



**FACT SHEETS AND MAPS FOR FEATURES OF THE NATIONAL
ECOSYSTEM RESTORATION RECOMMENDED PLAN**

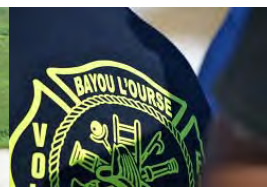




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NER Implementation Plan

This section describes the sequence in which NER Recommended Plan (RP) features would be constructed. NER RP features were categorized into three tiers whereby Tier I features would be constructed before Tier II, and Tier II features constructed before Tier III. Tier I features may be constructed simultaneously because they would not affect the construction of any nearby Tier I RP feature. Shoreline protection features would be constructed prior to marsh restoration features in order to provide immediate protection of the more storm-vulnerable marsh restoration features. This approach contributes to the sustainability of the marsh restoration features. Tier II RP features were so categorized because they utilize the same borrow or staging area, and/or construction of these features would potentially interfere with construction of a Tier I RP feature. Tier II RP features would be constructed contemporaneously as the construction of any one of these features would not affect any other feature within this grouping. Tier III RP features were so categorized because they would utilize the same borrow or staging area, and/or interfered with construction of a Tier II feature, and/or interfered with an existing mitigation project. Tier III features would be constructed contemporaneously if they would not affect construction of the other features within this grouping. In categorizing features, it was assumed that all construction funds would be available, multiple construction contracts could be let at one time, and there is an adequate supply of all materials to facilitate construction. More detailed design and analysis would be undertaken during the PED phase.

Tier I Projects:

- Holly Beach Shoreline Stabilization - Breakwaters (5a)
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b1)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bSE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bNE)
- Fortify Spoil Banks of the GIWW and Freshwater Bayou (16bW)
- Marsh Restoration at Mud Lake (124d)*
- Marsh Restoration at Pecan Island (127c3)
- Chenier Ridges: Grand Chenier Ridge (416)
- Restore Bill Ridge (509c)
- Chenier Ridges: Cheniere au Tigre (509d)
- Restore Blue Buck Ridge (510a)
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Tier II Projects:

- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b2)
- Marsh Restoration at Mud Lake (124c)
- Rainey Marsh Restoration Southwest Portion (Christian Marsh) (306a1)

Tier III Projects:

- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3a1)
- Beneficial Use of Dredged Material from the Calcasieu Ship Channel (3c1)*
- Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou (6b3)
- Marsh Restoration Using Dredged Material South of Highway 82 (47a1)



- Marsh Restoration Using Dredged Material South of Highway 82 (47a2)
- Marsh Restoration Using Dredged Material South of Highway 82 (47c1)

Recommended for Further Study:

- Calcasieu Ship Channel Salinity Control Structure
- Cameron-Creole Spillway Structure

**- Recommended for independent Congressional authorization and appropriation for construction by USFWS*

Two marsh restoration measures, (Features 124d and 3c1) are partially located on USFWS property (Sabine National Wildlife Refuge and Cameron Prairie National Wildlife Refuge, respectively) and are included in the NER RP. These features are vitally important to help preserve the Calcasieu Lake rim and prevent vast new expanses of open water from forming should the lake rim be breached by erosional forces. All NED and NER RP features (including those recommended for appropriation and construction by USFWS) represent the "Federal Plan". Because USFWS is ultimately responsible for managing its refuge lands, USACE is not seeking authorization and funding for the USFWS Features 124d and 3c1. (The NED RP and the subset of NER features that are recommended for authorization and appropriation by USACE (all features minus 124d and 3c1) represent the "Corps Plan".) Rather, USACE supports USFWS in seeking its own authorization and appropriation to construct the two features and offers USFWS the information that USACE developed under this study effort as a starting point for USFWS efforts to obtain independent authorization and funding for the USFWS features of the Federal Plan. These features are particularly desirable because they provide additional benefit not quantified in the evaluation and selection process (i.e. preserving critical geomorphic structure of the lake rim). These features are in the Federal interest and USFWS is encouraged to seek independent authorization and appropriation for construction.

In some instances, Permitted mitigation projects completed by others overlap with the NER RP features. When overlap occurs, the NER RP features would not be constructed until the mitigation projects satisfy their permitted obligations (this is reflected in the NER Implementation Plan).



Marsh Restoration Measures



Measure 3a1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Measure 3a1 is a marsh restoration feature located adjacent to the southern shoreline of the GIWW west of the Calcasieu Ship Channel near Black Lake.

The measure would restore marsh by converting approximately 599 acres of shallow open water to brackish marsh habitat through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel from MM18 to MM22 with a hydraulic dredge (approximately 139 acres) (see Annex A for typical design drawings for this measure). Approximately 5.3 million cubic yards of borrow would be required for this marsh restoration feature. Material for the measure would be utilized from the USACE maintenance dredging of the Calcasieu Ship Channel, and consists of the incremental effort and cost of transporting the material from the cutterhead dredge in the Calcasieu Ship Channel to the measure site during the USACE maintenance cycle. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹

The average depth of open water is 1.2 feet, and the average elevation of existing marsh (for nourishment) is 1.5 feet. The material would be transported directly to the site via pipeline, for a distance of approximately 8.3 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be placed along the southern extent of the GIWW. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 43,942 feet long (30 acres), and would require no dredging. Measure 3a1 would result in a net benefit of 191 AAHUs.

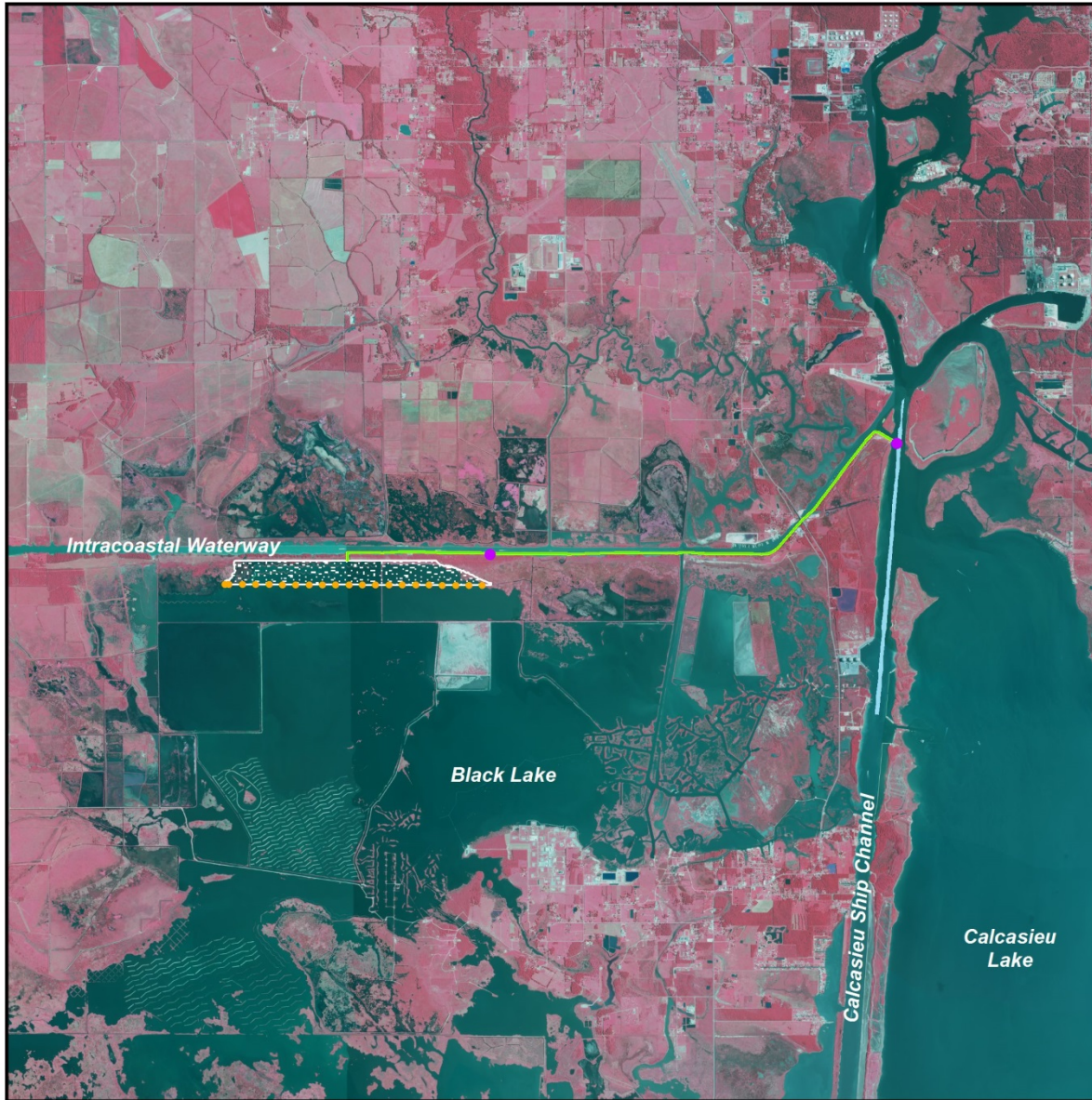
The dredged material would be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88), following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands to the south via spill box weirs. Approximately 44,700 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be the GIWW. No dredging for the access channel is anticipated. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

¹ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



One renourishment cycle at TY30 is estimated to include 62 acres of marsh restoration along with 507 acres of marsh nourishment. Approximately 1.0 million cubic yards of borrow from the Calcasieu Ship Channel would be required for this renourishment cycle. The pipeline corridor for the renourishment event is the same as for initial construction.

Best management practices would be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor would minimize impacts to existing marsh. Air boats and marsh buggies (if required) would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. No critical habitat is expected to be impacted by this measure. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.

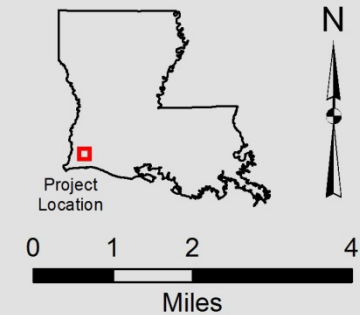


3a1

Beneficial Use of Dredged Material from Calcasieu Ship Channel

Legend

- Weir
- Booster Pump
- Dredge Pipeline Route (43,942 Feet/30 Acres)
- Equipment Access Route (43,942 Feet/132 Acres)
- Proposed Borrow Area (139 Acres)
- Marsh Creation (599 Acres)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: August 06, 2015



Measure 3c1 Beneficial Use of Dredged Material from Calcasieu Ship Channel

Measure 3c1 is a marsh restoration and nourishment feature located adjacent to the eastern rim of Calcasieu Lake and is situated within the Cameron-Creole Watershed area.

The measure would restore marsh by converting approximately 1,347 acres of open water to brackish marsh habitat, along with the nourishment of approximately 734 acres of adjacent wetlands, through maintenance dredging of material to be borrowed from the Calcasieu Ship Channel from MM5 to MM18 (approximately 314 acres) with a hydraulic dredge (see Annex A for typical design drawings for this measure). Approximately 9.5 million cubic yards of borrow would be required for this marsh restoration and nourishment feature. Material for the measure would be utilized from the USACE maintenance dredging of the Calcasieu Ship Channel, and consists of the incremental effort and cost of transporting the material from the cutterhead dredge in the Calcasieu Ship Channel to the measure site during the USACE maintenance cycle. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.²

The average depth of open water is 0.5 feet, and the average elevation of existing marsh (for nourishment) is 0.7 feet. The material would be transported directly to the site via pipeline, for a distance of approximately 11.6 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be located along the access corridor previously permitted for the Cameron Creole levee repair following Hurricane Ike. Inside the levee, the pipeline corridor would be placed in the open water borrow canal behind the levee. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 61,497 feet long (42 acres), and would not require dredging. Measure 3c1 would result in a net benefit of 607 AAHUs.

The dredged material would be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88), following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 97,250 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be via the pipeline corridor. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

² Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



One renourishment cycle at TY30 is estimated to include 787 acres of marsh restoration along with 1,190 acres of marsh nourishment. Approximately 3.7 million cubic yards of borrow from the Calcasieu Ship Channel would be required for this renourishment cycle. The pipeline corridor for the renourishment event is the same as for initial construction.

Best management practices would be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor would minimize impacts to existing marsh. Air boats and marsh buggies (if required) would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. No critical habitat is expected to be impacted by this measure. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.



3c1

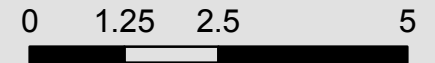
Beneficial Use of Dredged Material from Calcasieu Ship Channel

Legend

- Weir
- Booster Pump
- CWPPRA CS-54 (617 Acres)
- Dredge Pipeline Route (61,497 Feet/42 Acres)
- Equipment Access Route (61,497 Feet/182 Acres)
- Proposed Borrow Area (314 Acres)
- Marsh Creation (2,081 Acres)



Project Location



Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: February 19, 2016



Measure 47a1 Marsh Restoration Using Dredged Material South of Highway 82

Measure 47a1 is a marsh restoration and nourishment feature located adjacent to the south side of Highway 82 approximately 4.5 miles east of Grand Chenier.

The measure would restore marsh by converting approximately 933 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 88 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 3.0 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.³

The average depth of open water is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which would be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 6.7 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 35,519 feet long (24 acres), and would require no dredging. Measure 47a1 would result in a net benefit of 272 AAHUs.

This measure would be constructed before measures 47a2 and 47c1. The dredged material would be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs, with preference on placement that would flow into the footprint of measure 47a2. Approximately 68,300 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical (clamshell or bucket) dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be LA Highway 82. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if

³ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

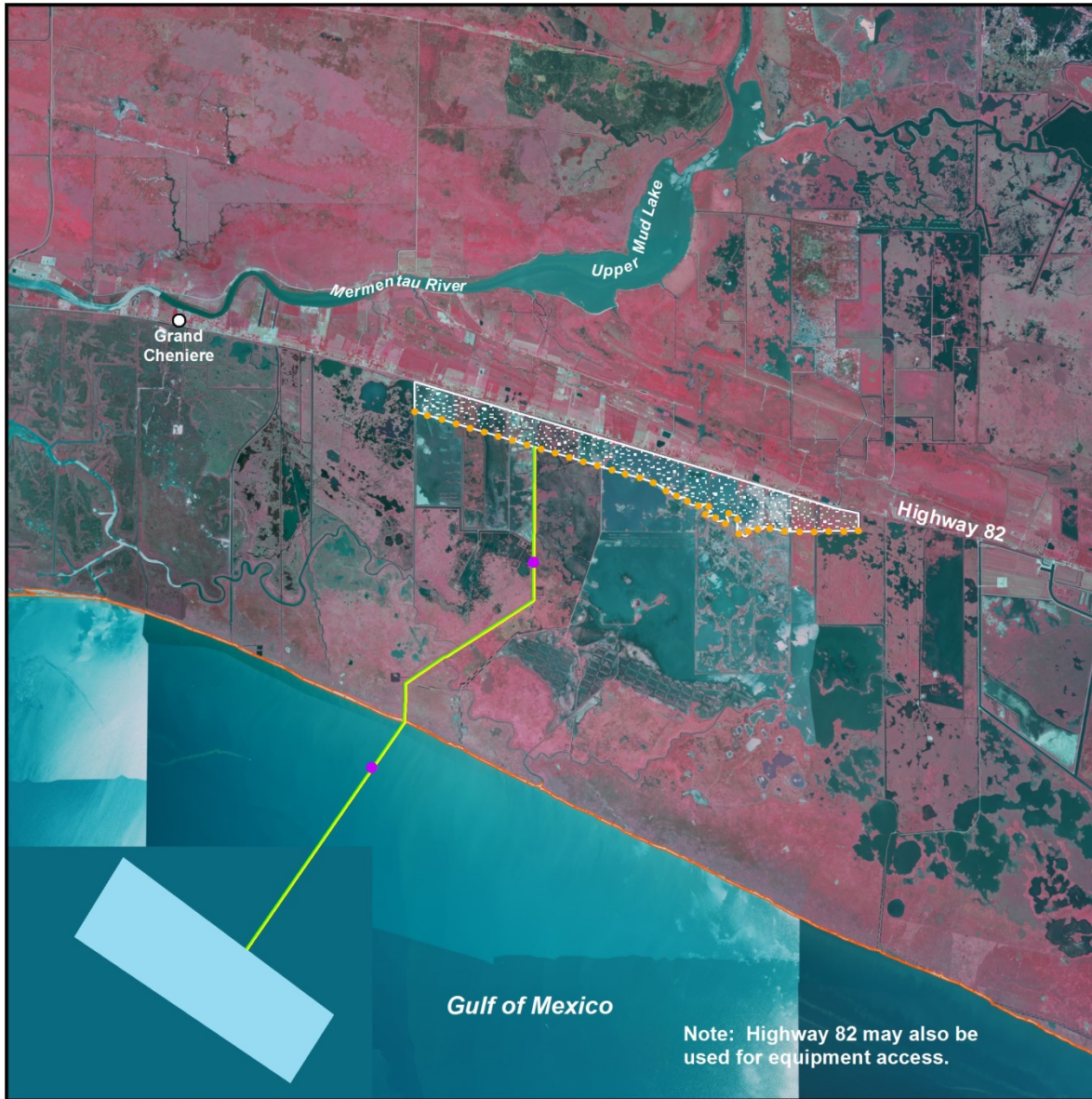


necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 70 acres of marsh restoration along with 900 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event would be the same as for initial construction.

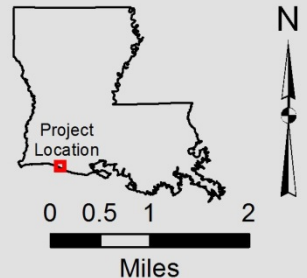
Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy would be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor may be utilized to minimize impacts to existing marsh. Air boats and marsh buggies would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, "Marsh Buggy Use in the Coastal Zone" (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 184 feet to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The USFWS Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable; and
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.



47a1 Marsh Restoration Using Dredged Material South of Highway 82

- Legend**
- Weir
 - Booster Pump
 - Dredge Pipeline Route (35,519 Feet/24 Acres)
 - Equipment Access Route (35,519 Feet/24 Acres)
 - Proposed Borrow Area (1,716 Acres)
 - Marsh Creation (1,021 Acres)
 - Piping Plover Critical Habitat (0.14 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 03, 2015



Measure 47a2

Marsh Restoration Using Dredged Material South of Highway 82

Measure 47a2 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles east of Grand Chenier. Measure 47a2 is located immediately south of Measure 47a1.

