 20' joints depending on the length of CMP required in the plans. As the Contractor began constructing the WCSs and placing the backfill material around the CMP, it was noticeable that the joint between pipes was flexing due to the weight of the embankment material and insufficient support below the pipes. The original layout of the pipe supports (timber piling and framing) had one pipe support near the pipe joint. One (1) additional pipe support was added to each CMP near the pipe joint to provide support for both pipe segments. Each pipe joint was connected utilizing a 42" coupling band, as specified in TS 1007.09. The details and layout for the additional pipe support were approved and provided in Change Order #3.

9.3 Dredge Pipeline Trench

Vermilion Bay and the surrounding area supports recreational and commercial fishing, hunting, and oil and gas activities. The layout of the dredge pipeline corridor crossed an existing channel that is travelled by many vessels for access to the area near the intersection of Equipment Access Corridor 2 (EAC2) and the Marsh Creation Borrow Area (MCBA) Access Corridor. GLDD's dredge pipeline plan included the placement of a 24" steel pipe across Vermilion Bay. The 24" steel pipe was placed in the MCBA Access



Corridor Channel and then laid on the natural bottom of Vermilion Bay. As the pipe went from the MCBA Access Corridor channel to the natural bottom of Vermilion Bay, the clearance between the top of the dredge discharge pipe and the water surface was reduced, presenting a safety hazard for boaters that use the existing channel and area. To avoid the hazard, it was determined that the Contractor should dredge an additional reach from the MCBA Access Corridor Channel and pin the dredge pipe to the bottom of the DPC by driving wooden piles. Doing so provided additional clearance above the pipe until the dredge discharge pipe cleared the existing channel and main path for boaters in the area. This additional work was approved in Change Order No. 2.

10 Construction Change Orders

10.1 Change Order No. 1

Change Order No. 1 was executed in October of 2018. During the construction of the earthen containment dike at MCA 1 field conditions indicated that the length of dike exposed to potential erosion from Freshwater Bayou was longer than anticipated. To protect the exposed ECD and MCA 1, quantities for Bid Item No. 14, Non-Woven Geotextile Fabric (TS-640) and Bid Item No. 15, Articulated Concrete Block Mat (TS-750) were increased. The increase in the aforementioned quantity allowed for the protection of an additional 400 square yards or 276 linear feet of ECD 1.

10.2 Change Order No. 2

During the construction of the MCBA Access Corridor significant concern was expressed regarding the 108° turn at the intersection of EAC 1, EAC 2 & EAC 4. The temporary dredge pipeline would rest on the undisturbed water bottom (approximate elevation -3.0') and then transition to the bottom of the MCBA Access Corridor (approximate elevation -6.0'). This transition would potentially leave the dredge pipeline at an unacceptable depth in a heavily trafficked access channel for recreational boaters. Therefore, Change Order No. 2 was executed to construct a transition trench at -6.0' to allow the dredge pipeline to rest below any potential boat traffic and mitigate safety concerns.

10.3 Change Order No. 3

Water Control Structure No. 9 presented a number of learning experiences that the project team utilized through Change Order No. 3 to prevent potential issues at the WCS. CMP Collars were added to secure the CMP to the timber joist preventing uplift on the pipes, and additional timber piles and treated timber were included to support the CMP joints and prevent sagging. Additionally, Change Order No. 3 increased the hydraulic dredging and marsh fill quantity to the as-built quantity. The final aspect of Change Order No. 3 was to increase the contract price for the additional dewatering efforts due to the changes in site conditions described in Section 9.1 of this report.

10.4 Change Order No. 4

As the project progressed, issues regarding scour and erosion of the earthen containment dikes at MCA 1 and MCA 2 became evident. The erosion was so significant that 136' of dike at MCA 2 required reconstruction to prevent marsh fill material from escaping the MCA. Bid items were adjusted and



added to remobilize Wilco to reconstruct ECD 2 and install geotextile fabric and ACB mats to prevent further scour and erosion.

An additional item included in Change Order No. 4 tasked Wilco with reconstructing EP 6 due to the erosion evident at the site (described in Section 3.6 and Figure 37). In addition to the reconstruction of EP 6, Wilco then installed geotextile fabric and ACB mats at EP 6. Geotextile fabric and ACB mats were also added to EP 3 to prevent erosion.

11 Field Orders

11.1 Field Order No. 1

Field Order No. 1 issued a revised monument data sheet for surveying. It was fully executed by all parties on 8/16/2018.

11.2 Field Order No. 2

Field Order No. 2 modified TS 640 and TS 750 in an effort to simplify payments. The ratio of efforts were adjusted to read "ninety percent (90%) of the Contract cost for this bid item will be paid to the contractor after installation of the non-woven geotextile fabric (articulated concrete mats), and the remaining ten percent (10%) will be paid to the contractor after Acceptance of the Marsh Creation Area 1 and all earthen dikes."

11.3 Field Order No. 3

Field Order No. 3 revised Technical Specifications TS-251 Instrumented Settlement Plate to include instrumentation needed to be procured by the Contractor. The specification was revised to include the equipment desired by CPRA.

11.4 Field Order No. 4

Field Order No. 4 revised the location for geotextile fabric and ACB mat placement at MCA 1. The revised locations were in response to a change in existing field conditions.

12 Requests for Information

12.1 RFI No. 1

GLDD requested clarification regarding discrepancies concerning EAC 1 layout between the plan drawings and CAD files provided. CPRA provided the correct survey layout and CAD drawings. Secondly, GLDD requested clarification regarding board mat placement. The locations of board mats are shown in the plans but not included in the CAD drawings. CPRA indicated that exact board mat locations would be determined in the field to protect existing marsh.



12.2 RFI No. 2

GLDD stated that the dredge pipeline board mat 2 shown in the plans was insufficient to fully protect the existing marsh. Should the mats be installed as depicted in the plans, approximately 90' of marsh along the dredge pipeline corridor would be disturbed. GLDD requested clarification on whether to extend the DPBM2 further than indicated in the plans. CPRA responded referencing TS-101.2.2.1 and TS-102.4.4 that the board mats should be installed in a manner to fully protect existing marsh and exact lengths would be determined by field conditions.

12.3 RFI No. 3

In RFI 3, GLDD requested clarification on ACB mat placement. Plan drawings indicated the ACB mats should extend 5' beyond the dike on the channel side, but did not specify the length of ACB mat required on the MCA side of the ECD. CPRA clarified that the ACB mats were required to extend past the crown of the dike and no minimum distance was required past the crown of the dike.

The second provision of RFI 3 included GLDD requesting direction on an additional 276' of dike exposed to Freshwater Bayou that would be left unprotected with the planned layout for ACB mats. CPRA directed that the ACB mat quantity was an estimate and the entire dike exposed to Freshwater Bayou should be protected, additional compensation would be handled through a change order.

12.4 RFI No. 4

GLDD requested permission to collect additional survey data at the MCBA in RFI No 4. They requested to survey transects perpendicular direction of their dredging pattern. They requested this in an effort to fully encapsulate the quantity of material dredged. CPRA approved the request provided that GLDD provide information on the additional transects to be collected so that the dredge cut quantity could be verified for payment.

12.5 RFI No. 5

Contech Engineered Solutions, the CMP manufacturer, recommended 16 gauge connector coupling bands for the corrugated metal pipes at the water control structures. GLDD requested permission to use the 16 gauge coupling bands on the project. CPRA denied the request and stated the coupling bands shall adhere to the current plans and specifications, which required 12 gauge coupling bands.

12.6 RFI No. 6

GLDD requested permission to attach the geotextile fabric directly to the ACB mats prior to placement at WCS sites. CPRA approved the alternative method of installation, per the manufacturer's recommendation.



13 Construction Incidents

13.1 Damaged Marsh Buggy

In the process of GLDD demobilizing equipment from the project, a GLDD marsh buggy pontoon was damaged. Damage to the machine was too significant to be repaired in the field and GLDD was required to extract the buggy with a spud barge. GLDD completed the removal of the damaged marsh buggy on June 4, 2019. Damage to a levee was caused by the damaged marsh buggy. The levee and surrounding area were reconstructed to preconstruction conditions. No injuries or environmental impacts were reported from the damaged marsh buggy.

13.2 Damaged Mantis Crane

On July 19, 2019, during the Construction of WCS 7, Wilco's Mantis Crane was damaged. During the removal of steel sheet piles the boom was over extended and bent while attempting to extract a sheet pile. Damage to the boom was severe enough that it could not be retracted. Due to the angle of the crane and the boom being extended the Mantis Crane could not safely track. BJ Services were contracted by Wilco for the removal of the remaining sheet piles at WCS 7 and the demobilization of the Mantis Crane. On July 20, 2019 the demobilization of the damaged crane was safely executed and no injuries were reported in this incident.

13.3 Tropical Storm Barry

On July 14, 2019 Hurricane Barry made landfall in Intracoastal City, Louisiana. Hurricane Barry caused significant impact with tidal surges exceeding 8' and sustained winds of 75 mph. The rainfall and tidal surge caused severe inundation throughout the project area and surrounding communities. Prior to landfall, all equipment was demobilized from the construction area, preventing significant damage to the construction site and equipment. On July 17, 2019 when water had receded enough to permit access to Intracoastal City, Wilco and GLDD remobilized to the construction site.