The measure would restore marsh by converting approximately 1,297 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 126 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 8.8 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁴

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which would be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 5.9 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. The pipeline corridor is approximately 30,898 feet long (21 acres), and would require no dredging. Measure 47a2 would result in a net benefit of 381 AAHUs.

This measure would require approximately 18 months of construction. Construction would begin in TY1, after the construction of measure 47a1, with anticipated completion in TY3. The dredged material would be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs, with preference on placement that would flow into the footprint of measure 47c1. Approximately 41,000 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be from LA Highway 82. The equipment access corridor is 1,829 feet long (1.3 acres). The borrow area used for

⁴ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

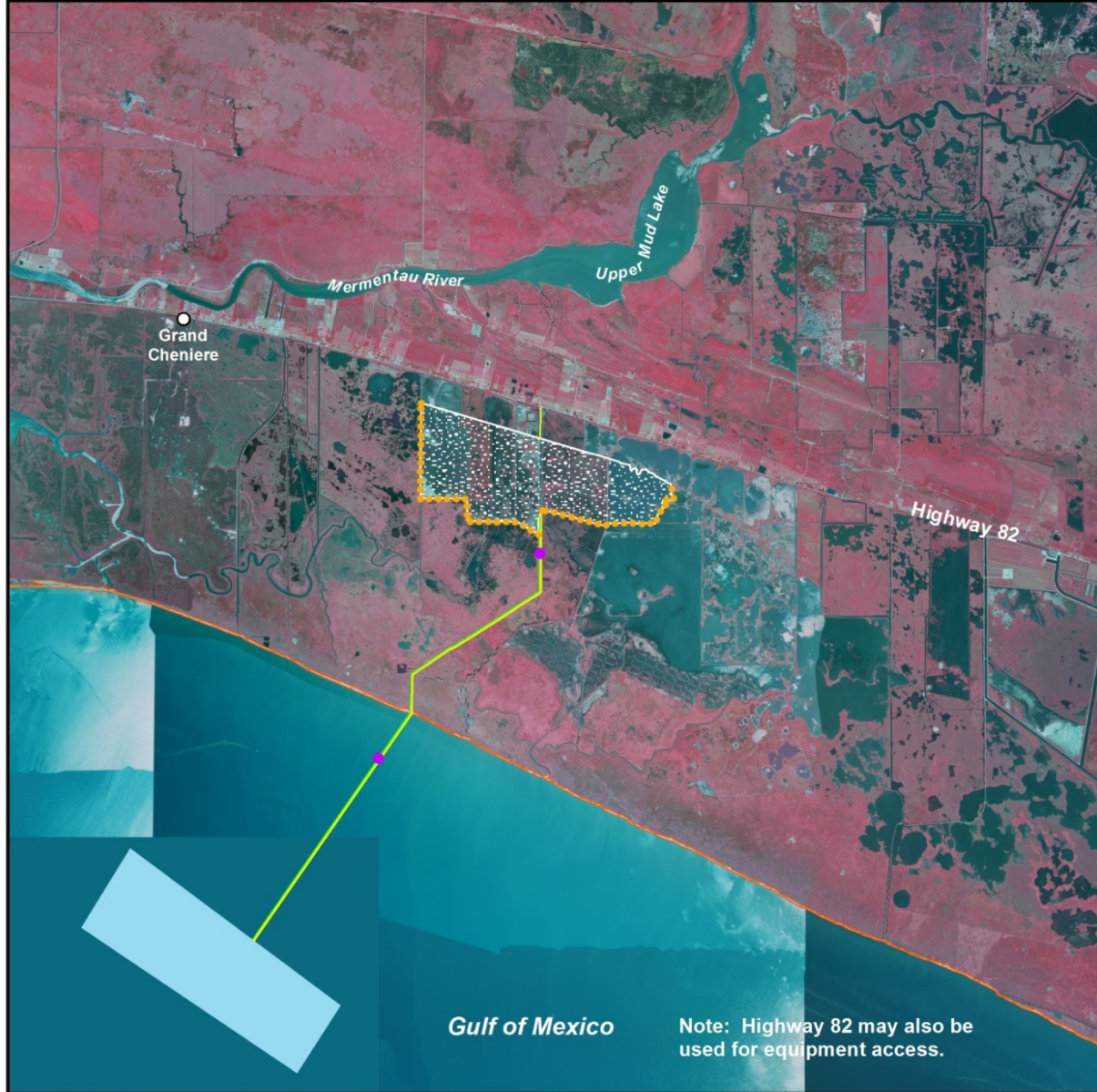


construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 125 acres of marsh restoration along with 1,227 acres of marsh nourishment. Approximately 1.5 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event would be the same as for initial construction.

Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy would be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor would be utilized to minimize impacts to existing marsh. Air boats and marsh buggies would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 184 feet to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The USFWS Conservation Measures are as follows:

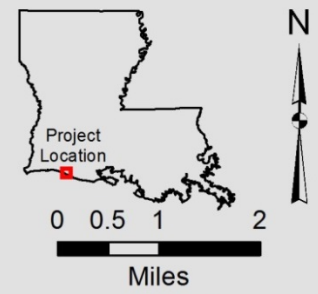
1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable; and
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.



47a2

Marsh Restoration Using Dredged Material South of Highway 82

- Legend**
- Weir
 - Booster Pump
 - Dredge Pipeline Route (30,898 Feet/21 Acres)
 - Equipment Access Route (32,727 Feet/23 Acres)
 - Proposed Borrow Area (1,716 Acres)
 - Marsh Creation (1,423 Acres)
 - Piping Plover Critical Habitat (0.14 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 03, 2015

Gulf of Mexico

Note: Highway 82 may also be used for equipment access.



Measure 47c1 Marsh Restoration Using Dredged Material South of Highway 82

Measure 47c1 is a marsh restoration and nourishment feature located on the south side of Highway 82 approximately 4.5 miles east of Grand Chenier.

The measure would restore marsh by converting approximately 1,304 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 4 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 8.6 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁵

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.27 feet (NAVD88). The borrow area is approximately 1,716 acres, which would be used for all of the dredging needs for 47a1, 47a2, and 47c1, including renourishment. The borrow area is anticipated to be dredged to a depth of 15 feet below the mudline. The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 5.7 miles. Access for the pipeline would require a corridor approximately 30 feet wide, and would be placed along existing open-water canals to the extent practicable. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 29,858 feet long (21 acres), and would require no dredging.

This measure would require approximately 18 months of construction. Construction would begin in TY3, after the construction of measure 47a2, with anticipated completion in TY5. The dredged material would be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 35,200 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be LA Highway 82 and would follow open water channels to the extent possible. The equipment access corridor for the mechanical dredge is 7,672 feet long (5.3 acres). The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard

⁵ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.

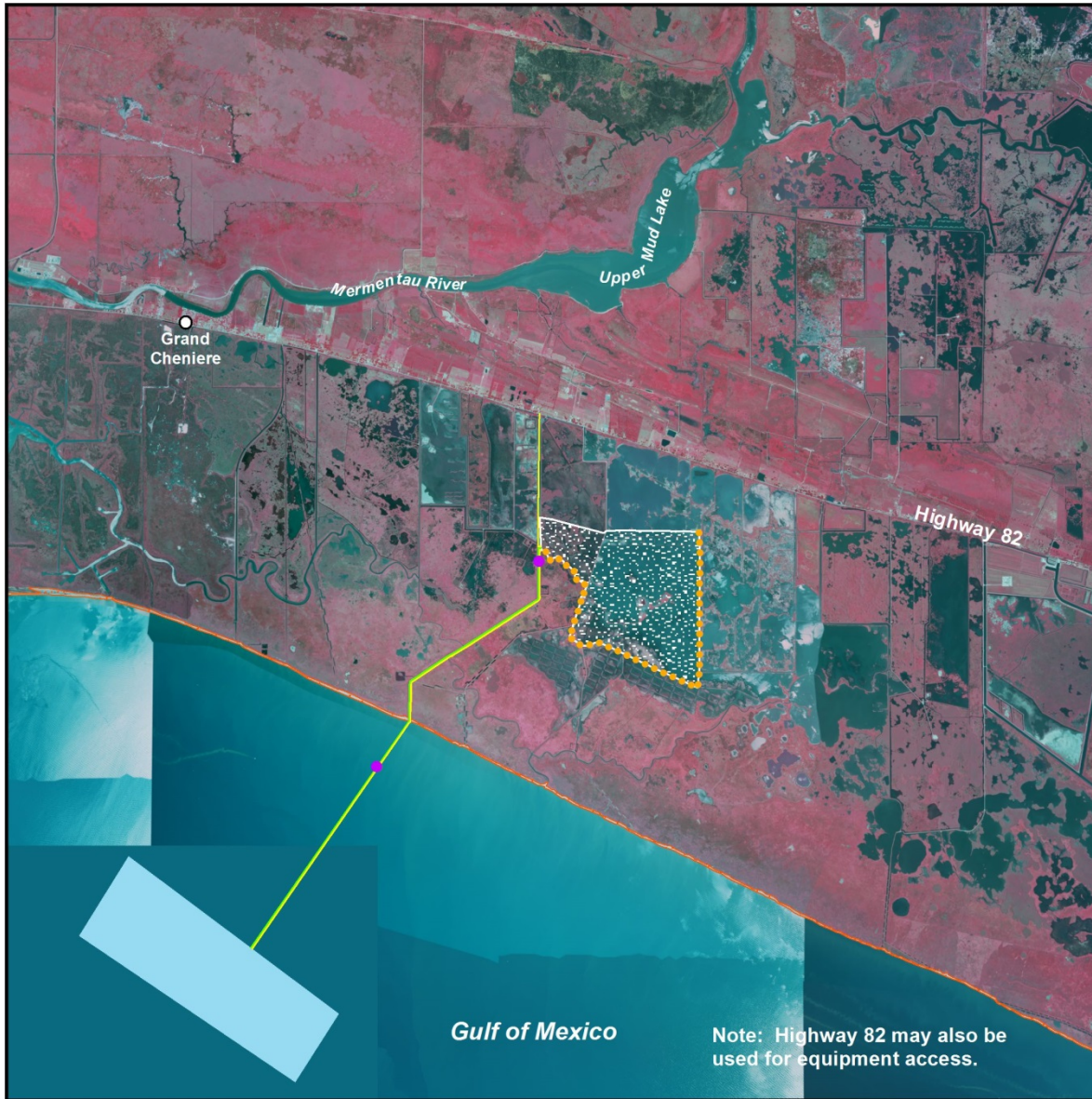


would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 55 acres of marsh restoration along with 1,188 acres of marsh nourishment. Approximately 1.8 million cubic yards of borrow from approximately 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area and pipeline corridor for the renourishment event would be the same as for initial construction. Measure 47c1 would result in a net benefit of 353 AAHUs.

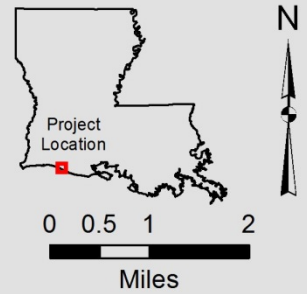
Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy would be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor would be utilized to minimize impacts to existing marsh. Marsh buggies and airboats would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 184 feet to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 0.14 acres (200 feet long by 30 feet wide) of critical habitat is expected to be impacted temporarily by this measure. The USFWS Conservation Measures are as follows:

1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable; and
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.



47c1 Marsh Restoration Using Dredged Material South of Highway 82

- Legend**
- Weir
 - Booster Pump
 - Dredge Pipeline Route (29,858 Feet/21 Acres)
 - Equipment Access Route (37,530 Feet/26 Acres)
 - Proposed Borrow Area (1,716 Acres)
 - Marsh Creation (1,308 Acres)
 - Piping Plover Critical Habitat (0.14 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: August 06, 2015



Measure 124c Marsh Creation at Mud Lake

Measure 124c is a marsh restoration and nourishment feature located adjacent and north of Highway 82 and east of Mud Lake.

The measure would restore marsh by converting approximately 1,077 acres of shallow open water to saline marsh habitat, along with the nourishment of approximately 708 acres of adjacent saline marsh, through dedicated dredging of material to be borrowed from an area approximately 531 acres located approximately 1.5 to 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 10.4 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁶

The average depth of open water in the placement area is -1.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.13 feet (NAVD88). The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 1.8 miles. The pipeline access corridor would be approximately 30 feet wide, and would follow existing waterways to the extent possible. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 9,485 feet long (7.0 acres), and would require no dredging. The pipeline would cross approximately 500 feet (0.34 acres) of beach placed for the Cameron Parish Shoreline Restoration (CS-33) project. The pipeline would be bored under Louisiana Highway 82. Measure 124c would result in a net benefit of 500 AAHUs.

The dredged material would be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 78,100 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area using a mechanical dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be via Louisiana Highway 82 and the pipeline corridor. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

⁶ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



One renourishment cycle at TY30 is estimated to include 351 acres of marsh restoration along with 1,344 acres of marsh nourishment. Approximately 2.0 million cubic yards of borrow from 1.5 to 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle would be the same as for construction.

Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. Although a marsh buggy would be used to place the pipeline across the beach and may be used to place the pipeline along the corridor, the use of airboats to place the pipeline along the corridor would be utilized to minimize impacts to existing marsh. Air boats and marsh buggies would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. Any changes in beach topography resulting from placement of the pipeline would be restored at least to their natural condition following construction, which would use the best available restoration techniques which improve the traversed area's ability to serve as a shoreline following pipeline removal. Piping plover critical habitat includes intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. Per USFWS protocol, the shoreline to vegetation line was digitized as a polygon, then buffered (on the water side) by 184 feet to approximate the mean lower-low water (MLLW) line. If necessary, a 100-foot wide bird abatement corridor across the beach would be maintained during construction to deter foraging, sheltering, and roosting of all potential migratory bird species. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. Approximately 1.8 acres of critical habitat is expected to be impacted temporarily by this measure.

The USFWS Conservation Measures are as follows:

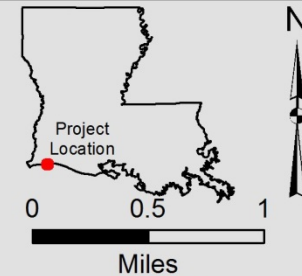
1. Pipeline alignment and associated construction activities may be modified to reduce impacts to foraging, sheltering, and roosting;
2. Avoid impacts to the primary constituent elements (PCEs) of piping plover Critical Habitat to the maximum extent practicable; and
3. Evaluate the project area prior to design and construction for the presence of piping plover PCEs as a basis for minimizing potential impacts.



124c Marsh Creation at Mud Lake

Legend

- Weir
- Booster Pump
- CWPPRA CS-59 (826 Acres)
- Jack and Bore Staging Area (0.6 Acres)
- Dredge Pipeline Route (9,485 Feet/7 Acres)
- Equipment Access Route (9,485 Feet/28 Acres)
- Proposed Borrow Area (531 Acres)
- Marsh Creation (1,785 Acres)
- Piping Plover Critical Habitat (1.8 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: October 05, 2015



Measure 124d Marsh Restoration at Mud Lake

Measure 124d is a marsh restoration and nourishment feature located west of the Calcasieu Ship Channel and adjacent to the southern rim of West Cove.

The measure would restore marsh by converting approximately 159 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 448 acres of adjacent saline marsh, through dedicated dredging of material to be borrowed from the Calcasieu Ship Channel from MM00 to MM05 (378 acres) or West Cove with a hydraulic dredge (see Annex A for typical design drawings for this measure). Approximately 1.4 million cubic yards of borrow would be required for this marsh restoration and nourishment feature. Material for the measure would be utilized from the USACE maintenance dredging of the Calcasieu Ship Channel, and consists of the incremental effort and cost of transporting the material from the cutterhead dredge in the Calcasieu Ship Channel to the measure site during the USACE maintenance cycle. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁷

The average depth of open water is 1.1 feet, and the average elevation of existing marsh (for nourishment) is 1.45 feet. The material would be transported directly to the site via pipeline, for a distance of approximately 4.1 miles. The pipeline access corridor would be approximately 21,452 feet long and 30 feet wide (15 acres), and would go west from the Calcasieu Shipping Channel to West Cove. The access channel for construction equipment would be dredged to a depth of 7 feet where required with a mechanical dredge to a bottom width of 80 feet, and a top width of approximately 130 feet, with 4H:1V side slopes. Material from the access channel would be sidecast adjacent to the access channel and returned after construction. Approximately 64 acres of state waterbottoms would be dredged for access. Measure 124d would result in a net benefit of 4 AAHUs. Despite the low environmental benefit, this measure was deemed justified for inclusion in the TSP because it would result in an increase of 168 acres over the No Action alternative, and would increase the integrity of the southern rim of the West Cove of Calcasieu Lake, protecting the marshes to the south from increased tidal energy and salinity levels.

The dredged material would be placed to achieve a post-construction marsh target elevation of +1.5 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 32,500 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical (clamshell or bucket) dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level

⁷ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). The access for the mechanical dredge would be via the pipeline corridor. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

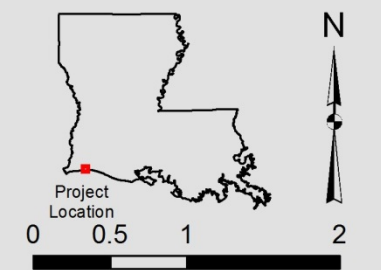
One renourishment cycle at TY30 is estimated to include 103 acres of marsh restoration along with 474 acres of marsh nourishment. Approximately 1.2 million cubic yards of borrow from the Calcasieu Ship Channel or West Cove would be required for this renourishment cycle. Access for the renourishment cycle would be the same as for construction.

Best management practices would be implemented to avoid unnecessary impacts. By utilizing material from the Calcasieu Shipping Channel, hypoxic conditions in the borrow area are anticipated to be avoided. The use of airboats to place the pipeline along the corridor would minimize impacts to existing marsh. Air boats and marsh buggies (if required) would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline would be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.



124d Marsh Creation at Mud Lake

- Legend**
- Weir
 - Booster Pump
 - Dredge Pipeline Route (21,452 Feet/15 Acres)
 - Equipment Access Route (21,452 Feet/64 Acres)
 - Proposed Borrow Area (378 Acres)
 - Marsh Creation (607 Acres)
 - Piping Plover Critical Habitat (0 Acres Impacted)
 - Cameron Parish Shoreline Restoration



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measure 127c3 Marsh Restoration at Pecan Island

Measure 127c3 is a marsh restoration and nourishment feature located west of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks.

The measure would restore marsh by converting approximately 832 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 62 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 1 to 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 7.3 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁸

The average depth of open water in the placement area is -0.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.43 feet (NAVD88). The borrow area is approximately 3,950 acres, which would be used for all of the dredging needs for measures 127c3 and 306a1, including renourishment. The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 7.0 miles. The pipeline access corridor would be approximately 130 feet wide, and follow the east bank of Freshwater Bayou, and would avoid the Freshwater Bayou Lock by following the bypass channel to the east. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 37,074 feet long (26 acres), the equipment access corridor is approximately 37,134 feet long (110 acres), and neither would require dredging. The pipeline corridor is contained within the equipment access corridor for the entire route except for where it bypasses the Freshwater Bayou Lock. This route is approximately 12,491 feet (8.60 acres). Measure 127c3 would result in a net benefit of 241 AAHUs.

Construction would begin in TY0, prior to construction of measure 306a1, with anticipated completion in TY1. The dredged material would be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 46,000 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be via Freshwater Bayou. No flotation dredging is anticipated to be required. The

⁸ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations.

One renourishment cycle at TY30 is estimated to include 45 acres of marsh restoration along with 425 acres of marsh nourishment. Approximately 781,000 cubic yards of borrow from approximately 1 to 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle would be the same as for construction.

Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. The use of airboats to place the pipeline along the corridor would minimize impacts to existing marsh. Air boats and marsh buggies (if required) would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, "Marsh Buggy Use in the Coastal Zone" (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline would be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.

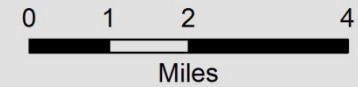


127c3

Marsh Restoration at Pecan Island

Legend

- Weir
- Booster Pump
- Dredge Pipeline Route (37,074 Feet/26 Acres)
- Equipment Access Route (37,134 Feet/110 Acres)
- Proposed Borrow Area (3,950 Acres)
- Marsh Creation (894 Acres)
- Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: August 06, 2015



Measure 306a1
Rainey Marsh Restoration – Southwest Portion (Christian Marsh)

Measure 306a1 is a marsh restoration and nourishment feature located east of the Freshwater Bayou Canal and approximately 5 miles north of the Freshwater Bayou locks. It would be constructed after the Shoreline Protection 16b measure so that the retention dikes would be protected from wave scour.

The measure would restore marsh by converting approximately 627 acres of shallow open water to brackish marsh habitat, along with the nourishment of approximately 1,269 acres of adjacent brackish marsh, through dedicated dredging of material to be borrowed from approximately 1 to 3 miles offshore within state waterbottoms (see Annex A for typical design drawings for this measure). Approximately 8.1 million cubic yards of borrow would be dredged with a hydraulic dredge for this marsh restoration and nourishment feature. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.⁹

The average depth of open water in the placement area is -0.5 feet (NAVD88), and the average elevation of existing marsh (for nourishment) is 1.43 feet (NAVD88). The borrow area is approximately 3,950 acres, which would be used for all of the dredging needs for measures 127c3 and 306a1, including renourishment. The size, location, and configuration of the borrow area (offshore, with the long axis parallel to the shoreline) is designed to minimize the potential to create hypoxic conditions. The material would be transported directly to the site via pipeline, for a distance of approximately 11.3 miles. The pipeline access corridor would be approximately 30 feet wide, and follow the east bank of Freshwater Bayou, and would avoid the Freshwater Bayou Lock by following the bypass channel to the east. Navigation traffic is not anticipated to be impacted. The pipeline corridor is approximately 59,731 feet long (41 acres), the equipment access corridor is approximately 59,695 feet long (179 acres), and neither would require dredging. The pipeline corridor is contained within the equipment access corridor for the entire route except for where it bypasses the Freshwater Bayou Lock. This route is approximately 12,491 feet (8.6 acres). Measure 306a1 would result in a net benefit of 151 AAHUs.

Construction would begin in TY1, after the construction of measure 16bSE which would provide protection to the marsh creation area, and measure 127c3, with anticipated completion in TY2. The dredged material would be placed to achieve a post-construction marsh target elevation of +1.4 feet (NAVD88) following dewatering. During construction, effluent from dewatering would be discharged into adjacent wetlands via spill box weirs. Approximately 108,000 feet of earthen containment dikes would be constructed from in-situ material located within the marsh restoration/nourishment area with a mechanical dredge. Generally, containment dikes are constructed around the perimeter of the feature. Spill box weirs would be placed in

⁹ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



optimal locations along the containment dikes to control the level of water and to allow for dewatering (see Figure below for containment dike and spill box weir locations). Access for the mechanical dredge would be via Freshwater Bayou. No flotation dredging is anticipated to be required. The borrow area used for construction of the earthen containment dike would be refilled during the placement of dredged material. One (1) foot of freeboard would be maintained at all times during dredge discharge operations. The earthen containment dikes would be constructed to an approximate 5 foot crown width and slopes no steeper than 4H:1V. Containment dikes would be breached in multiple places at TY3 if necessary to restore fish access if natural degradation is not sufficient. Breach locations would correspond to weir locations. Dewatering spill boxes would discharge into Freshwater Bayou behind the foreshore rock dikes (Shoreline Protection 16b measure) so that additional sediment discharged in the effluent would preferentially settle between the dike and the shoreline.

One renourishment cycle at TY30 is estimated to include 317 acres of marsh restoration along with 1,484 acres of marsh nourishment. Approximately 3.5 million cubic yards of borrow from approximately 1 to 3 miles offshore within state waterbottoms would be required for this renourishment cycle. The borrow area, pipeline corridor, and equipment access for the renourishment cycle would be the same as for construction.

Best management practices would be implemented to avoid unnecessary impacts. By dredging the borrow area with side slopes of no less than a 4H:1V, hypoxic conditions are anticipated to be minimized. The use of airboats to place the pipeline along the corridor would minimize impacts to existing marsh. Air boats and marsh buggies (if required) would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). Booster pumps would be situated within the access corridor if possible, or located to minimize impacts to existing wetlands. The pipeline would be sunk where necessary to provide navigation access. No critical habitat is expected to be impacted by this measure. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.

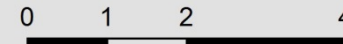


306a1

Rainey Marsh Restoration Southwest Portion (Christian Marsh)

Legend

- Weir
- Booster Pump
- Dredge Pipeline Route
(59,731 Feet/41 Acres)
- Equipment Access Route
(59,695 Feet/178 Acres)
- Proposed Borrow Area
(3,950 Acres)
- Marsh Creation
(1,896 Acres)
- Piping Plover Critical
Habitat (0 Acres Impacted)



Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: August 06, 2015



Shoreline Protection Measures



Measure 5a Holly Beach Shoreline Stabilization – Breakwaters

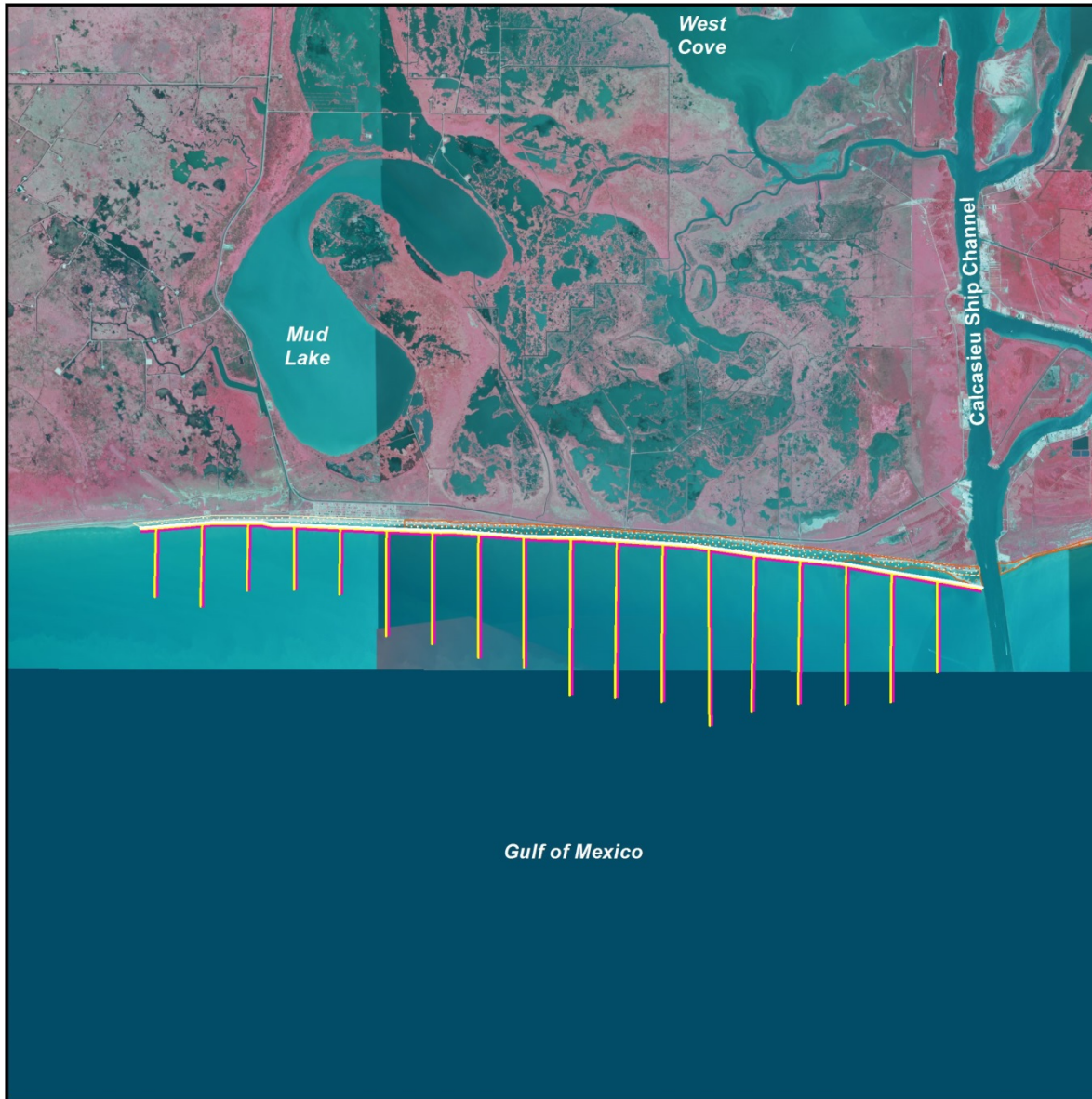
This measure consists of the construction of approximately 8.7 miles of rock breakwaters and is a continuation of existing breakwaters. The breakwaters would be constructed at the approximate -4.0 foot (NAVD88) contour on state waterbottoms to a crown elevation of 3.5 feet (NAVD88) with a crown width of 24.0 feet and 2(H):1(V) side slopes (see Annex B for typical design drawings for this measure). It would also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -5 feet (NAVD88). The rock breakwaters would be constructed using 860,540 tons of rock (minimum of 250-pound gradation) underlain with 386,460 square yards of geotextile fabric to minimize settlement. Breakwater segments would be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 57.4 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹⁰

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 479 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge would be sidecast adjacent to the channel, and returned after construction. Approximately 462 acres are anticipated to be impacted by material removed from the access channels. A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance at TY25 consisting of approximately 10% of the initial rock quantity is also included. Access for these maintenance events would be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 5a would result in a net benefit of 56 AAHUs. Despite the low environmental benefit, this measure was deemed justified for inclusion in the TSP because it provides protection for the recently-constructed Cameron Parish Shoreline Restoration (CS-33) project, which renourished the beach with sand pumped from offshore. It ties into the existing breakwater field of the Holly Beach Sand Management (CS-31) project, and provides additional protection to the community of Holly Beach and Louisiana Highway 82, the only evacuation route in the vicinity. It also reduces the likelihood of a breach forming across Hwy 82, which would negatively impact the marshes to the north, including feature 124d.

¹⁰ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.








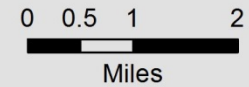
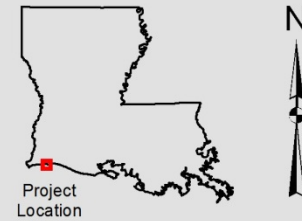
Best management practices would be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their habitats would be avoided by remaining offshore. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. The proposed project would not impact designated wintering piping plover critical habitat.



5a Holly Beach Shoreline Stabilization - Breakwaters

Legend

-  Engineered Breakwater
(46,014 Feet)
-  Access Route Disposal
(159,741 Feet/462 Acres)
-  Equipment Access Route
(161,957 Feet/479 Acres)
-  Piping Plover Critical
Habitat (0 Acres Impacted)
-  Cameron Parish Shoreline
Restoration



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measures 6b1

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

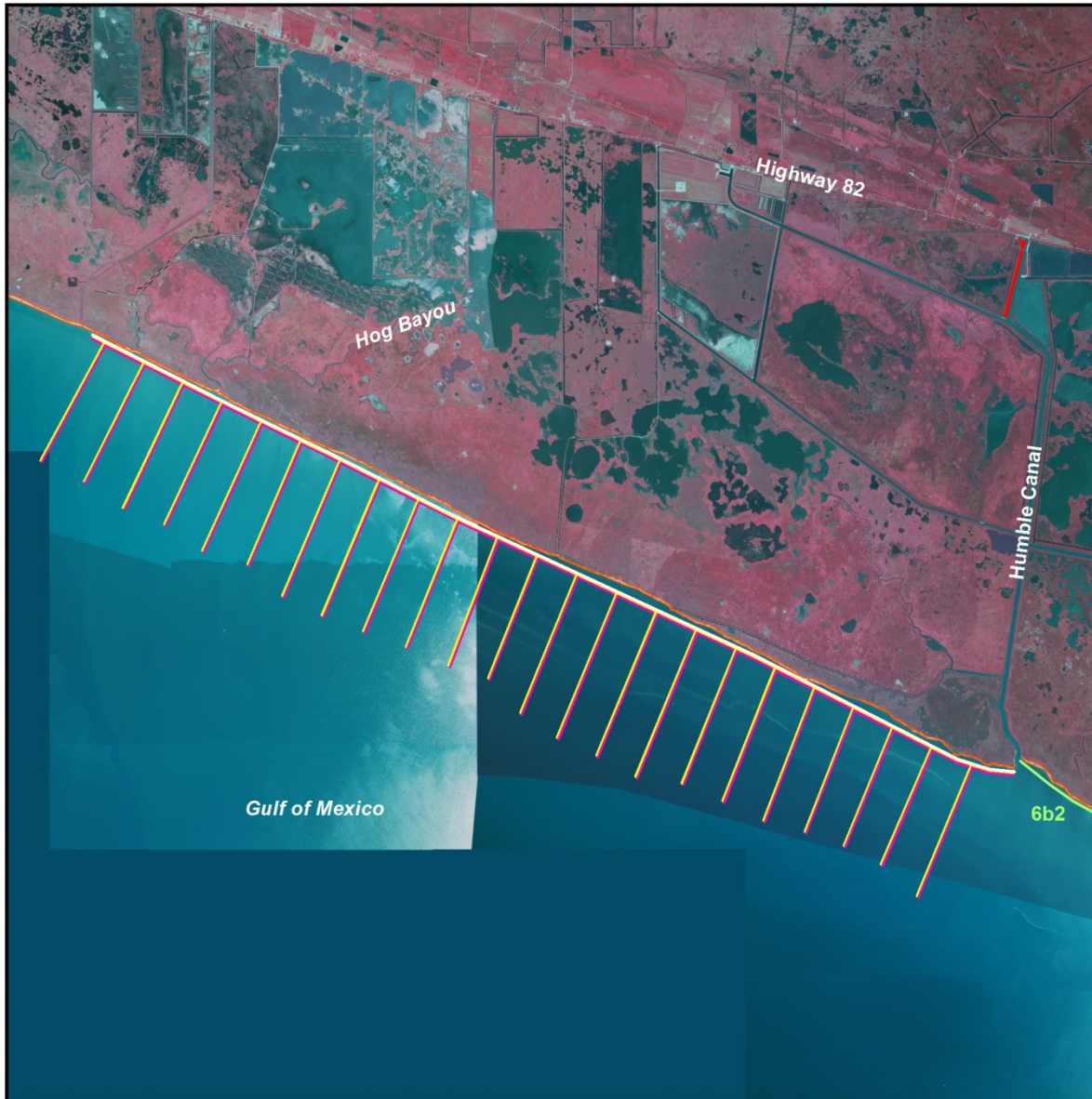
Measure 6b1 consists of the construction of approximately 11.0 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Annex C for typical design drawings for this measure). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project, Rockefeller Refuge Gulf Shoreline Stabilization (ME-18), along the Rockefeller Refuge shoreline. The breakwater would be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (447,830 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 479,150 tons of LWA would be used for the core, and 868,480 tons of rock (minimum 250-pound grade) would be used for the armor stone. The structure would have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It would also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments would be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 65.9 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹¹

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 725 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 711 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres would be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event would be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b1 would protect 2,140 acres and result in a net benefit of 625 AAHUs.

¹¹ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.



Best management practices would be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their habitats would be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. The proposed project would not impact designated wintering piping plover critical habitat.



6b1

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Legend

- Engineered Breakwater
(58,293 Feet)
- Potential Staging Area (21 Acres)
- Access Route Disposal
(239,001 Feet/711 Acres)
- Equipment Access Route
(244,857 Feet/725 Acres)
- Piping Plover Critical
Habitat (0 Acres Impacted)

Project Location

N

0 0.5 1 2
Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 27, 2015



Measures 6b2

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Measure 6b2 consists of the construction of approximately 8.1 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Annex C for typical design drawings for this measure). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project, Rockefeller Refuge Gulf Shoreline Stabilization (ME-18), along the Rockefeller Refuge shoreline. The breakwater would be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (363,270 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 357,010 tons LWA would be used for the core, and 687,140 tons of rock (minimum 250-pound grade) would be used for the armor stone. The structure would have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It would also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments would be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 40.2 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹²

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 507 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 497 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres would be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event would be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b2 would protect 1,583 acres and result in a net benefit of 466 AAHUs.