14 Significant Construction Dates

| SIGNIFICANT CONSTRUCTION DATES | |
|---|--------------------|
| Description | Date |
| Bid Opening | May 3, 2018 |
| Construction Contract Execution | June 8, 2018 |
| Notice to Proceed | July 18, 2018 |
| Pre-Construction Conference | July 17, 2018 |
| Start Pre-Construction Surveys | July 31, 2018 |
| Start MCA 1 & 2 Containment Dike Construction | September 11, 2018 |
| Completed MCA 1 & 2 Containment Dike Construction | September 28, 2018 |
| Start MCA 3 Containment Dike Construction | October 2, 2018 |
| Start MCBA Access Corridor Dredging | October 10, 2018 |



| | |
|---|-------------------|
| MCBA Access Corridor - Acadian Pipeline Crossing | October 16, 2018 |
| Start Dredge Pipeline Installation | October 20, 2018 |
| Start Geotextile Fabric and ACB Mat Installation on MCA 1 | October 26, 2018 |
| Dredge Sandpiper arrived onsite for assembly | October 31, 2018 |
| MCBA Access Corridor Dredging Completed | November 2, 2018 |
| MCA 1 ACB Mat Placement Complete | November 4, 2018 |
| Completed MCA 3 ECD Construction | November 20, 2018 |
| Dredge Sandpiper mobilized to MCBA | December 3, 2018 |
| Start Hydraulic Dredge and Marsh Fill into MCA 1 | December 6, 2018 |
| Start Hydraulic Dredge and Marsh Fill into MCA 2 | December 9, 2018 |
| Completed Hydraulic Dredge and Marsh Fill into MCA 1 | January 6, 2019 |
| Start WCS 9 Construction | January 11, 2019 |
| Completed Hydraulic Dredge and Marsh Fill into MCA 2 | January 15, 2019 |
| Start Hydraulic Dredge and Marsh Fill into MCA 3 | January 19, 2019 |
| Start WCS 8 Construction | January 24, 2019 |
| Start EP 6 Construction | February 13, 2019 |
| Completed EP 6 Construction | February 15, 2019 |
| Completed WCS 9 Construction | February 23, 2019 |
| Completed WCS 8 Construction | March 1, 2019 |
| Completed Hydraulic Dredge and Marsh Fill into MCA 3 | March 9, 2019 |
| Start WCS 1 Construction | March 19, 2019 |
| Start WCS 2 Construction | March 26, 2019 |
| Start WCS 4 Construction | April 3, 2019 |
| Start WCS 6 Construction | April 15, 2019 |
| Completed WCS 2 Construction | April 29, 2019 |
| Completed WCS 6 Construction | April 30, 2019 |
| Completed WCS 1 Construction | May 6, 2019 |
| Completed WCS 4 Construction | May 7, 2019 |
| Start EP 3 and WCS 3 Construction | May 14, 2019 |
| Start WCS 5 Construction | May 31, 2019 |
| Start WCS 7 Construction | June 27, 2019 |
| Fabric and ACB Mat Placement at MCA 2 | August 8, 2019 |
| Additional Fabric and ACB Mat Placement at MCA 1 | August 9, 2019 |
| Completed WCS 7 Construction | July 30, 2019 |
| Completed EP 3 and WCS 3 Construction | August 1, 2019 |
| Completed WCS 5 Construction | August 2, 2019 |
| Final Inspection | August 21, 2019 |
| Notice of Acceptance | November 8, 2019 |
| Notice of Acceptance Recorded | November 25, 2019 |



15 Other Identified Submittals

- Appendix A - As-Built Surveys
11x17" MCA 1, MCA 2, MCA 3, MCBA Access Corridor, MCBA, WCS 1-9 and EP 3 and 6 are attached and on USB, pdf format
- Appendix B - Change Orders on USB, pdf format
- Appendix C - Field Orders on USB, pdf format
- Appendix D - Requests for Information on USB, pdf format
- Appendix E - GLDD Daily Progress Reports on USB, pdf format
- Appendix F - GLDD Quality Control Reports on USB, pdf format
- Appendix G - Sellers & Associates Daily Inspection Reports on USB, pdf format
- Appendix H - Grade Stake Tracking Logs on USB, pdf format
- Appendix I - Grade Stake, Settlement Plate, Weir Box Locations on USB, pdf format
- Appendix J - Contractor's Invoices on USB, pdf format
- Appendix K - GLDD Material Submittals on USB, pdf format
- Appendix L - Aerial Photographs on USB, pdf format
- Appendix M - Davis Bacon Forms, hard copies only for confidentiality
- Appendix N - Davis Bacon Forms, hard copies only for confidentiality