¹² Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.








Best management practices would be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their habitats would be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. The proposed project would not impact designated wintering piping plover critical habitat.

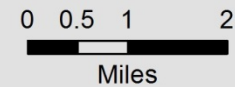


6b2

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Legend

-  Engineered Breakwater
(42,883 Feet)
-  Staging Area
(21 Acres)
-  Access Route Disposal
(168,533 Feet/497 Acres)
-  Equipment Access Route
(173,050 Feet/507 Acres)
-  Piping Plover Critical
Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measures 6b3

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Measure 6b3 consists of the construction of approximately 6.3 miles of reef breakwater with a lightweight aggregate (LWA) core. The encapsulated LWA core decreases the bearing pressure and allows greater crest elevation and increased wave attenuation (see Annex C for typical design drawings for this measure). The design of this feature incorporates the design and construction of a portion of a CWPPRA demonstration project, Rockefeller Refuge Gulf Shoreline Stabilization (ME-18), along the Rockefeller Refuge shoreline. The breakwater would be located along the approximate -4 foot (NAVD88) contour approximately 150 feet offshore on state waterbottoms. The feature includes geotextile fabric overlying geogrid (244,205 square yards), 1 foot of bedding stone with 3.75 feet of LWA core to be initially covered by approximately 4 feet of armor stone. Approximately 279,030 tons of LWA would be used for the core, and 561,530 tons of rock (minimum 250 pound grade) would be used for the armor stone. The structure would have a crest elevation of +3.25 feet (NAVD88) with a width of 18 feet with 2(H):1(V) side slopes. It would also have a 10-foot (minimum) apron on the Gulf side and a 6 foot (minimum) apron on the shoreward side at -0.5 feet (NAVD88). Breakwater segments would be approximately 280 feet in length with 175 feet of gapping between breakwaters with offset, overlapping ends. The breakwater footprint is approximately 37.8 acres. Flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be limited to an 80-foot bottom width channel not to exceed an elevation of -7.0 feet (NAVD88), with a top width of 130 feet and 3:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹³

Access channels would be dredged perpendicular to the shoreline out to the -7.0 foot (NAVD88) contour every 2,500 feet. Approximately 372 acres are anticipated to be dredged for the access channels. Material removed from the access channel via mechanical dredge (clamshell or bucket) would be sidecast adjacent to the channel, and returned after construction. Approximately 289 acres are anticipated to be impacted by material removed from the access channels. Approximately 21 acres would be used for the staging area located off of Highway 82 adjacent to the Humble Canal. One maintenance lift at TY25 consisting of approximately 10% of the original armor stone quantity is included. Access for this maintenance event would be along the same access channels as the construction event. There is a possibility that longshore transport may be disrupted by the creation of tombolos. In other words, sediment may eventually fill in the lee of the breakwater and form a tombolo; the breakwater-tombolo formation may then act as a groin which might disrupt the longshore sediment transport in the area. Measure 6b3 would protect 1,098 acres and result in a net benefit of 312 AAHUs.

¹³ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.








Best management practices would be implemented to avoid unnecessary impacts. Impacts to sea turtles would be minimized through the use of mechanical dredges and dropping the bucket empty to alert nearby organisms. Shorebirds, including piping plover and red knot, and their habitats would be avoided by keeping construction activities offshore from the Gulf of Mexico shoreline. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. The proposed project would not impact designated wintering piping plover critical habitat.

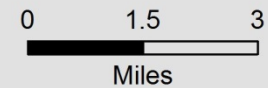
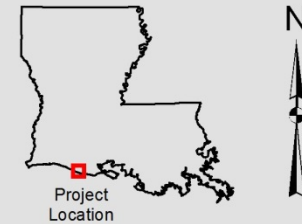


6b3

Gulf Shoreline Restoration: Calcasieu River to Freshwater Bayou

Legend

-  Engineered Breakwater
(33,355 Feet)
-  Potential Staging Area (21
Acres)
-  Access Route Disposal
(98,683 Feet/289 Acres)
-  Equipment Access Route
(126,542 Feet/372 Acres)
-  Piping Plover Critical
Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measure 16b
Fortify Spoil Banks of GIWW & Freshwater Bayou

These three measure reaches, 16bNE (approx. 2.9 miles), 16bSE (approx. 7.7 miles), and 16bW (approx. 2.8 miles), consist of the construction of foreshore rock dike shoreline protection along critical areas of the Freshwater Bayou navigation canal. Armoring of the shoreline is intended to prevent the shoreline from breaching so that salt water does not negatively impact the surrounding freshwater marshes and lakes in the Mermentau Basin. Implementation of similar shoreline protection projects along Freshwater Bayou has halted the shoreline erosion along those reaches. The proposed rock dike feature would be located at the approximate -0.3 foot (NAVD88) contour (at Mean Low Water) on state waterbottoms, and contain 617,640 tons of rock (minimum 250 pounds gradation). Crown elevation would be +3.0 feet (NAVD88) with a 4 foot crown width and 4(H):1(V) side slopes (see Annex D for typical design drawings for this measure). The rock dike would be underlain with approximately 516,860 square yards of geotextile fabric to minimize settlement. Gaps would be included at naturally occurring waterways or navigable channels, with additional gaps for ingress and egress of aquatic organisms at 1,500 foot intervals, as needed. These features would be constructed prior to the Marsh Restoration 306a1 feature to provide protection to the retention dike from wave scour. Limited flotation dredging is anticipated for access to the site for construction equipment and material barges. Flotation excavation along the alignment would be accomplished with a mechanical dredge, and would be limited to a 120-foot bottom width channel not to exceed an elevation of -5.0 feet (NAVD88), with a top width of 130 feet and 2:1 side slopes. Hopper dredges are not being proposed. Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction dragheads. Thus far, no incidental takes of sea turtles have been reported from clamshell (mechanical dredge), pipeline cutterhead (hydraulic dredge), or other types of dredges operating in southeastern coastal channels. Operational differences between these dredge types contribute to the differences in potential impacts to sea turtles. The relatively slow dredging motion of clamshell and pipeline dredges presents minimal risk for sea turtle takes.¹⁴

The access channel would be at least 50 feet from the centerline of the rock dike. A maximum of approximately 358 acres could be dredged for the access channels. Any material dredged for access would be placed between the rock dike and the shoreline (to a maximum elevation of +5.0 feet NAVD88). A maintenance lift at TY15 consisting of approximately 15% of the initial rock quantity is included. A second maintenance lift at TY25 consisting of approximately 10% of the initial rock quantity is also included. Measure 16b would protect 1,288 acres and result in a net benefit of 279 AAHUs.

Best management practices would be implemented to minimize impacts to the water quality of Freshwater Bayou, including the use of mechanical dredging for access channels, if required. Shorebirds, including piping plover and red knot, and their habitats would be avoided by keeping construction activities offshore from the Freshwater Bayou shoreline. All construction activities shall observe a buffer zone of 1,000 feet for any

¹⁴ Dickerson, D., M. Wolters, C. Theriot, and C. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Presented during World Dredging Congress XVII – Dredging in Sensitive Environment. Congress Centre Hamburg, Germany. September 2004.






colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies. The proposed project would not impact designated wintering piping plover critical habitat.

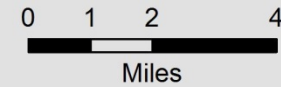
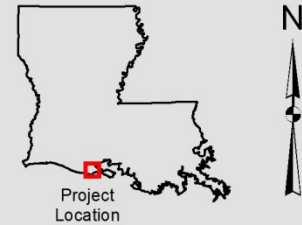


16b

Fortify Spoil Banks of the GIWW and Freshwater Bayou

Legend

-  Rock Revetment
-  Equipment Access Route (120,689 Feet/358 Acres)
-  Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: January 27, 2015



Chenier Reforestation Measures



Measure CR Chenier Reforestation

Measure CR is a series of chenier ridge reforestation features located along existing chenier ridges situated within Cameron and Vermilion Parishes (see following maps).

The measure would consist of invasive species control and planting native species seedlings to achieve a 50 percent canopy cover. From the possible locations, east/west-oriented chenier ridges with elevations identified through LiDAR surveys as generally being greater than +5 feet (NAVD 88) were selected. The +5 feet (NAVD 88) target elevation is considered a conservative minimum elevation that could sustain tree plantings for the duration of the study period given relative sea level rise, and is taken from Didier (2007) and other professional opinions.

The selected chenier ridges included: Measure 416 - Grand Chenier Ridge (nine locations with 251.9 total acres); Measure 509c - Bill Ridge (three locations with 21.4 total acres); Measure 509d - Cheniere Au Tigre (one location with 8.2 acres); Measure 510a - Blue Buck Ridge (eight locations with 524.4 total acres); Measure 510b - Hackberry Ridge (three locations with 148.5 total acres); and Measure 510d - Front Ridge (eleven locations with 458.7 total acres). The total acreage included in the Chenier Reforestation measure is 1,413.1 acres. A total of 538.2 AAHUs are anticipated to be restored with this measure.

Prior to planting, an application of 64 ounces of Clearcast® would be sprayed over the top of hardwoods to control invasive species, primarily Chinese tallow (*Triadica sebifera*), if needed. Up to 50 percent of the measure acreage would be planted with live oak (*Quercus virginiana*) and hackberry (*Celtis occidentalis*). Bare-root seedlings would be planted on 10x10-foot spacing (435 trees per acre), which assumes 57% survival. Fencing would be installed to exclude cattle and reduce deer herbivory. Fencing would be 7.5 feet tall, and fence posts would be installed in concrete with a small tractor using an auger bit and portable cement mixer. Approximately 150,000 linear feet of fencing would be required at \$1.00 per linear foot, not including labor. Fencing would not be required for the CR-509c and CR-509d measures, since they are located in a remote area along the coast where there is currently no cattle grazing.

For a given planting, a minimum of 250 seedlings/saplings per acre must be present (with a 60 to 40 hard mast to soft mast ratio) at the end of the fourth year (i.e., Year 5) following successful attainment of the one-year survivorship criteria. Trees established through natural recruitment may be included in this tally; however, no less than 125 hard mast-producing seedlings per acre must be present. Surviving hard mast seedlings must be representative of the species composition and percentage identified in this Plan. Exotic/invasive species may not be included in this tally. By Year 5 (four years following successful attainment of the one-year survivorship criteria) the perimeter would be virtually free (approximately 5% or less on an acre-by-acre basis) of exotic/invasive vegetative species. The developing plant community must exhibit characteristics and diversity indicative of a viable native forested chenier community commensurate with stand age and site conditions by Year 5.

Costs are based on:

- Cost of bare root seedlings is \$0.30 per seedling which includes delivery to the sites.
- Planting scheme: 10x10 spacing (435 trees per acre).



- Planting costs (labor): 20 acres and up = \$65 per acre; 19 acres and less = \$75 per acre
- Chinese tallow control spraying: \$150 per acre for helicopter spraying. Sites would be sprayed using 64 ounces of Clearcast® sprayed over the top of hardwoods to control the tallow trees.
- Fencing cost is \$1.00 per linear foot, not including labor (150,000 linear feet required).
- Air boat rental may be required for measures that are inaccessible by automobile (extra \$10 per acre).

Mobilization for the chenier ridge restoration sites would be via Louisiana Highway 82 or other existing roadways, except for remote locations, such as measures 509c and 509d, which are not accessible by roadway. Measure 509c would be accessed by airboat using existing waterways and canals to the extent practicable to minimize impacts to existing wetlands. This access corridor is 13,867 feet long (10 acres). Measure 509d would be accessed by airboat or small barge from existing waterways connected to Freshwater Bayou. Air boats and marsh buggies would follow the best management practices developed by the Louisiana Department of Natural Resources and Department of Wildlife and Fisheries, “Marsh Buggy Use in the Coastal Zone” (2000). No wetland impacts are anticipated. For sites that are not immediately accessible via roadways, staging areas would be on developed land near the roadway, and would not damage existing chenier or other habitats. Planting would be accomplished by delivering seedlings to the planting site with a four-wheeler, marsh buggy or airboat, depending on topography and land use. Planting of seedlings would be by hand using staff that would walk to the site or be transported by marsh buggy or airboat. Staging areas and access routes would be returned to their pre-construction condition following construction. All construction activities shall observe a buffer zone of 1,000 feet for any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis, pelicans, etc.), 1,300 feet for any shorebird nesting colonies (e.g., terns, gulls, plovers, skimmers, etc.), and 2,000 feet for any brown pelican nesting colonies near the project feature. USFWS and USACE biologists would survey the area before construction to confirm active nesting bird locations. A nesting bird abatement plan would be developed if one of the aforementioned nesting colonies falls within its respective buffer zone. Additionally, USFWS guidelines would be followed to avoid adverse impacts to the nesting colonies.

Recommendation. Because of the low relative cost, it was decided that the chenier reforestation program would be included in any restoration alternative recommended by the study.

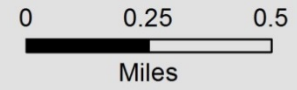


416

Chenier Ridges: Grand Chenier Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
416a	8.5	0.5	0.1
416b	11	0.5	0.0
416c	13.1	0.5	0.0
416d	19.4	0.5	0.0







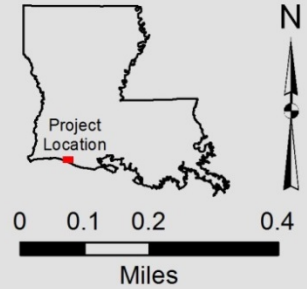


416

Chenier Ridges: Grand Chenier Ridge

Legend

-  Staging Area
-  Chenier Reforestation
-  Staging Route
-  Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
416e	85.6	1	0.3



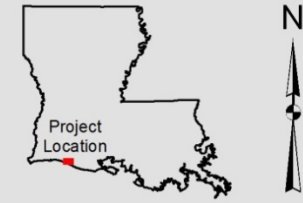


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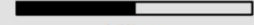
Chenier Ridges: Grand Chenier Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



0 0.3 0.6



Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
416f	46.7	1	0.0
416g	25.7	0.5	0.2
416h	29.1	0.5	0.2
416i	12.8	0.5	0.1







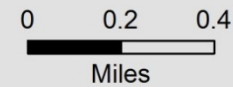
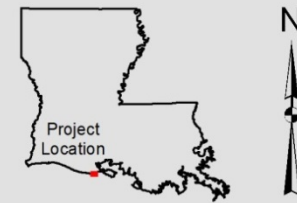


509c

Chenier Ridges: Restore Bill Ridge

Legend

-  Staging Area
-  Chenier Reforestation
-  Staging Route
-  Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
509c1	6.5	0.5	0.7
509c2	8.8	0.5	0.0
509c3	6.1	0.5	10.2





509d

Chenier Ridges: Cheniere au Tigre

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)

Project Location

0 0.15 0.3
Miles

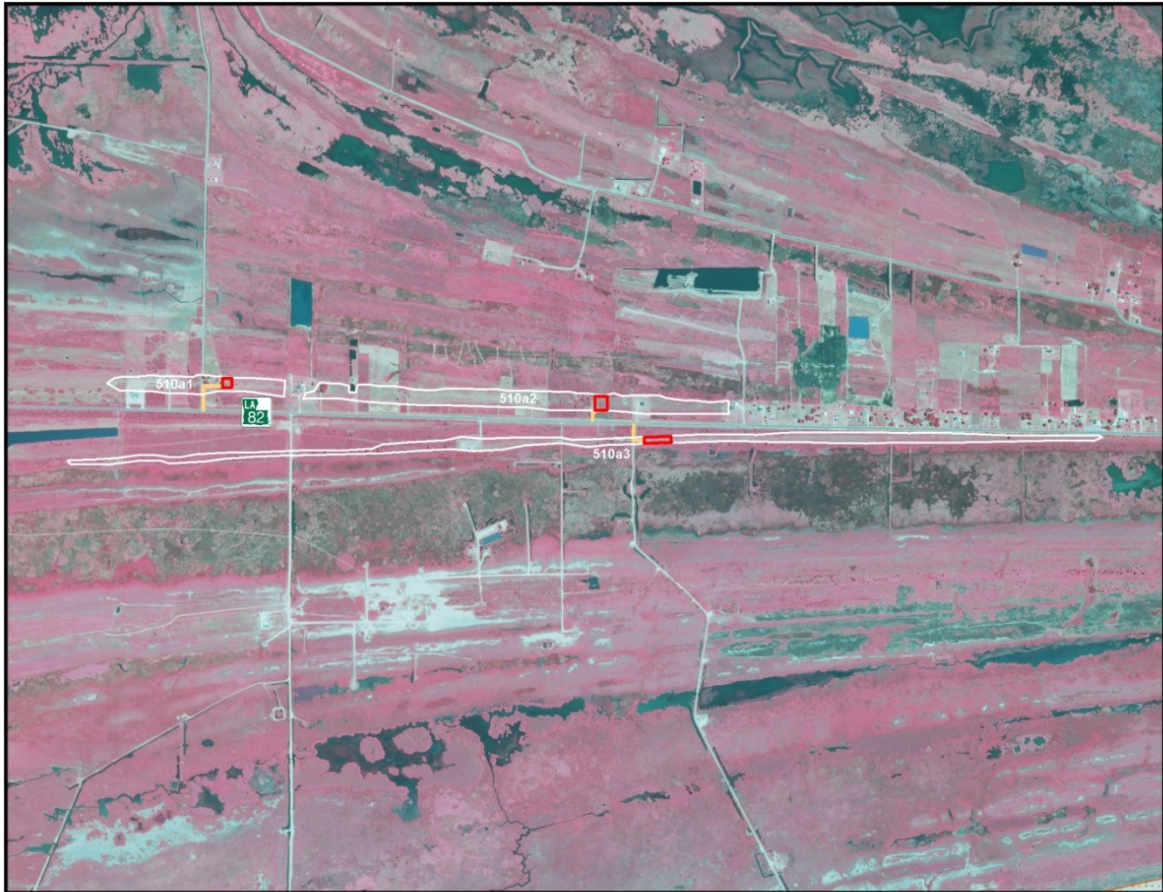
Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 03, 2015

Measure	Acres	Staging Acres	Access Acres
509d	8.2	0.5	18.5



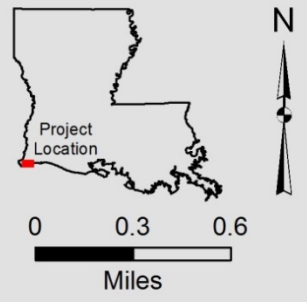


510a

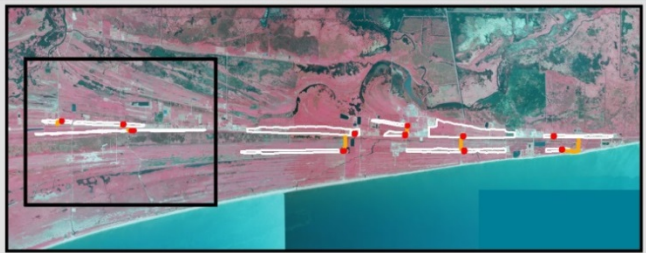
Chenier Ridges: Restore Blue Buck Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Measure	Acres	Staging Acres	Access Acres
510a1	16.2	0.5	0.5
510a2	40.4	1	0.2
510a3	45.6	1	0.3



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

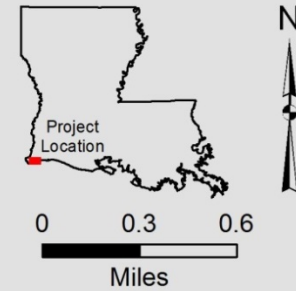


510a

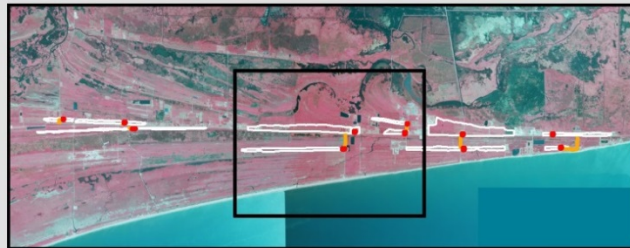
Chenier Ridges: Restore Blue Buck Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Measure	Acres	Staging Acres	Access Acres
510a4	141.2	1	0.0
510a5	18.2	0.5	0.6
510a6	20.4	1	0.1



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

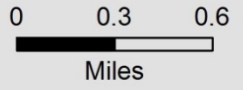
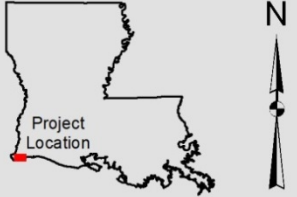


510a

Chenier Ridges: Restore Blue Buck Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)

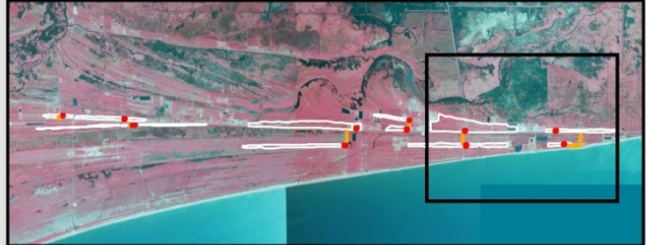


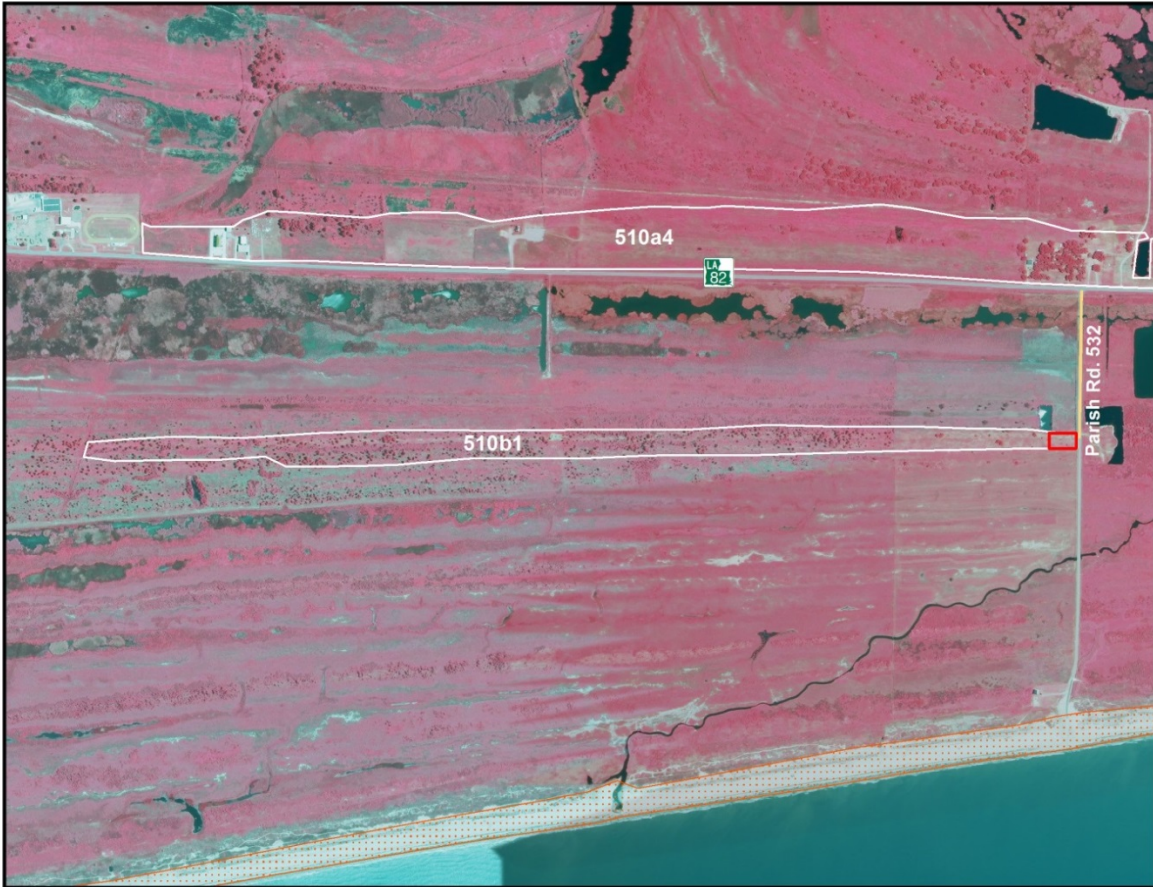
Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
510a7	202.8	1	0.0
510a8	39.6	1	0.1



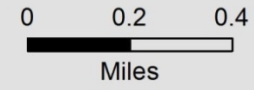
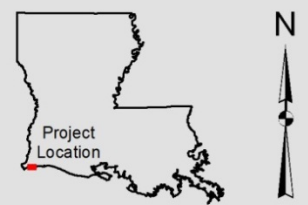


510b

Chenier Ridges: Restore Hackberry Ridge

Legend

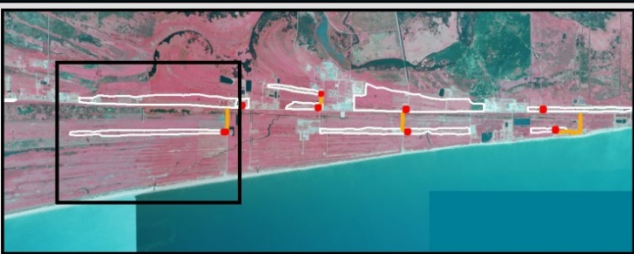
- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measure	Acres	Staging Acres	Access Acres
510b1	62.7	1	1.1

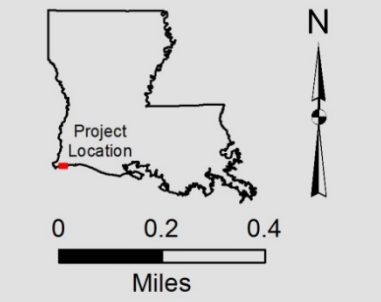


510b

Chenier Ridges: Restore Hackberry Ridge

Legend

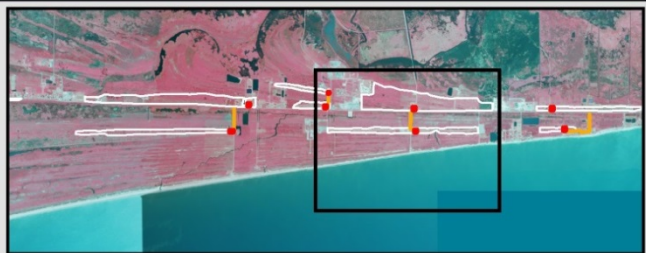
- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015



Measure	Acres	Staging Acres	Access Acres
510b2	72.2	1	1.0

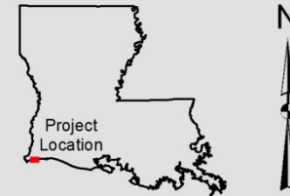


510b

Chenier Ridges: Restore Hackberry Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



0 0.125 0.25

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
510b3	13.6	1	2.0



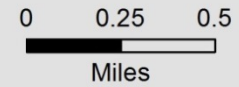
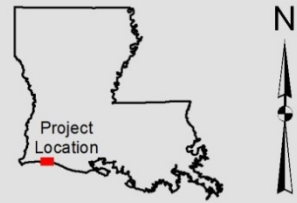


510d

Restore Front Ridge

Legend

- Staging Area
- Chenier Reforestation
- Staging Route
- Piping Plover Critical Habitat (0 Acres Impacted)



Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
510d1	35.7	0.5	5.8
510d2	47.1	1	5.7







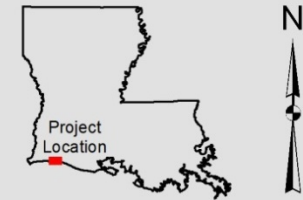


510d

Restore Front Ridge

Legend

-  Staging Area
-  Chenier Reforestation
-  Staging Route
-  Piping Plover Critical Habitat (0 Acres Impacted)



0 0.25 0.5

Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
510d3	70	1	1.4
510d4	125.6	1	2.1
510d5	65.2	1	0.0







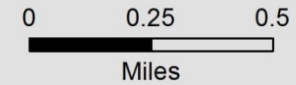


510d

Restore Front Ridge

Legend

-  Staging Area
-  Chenier Reforestation
-  Staging Route
-  Piping Plover Critical Habitat (0 Acres Impacted)

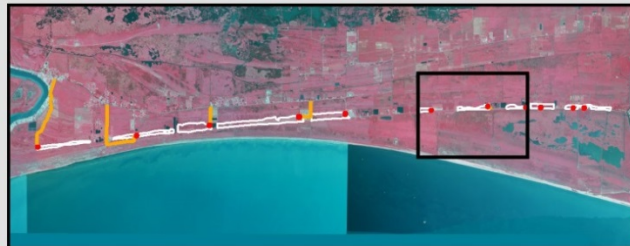


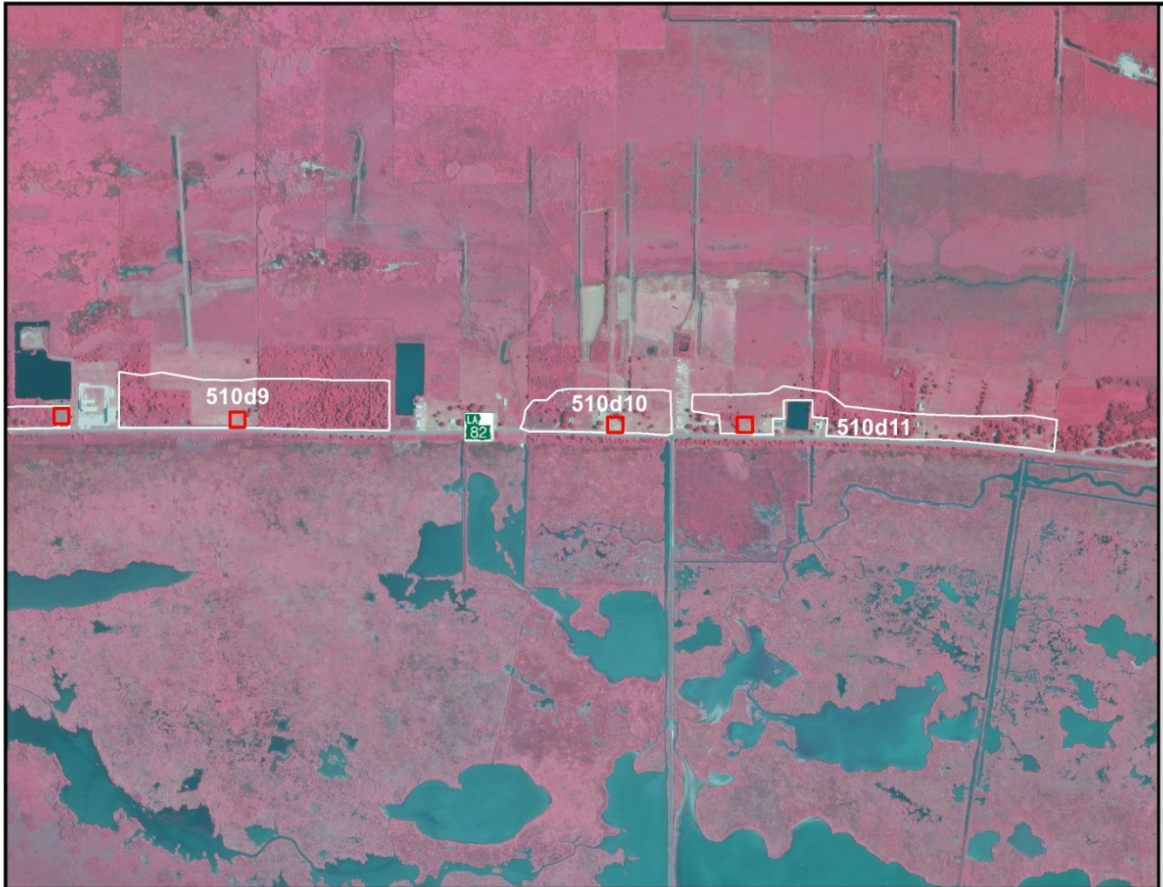
Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

Measure	Acres	Staging Acres	Access Acres
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510d7	22.4	0.5	0.3
510d8	15	0.5	0.0









510d

Restore Front Ridge

Legend

-  Staging Area
-  Chenier Reforestation
-  Staging Route
-  Piping Plover Critical Habitat (0 Acres Impacted)



0 0.225 0.45

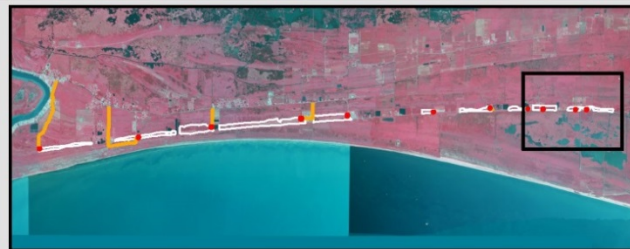
Miles

Map Produced By:
Coastal Protection & Restoration Authority

Background Imagery:
2013 National Agriculture Imagery Program

Map Date: September 04, 2015

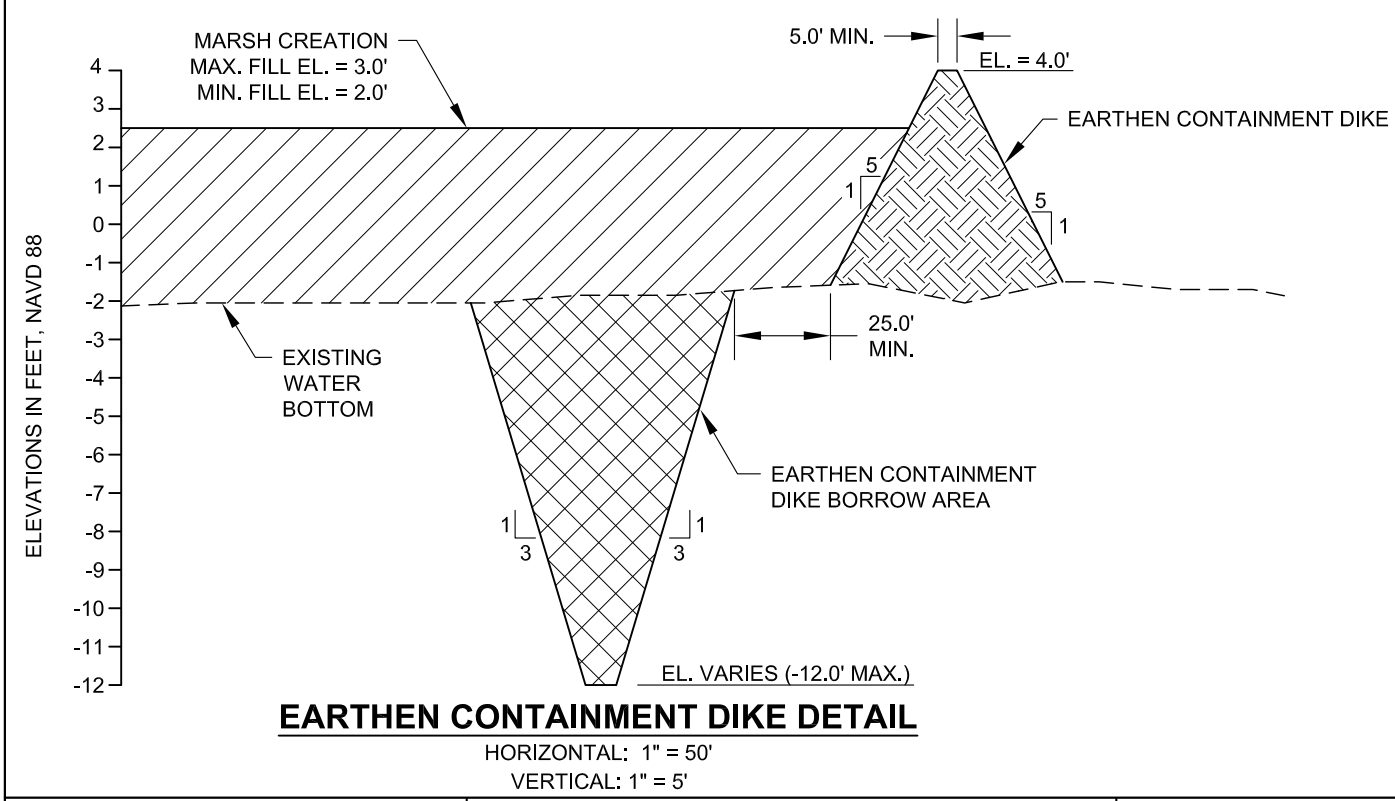
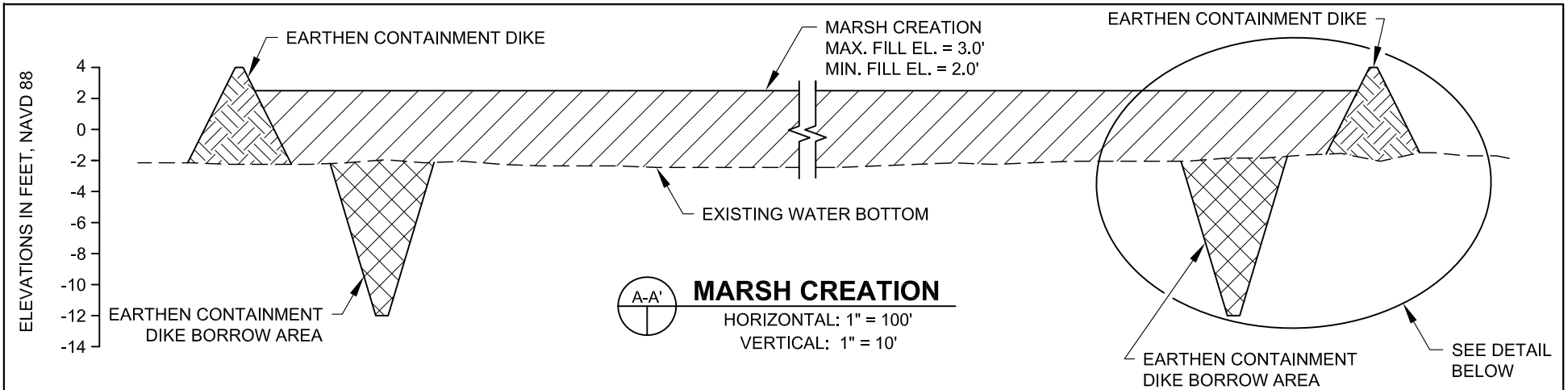
Measure	Acres	Staging Acres	Access Acres
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510d10	13	0.5	0.0
510d11	22.6	0.5	0.0





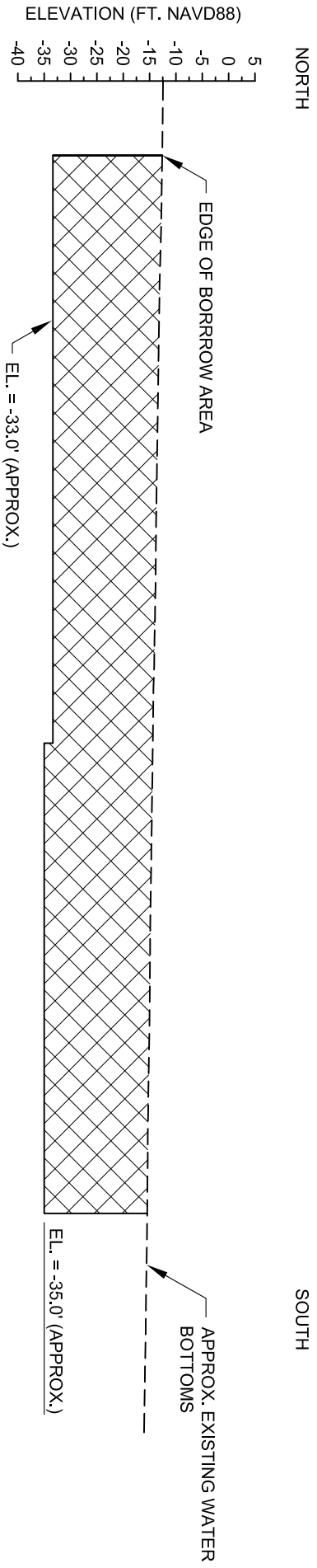
Annex A

Typical Design Drawings for Marsh Creation Features



LEGEND	
---	EXISTING GROUND/WATER BOTTOM
	MARSH CREATION (FILL)
	EARTHEN CONTAINMENT DIKE
	BORROW AREA

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	MARSH CREATION TYPICAL SECTION	
DRAWN BY: K. CANTU		DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
		FEDERAL PROJECT NUMBER:	SHEET 1 OF 1	



AA
1 1
NOT TO SCALE

TYPICAL SECTION - 47A1, 47A2 & 47C1 BORROW AREA

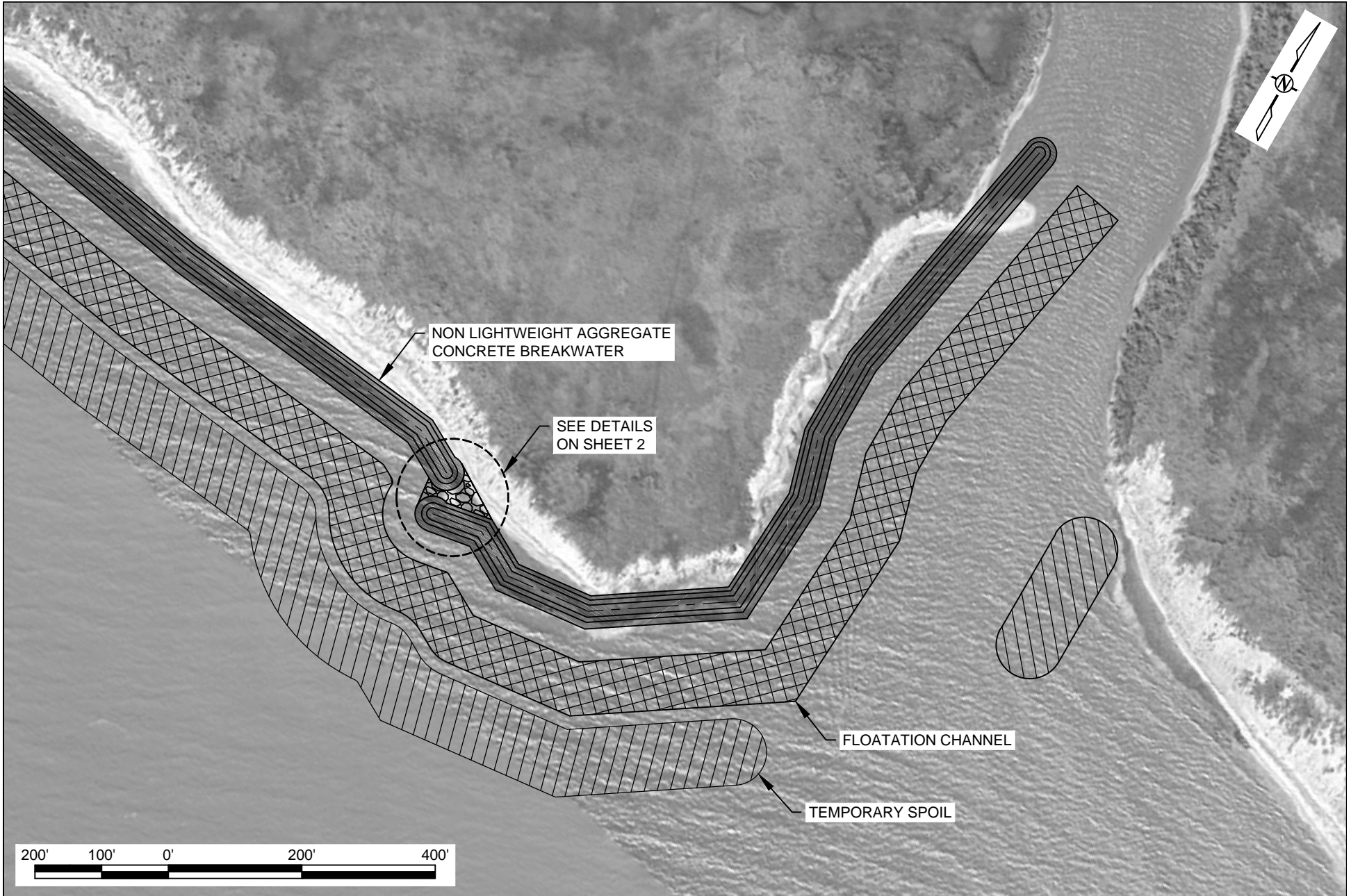
NOTE:
OFFSHORE BORROW AREA EXISTING WATER BOTTOM AND
CUT DEPTH ELEVATIONS WILL BE FINALIZED DURING PED.

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801		SWCLA	OFFSHORE BORROW AREA TYPICAL SECTION
DRAWN BY: SHANE FAUST	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:	DATE: FEBRUARY 2016
			FEDERAL PROJECT NUMBER:	SHEET 1 OF 1

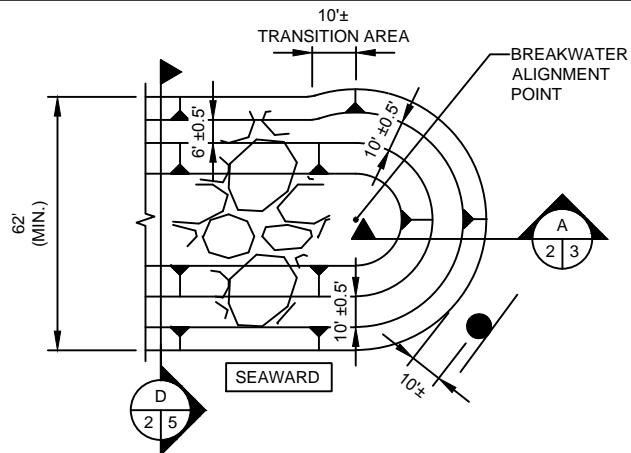


Annex B

Typical Design Drawings for Non Lightweight Aggregate Concrete Breakwater Features

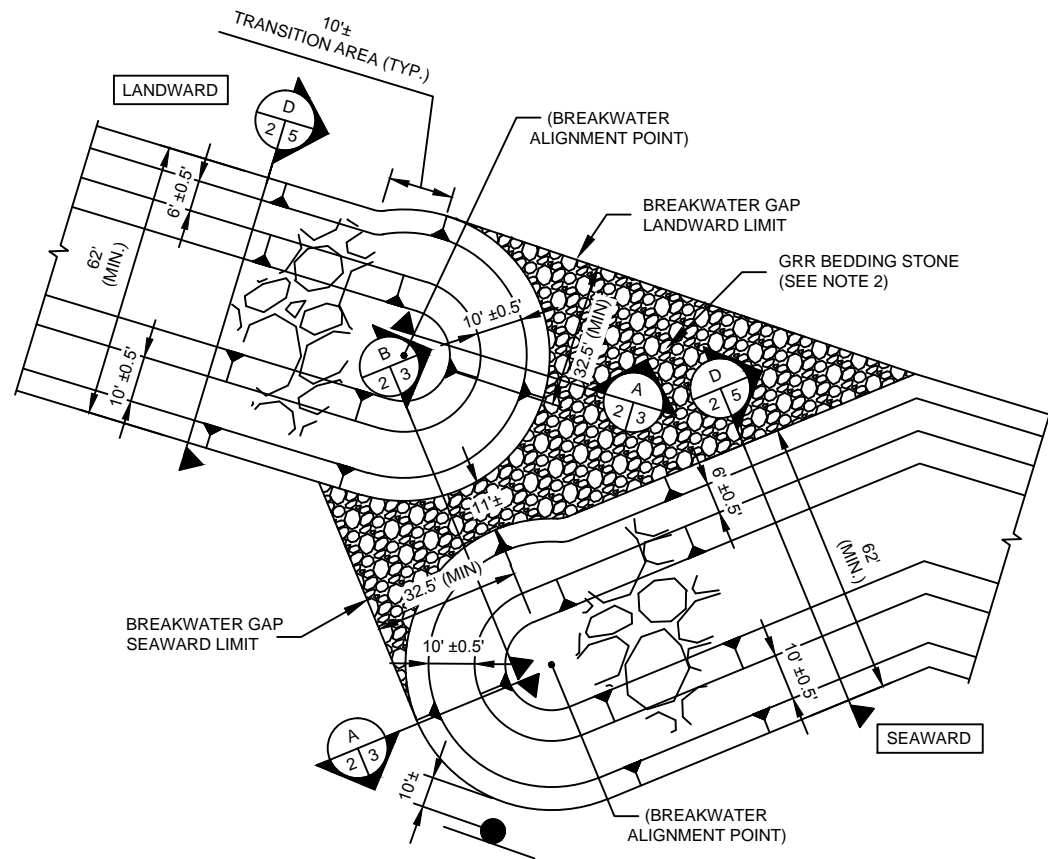


APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER PLAN VIEW
DRAWN BY: K. CANTU	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER: FEDERAL PROJECT NUMBER:
		DATE: JULY 2015 SHEET 1 OF 5	



**TYPICAL DETAIL -
BREAKWATER TERMINAL**

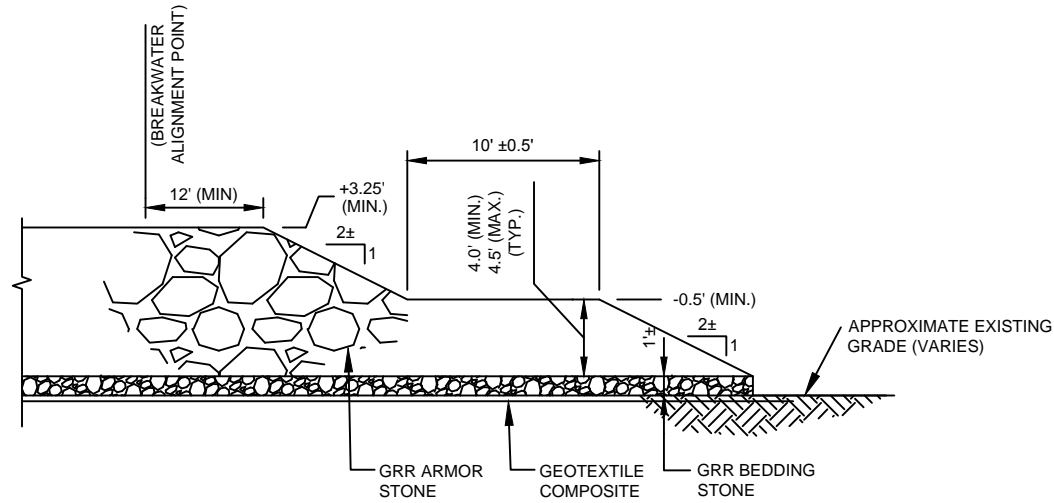
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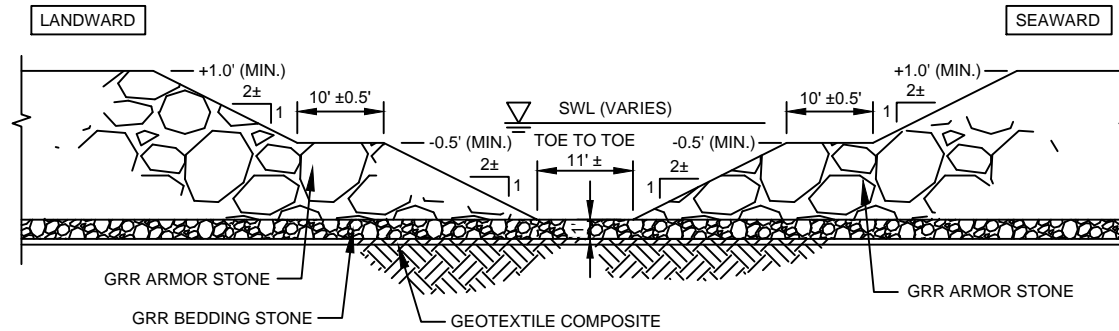
TYPICAL DETAIL - BREAKWATER GAP

SCALE: N.T.S.

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER PLAN VIEW
DRAWN BY: K. CANTU			DESIGNED BY:

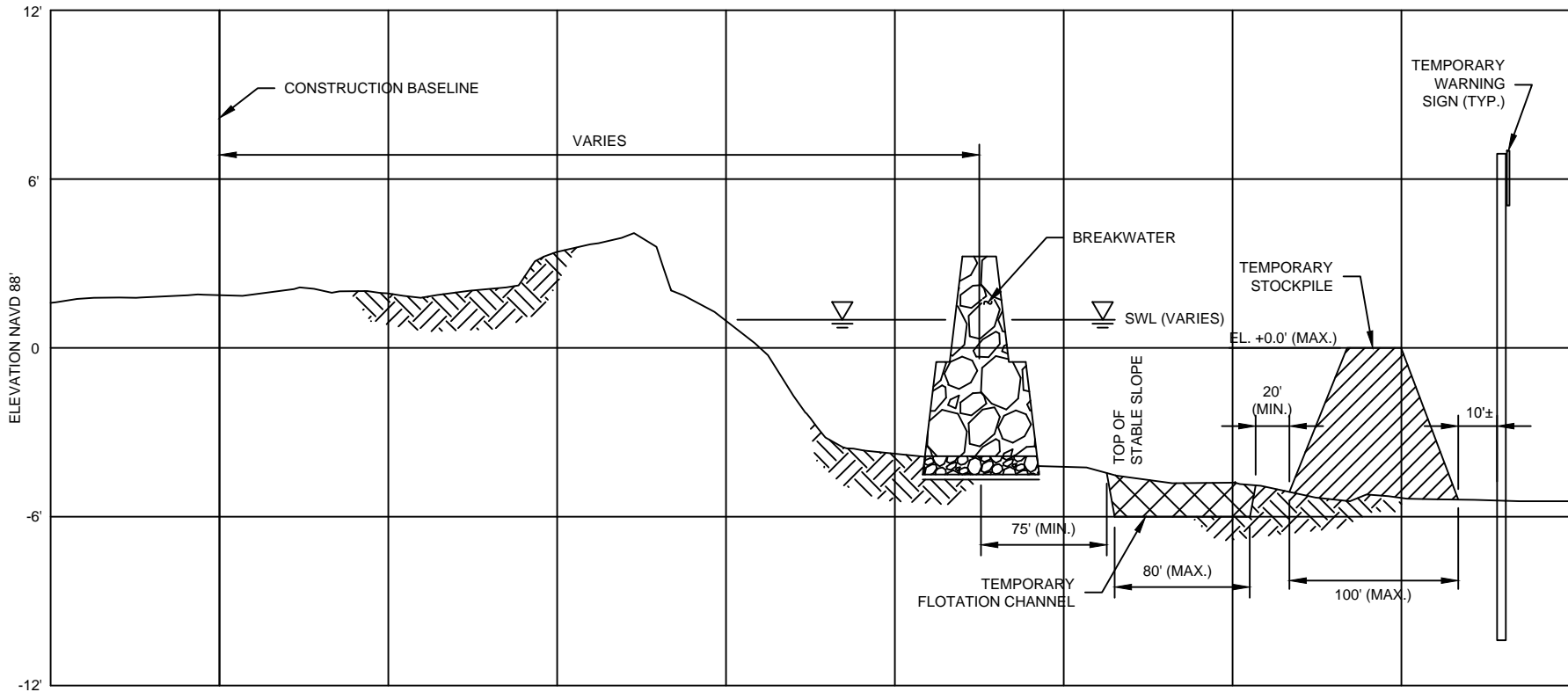


A **TYPICAL DETAIL - BREAKWATER TERMINAL**
 3 | 2 SCALE: N.T.S.



B **TYPICAL DETAIL - BREAKWATER GAP**
 3 | 2 SCALE: N.T.S.

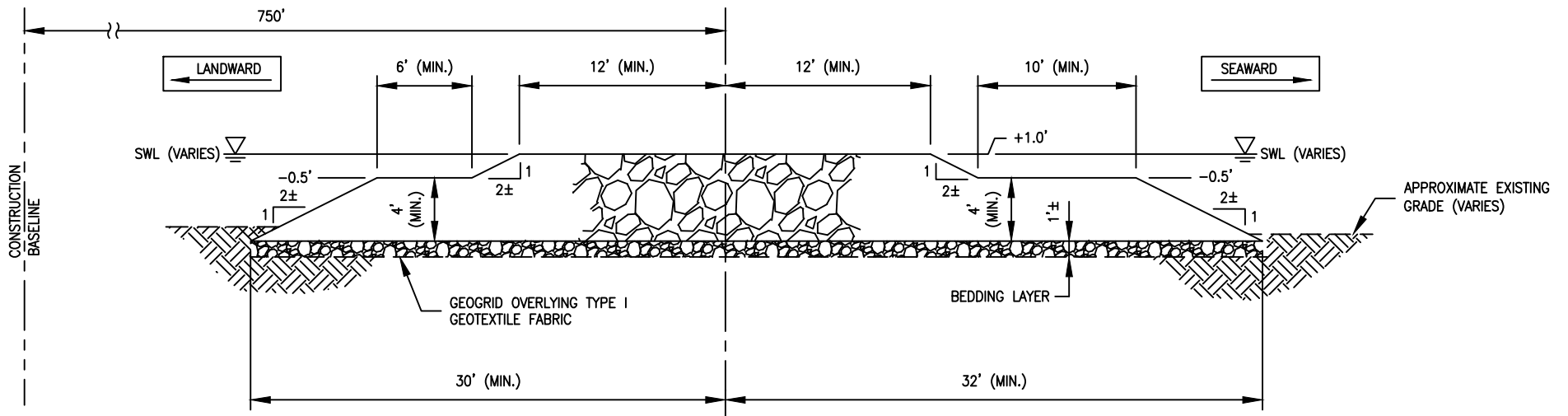
APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER SECTION	
DRAWN BY: K. CANTU		DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
			FEDERAL PROJECT NUMBER:	SHEET 3 OF 5



TYPICAL SECTION - BREAKWATER

SCALE: N.T.S.

APPLICATION BY:	<p align="center">COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801</p>	SWCLA	TYPICAL BREAKWATER SECTION
DRAWN BY: K. CANTU		DESIGNED BY:	APPROVED BY:
		DATE: JULY 2015 SHEET 4 OF 5	



2
5 | 2

TYPICAL DETAIL – ROCK BREAKWATER

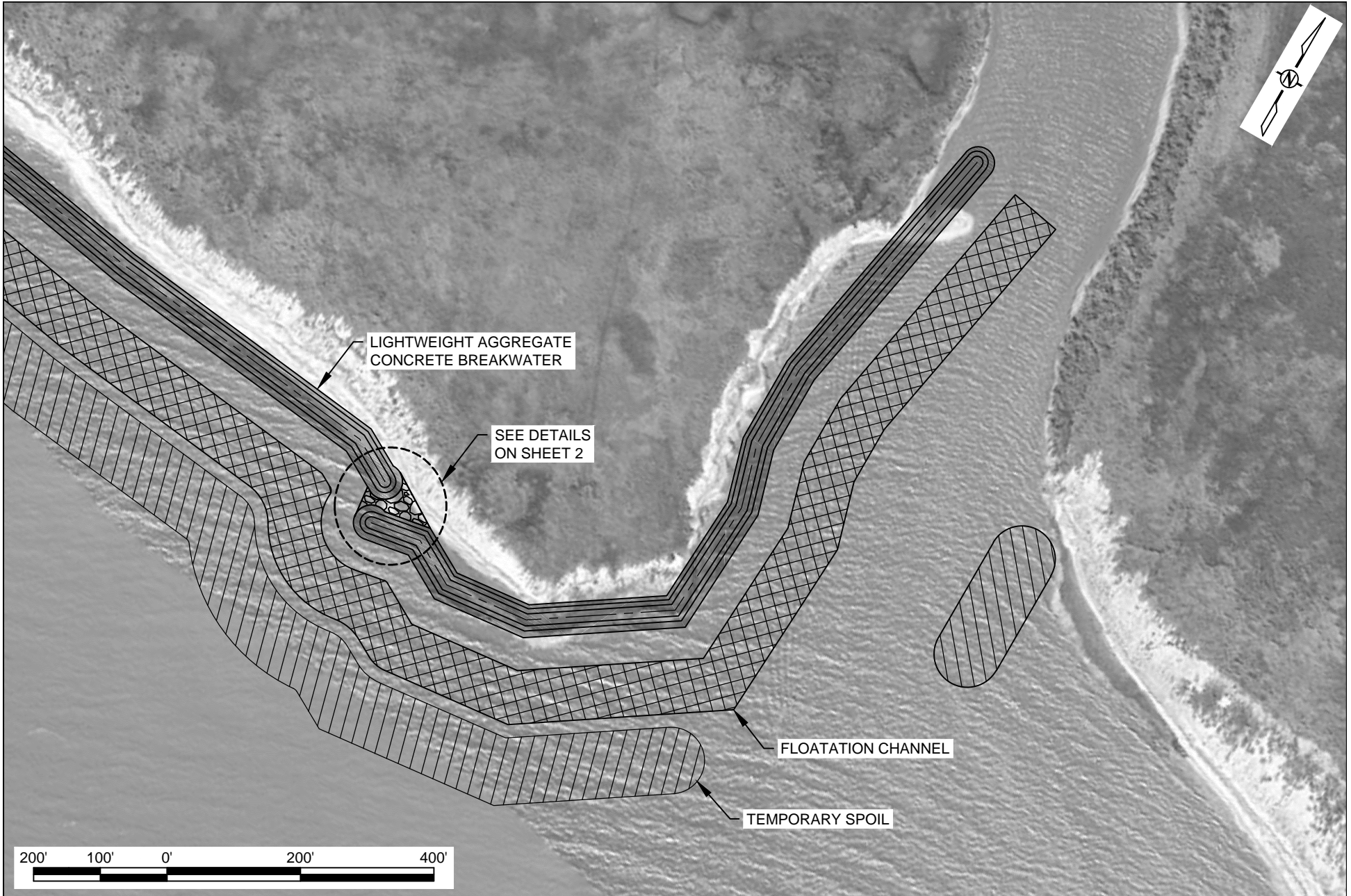
SCALE: N.T.S.

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	ROCK BREAKWATER TYPICAL DETAIL
DRAWN BY:		DESIGNED BY:	APPROVED BY:
		STATE PROJECT NUMBER:	DATE: JULY 2015
		FEDERAL PROJECT NUMBER:	SHEET 5 OF 5

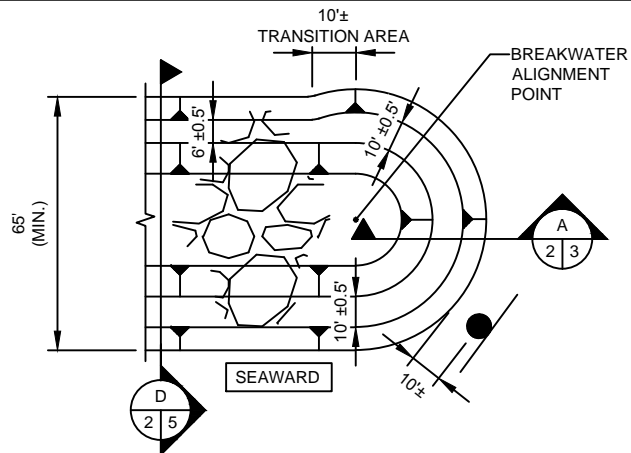


Annex C

Typical Design Drawings for Lightweight Aggregate Concrete Breakwater Features

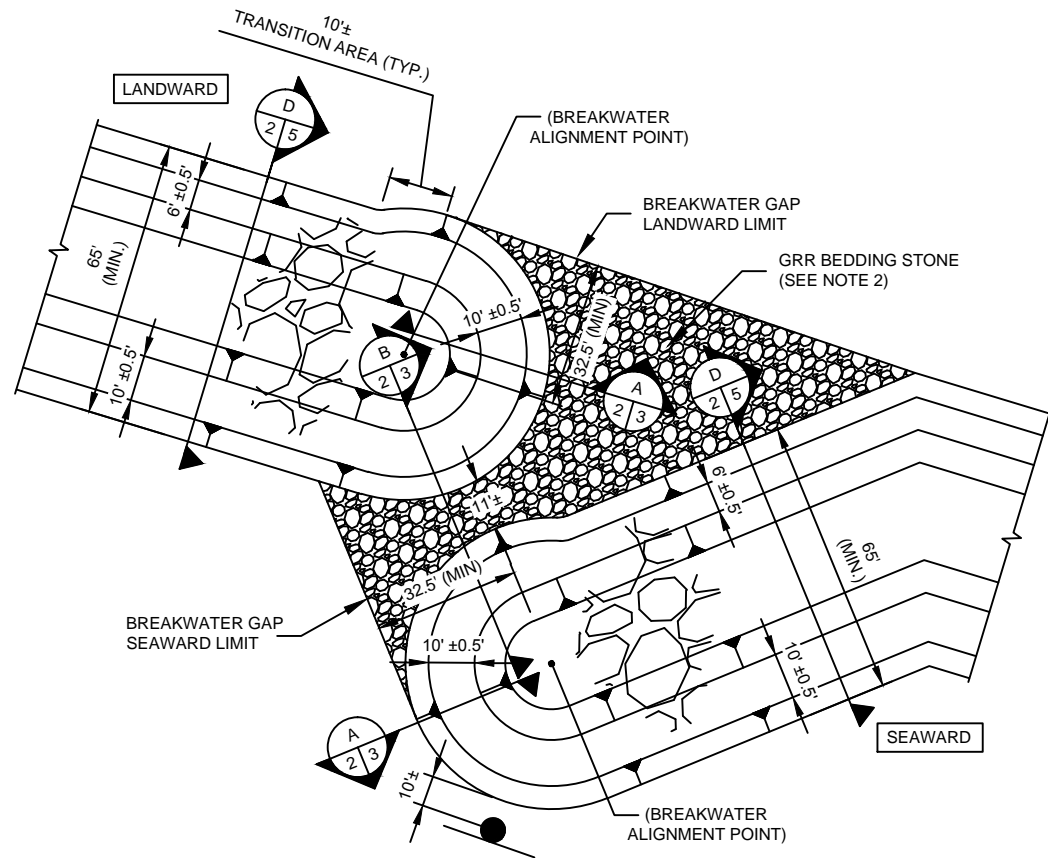


APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER PLAN VIEW
DRAWN BY: K. CANTU		STATE PROJECT NUMBER:	DATE: JULY 2015
DESIGNED BY:	APPROVED BY:	FEDERAL PROJECT NUMBER:	SHEET 1 OF 5



**TYPICAL DETAIL -
BREAKWATER TERMINAL**

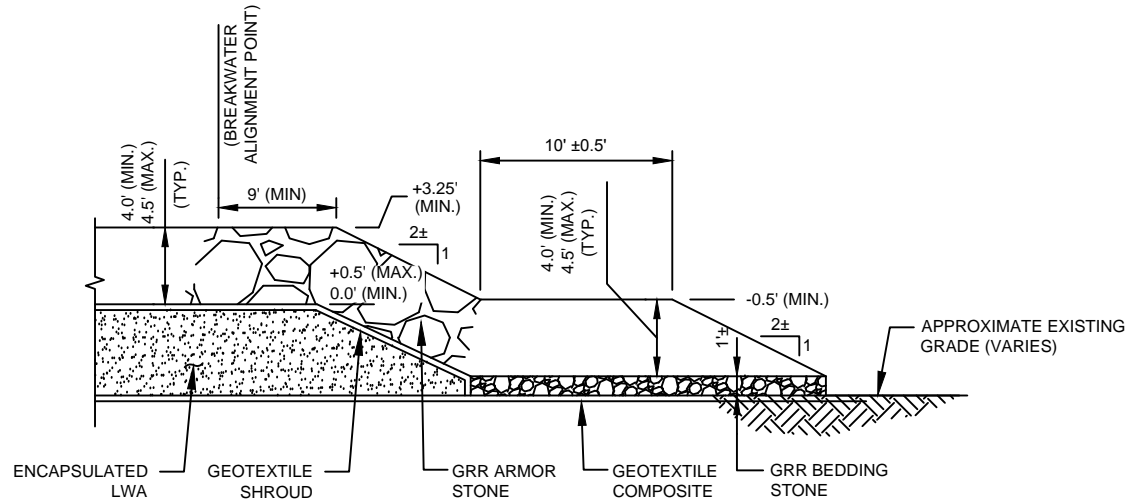
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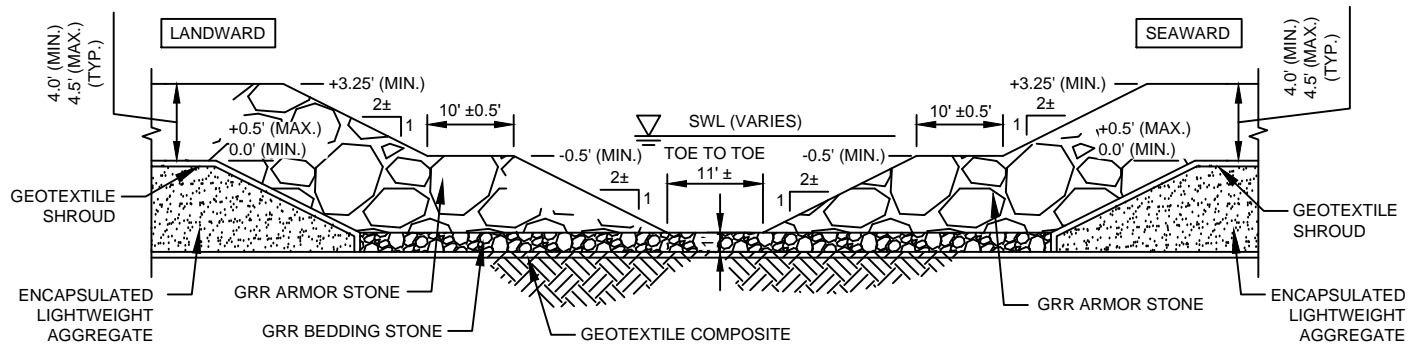
TYPICAL DETAIL - BREAKWATER GAP

SCALE: N.T.S.

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER PLAN VIEWS
DRAWN BY: K. CANTU	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
		FEDERAL PROJECT NUMBER:	DATE: JULY 2015
		SHEET 2 OF 5	

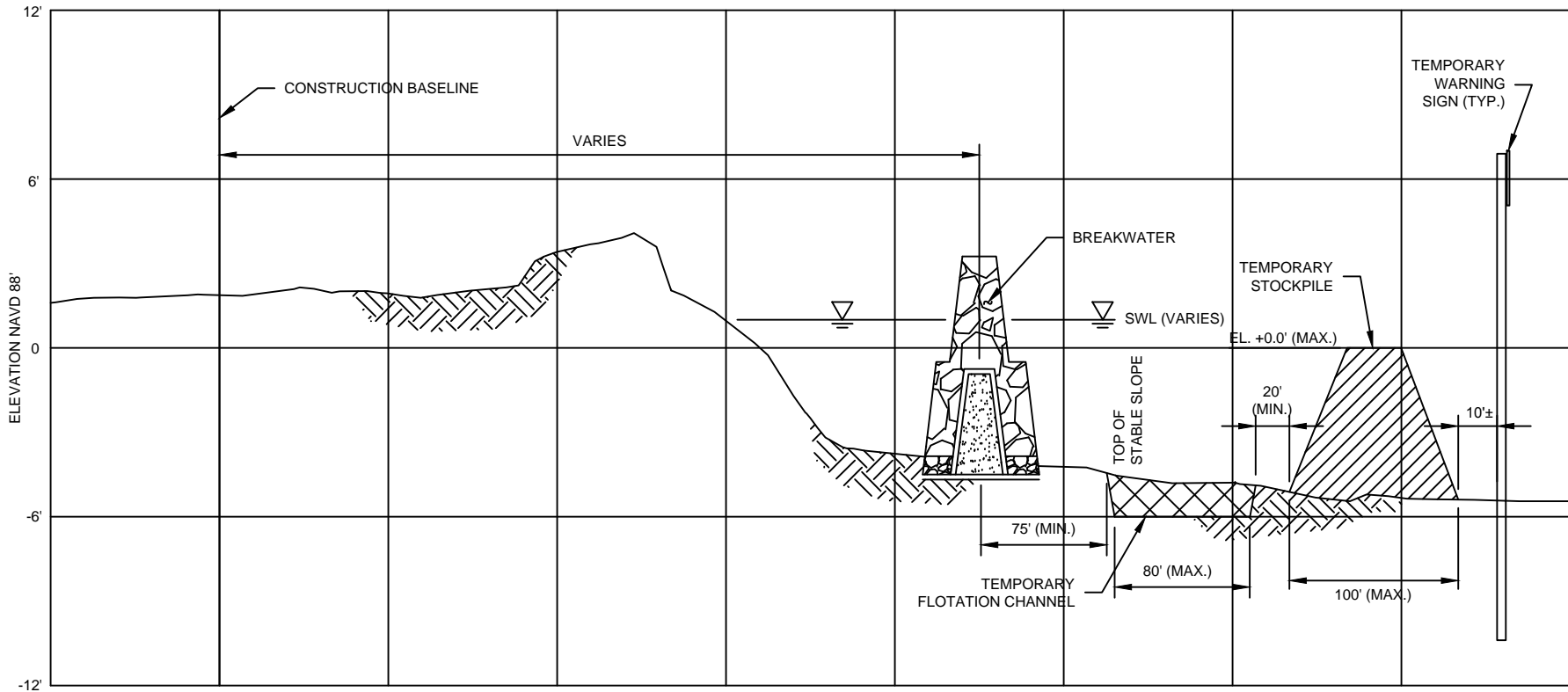


A TYPICAL DETAIL - BREAKWATER TERMINAL
 3 | 2 SCALE: N.T.S.



B TYPICAL DETAIL - BREAKWATER GAP
 3 | 2 SCALE: N.T.S.

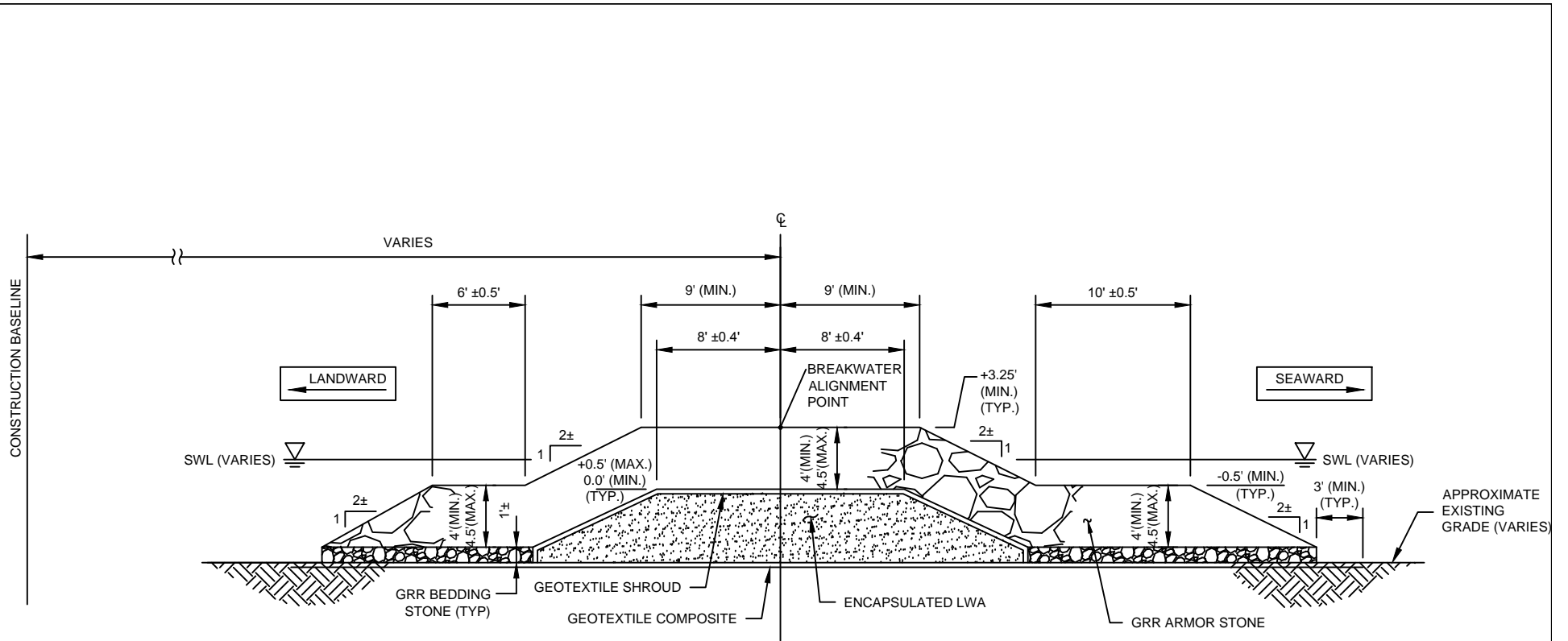
APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER SECTIONS	
DRAWN BY: K. CANTU		DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
			FEDERAL PROJECT NUMBER:	SHEET 3 OF 5



TYPICAL SECTION - BREAKWATER

SCALE: N.T.S.

APPLICATION BY:	<p align="center">COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801</p>	SWCLA	TYPICAL BREAKWATER SECTION
DRAWN BY: K. CANTU		STATE PROJECT NUMBER:	DATE: JULY 2015
DESIGNED BY:	APPROVED BY:	FEDERAL PROJECT NUMBER:	SHEET 4 OF 5



TYPICAL SECTION - BREAKWATER

SCALE: N.T.S.

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL BREAKWATER SECTION
DRAWN BY: K. CANTU	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER: DATE: JULY 2015 FEDERAL PROJECT NUMBER: SHEET 5 OF 5



Annex D

Typical Design Drawings for Foreshore Rock Dike Features

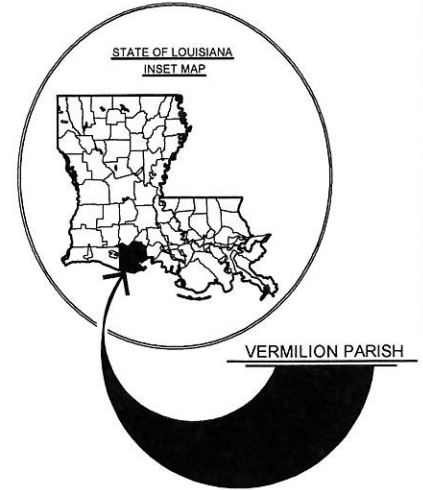
INDEX TO SHEETS

<u>SHEET NO.</u>	<u>DESCRIPTION</u>
1	TITLE SHEET
2	TYPICAL ROCK BREAKWATER PLAN VIEW
3	TYPICAL ROCK DIKE SECTION
4	TYPICAL NAVIGATIONAL GAP AND FISH DIP SECTIONS
5	TYPICAL ROCK DIKE DETAILS
6	TYPICAL NAVIGATIONAL GAP AND FISH DIP DETAILS

STATE OF LOUISIANA
COASTAL PROTECTION AND RESTORATION AUTHORITY

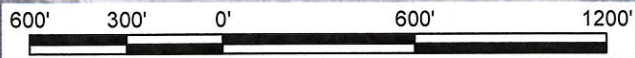
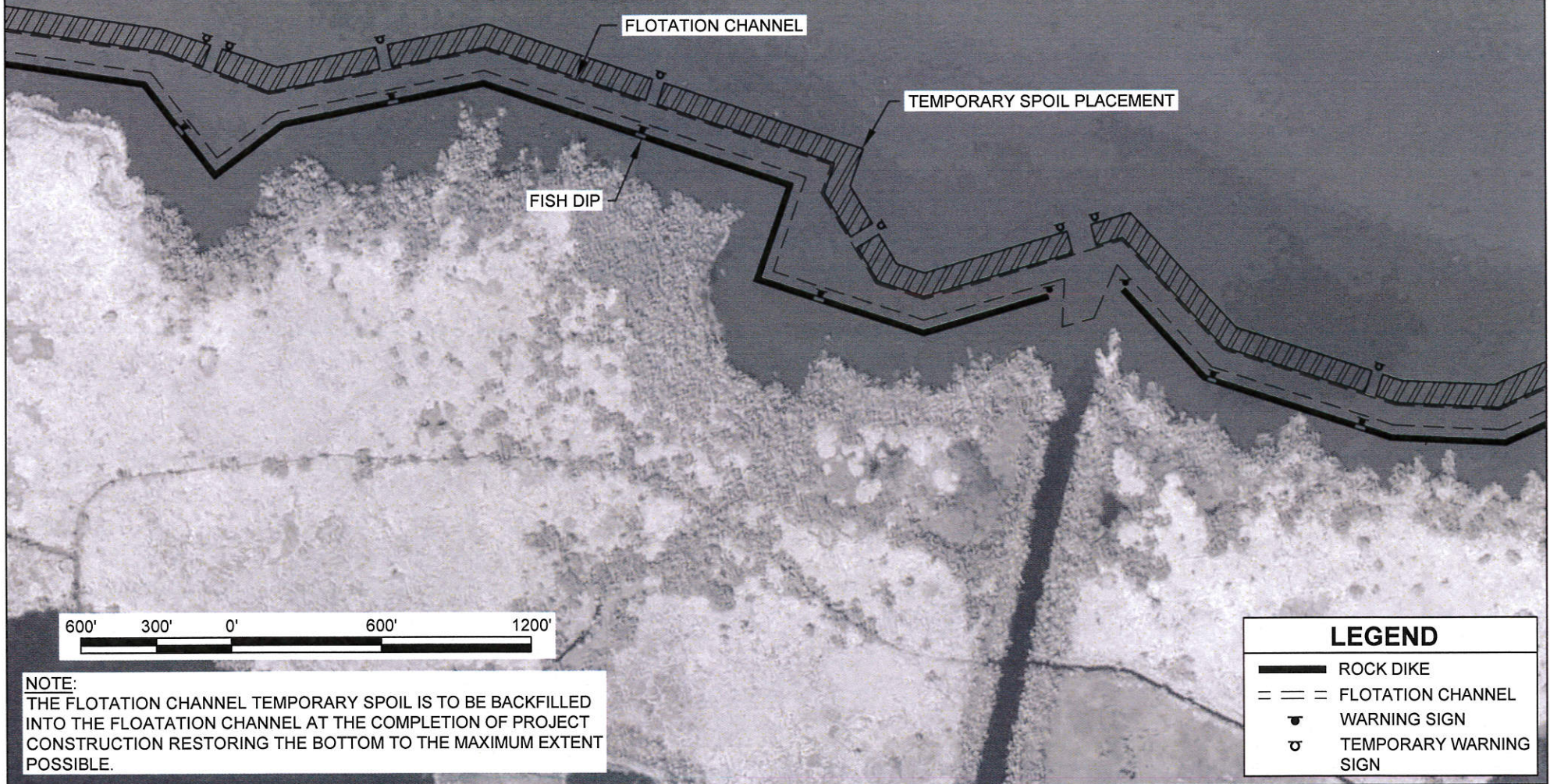
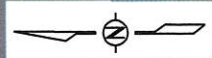
SOUTHWEST COASTAL
LOUISIANA STUDY

VERMILION PARISH



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DOCUMENTS ARE NOT TO BE USED FOR
CONSTRUCTION, BIDDING, RECORDATION,
CONVEYANCE, OR SALES.

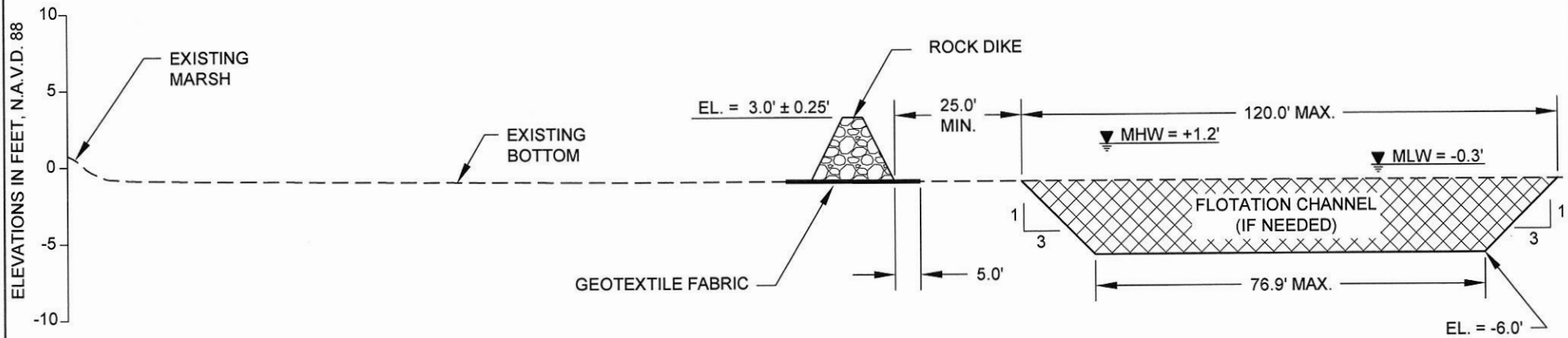
APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TITLE SHEET
		STATE PROJECT NUMBER:	DATE: AUGUST 2015
DRAWN BY: SHANE FAUST	DESIGNED BY:	APPROVED BY:	FEDERAL PROJECT NUMBER:
			SHEET 1 OF 6



NOTE:
 THE FLOTATION CHANNEL TEMPORARY SPOIL IS TO BE BACKFILLED INTO THE FLOTATION CHANNEL AT THE COMPLETION OF PROJECT CONSTRUCTION RESTORING THE BOTTOM TO THE MAXIMUM EXTENT POSSIBLE.

LEGEND	
	ROCK DIKE
	FLOTATION CHANNEL
	WARNING SIGN
	TEMPORARY WARNING SIGN

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL ROCK BREAKWATER PLAN VIEW	
DRAWN BY: SHANE FAUST		DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
			FEDERAL PROJECT NUMBER:	SHEET 2 OF 6

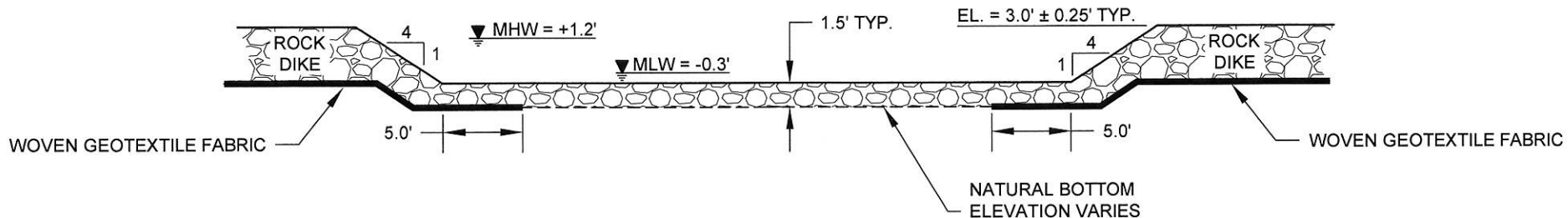


TYPICAL SECTION
ROCK DIKE - NOT TO SCALE

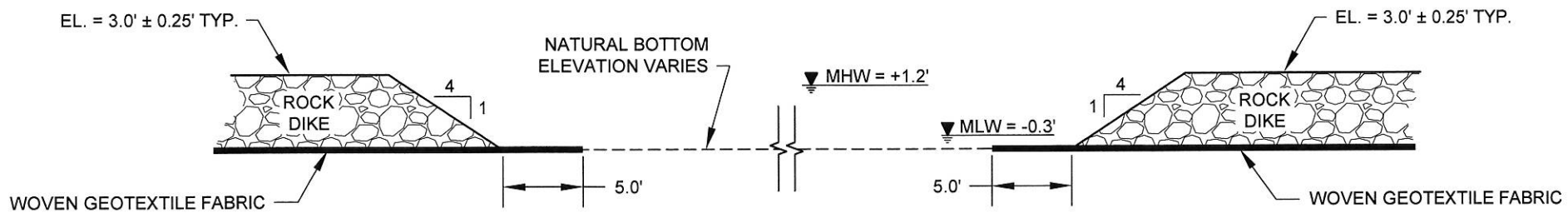
NOTE:
THE FLOTATION CHANNEL TEMPORARY SPOIL IS TO BE BACKFILLED INTO THE FLOTATION CHANNEL AT THE COMPLETION OF PROJECT CONSTRUCTION RESTORING THE BOTTOM TO THE MAXIMUM EXTENT POSSIBLE.

LEGEND	
	ROCK DIKE
	FLOTATION CHANNEL (IF NEEDED)

APPLICATION BY:	LOUISIANA DEPARTMENT OF NATURAL RESOURCES COASTAL ENGINEERING DIVISION 617 NORTH 3RD STREET BATON ROUGE, LOUISIANA 70802	SWCLA	TYPICAL ROCK DIKE SECTION
DRAWN BY: SHANE FAUST		DESIGNED BY:	APPROVED BY:
			DATE: AUGUST 2015
		FEDERAL PROJECT NUMBER:	SHEET 3 OF 6

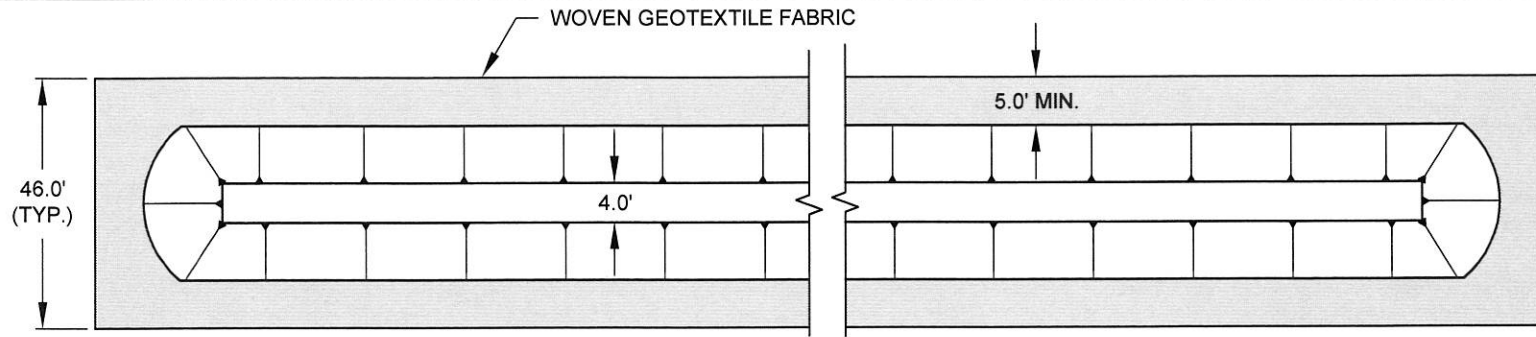


TYPICAL FISH DIP SECTION
NOT TO SCALE

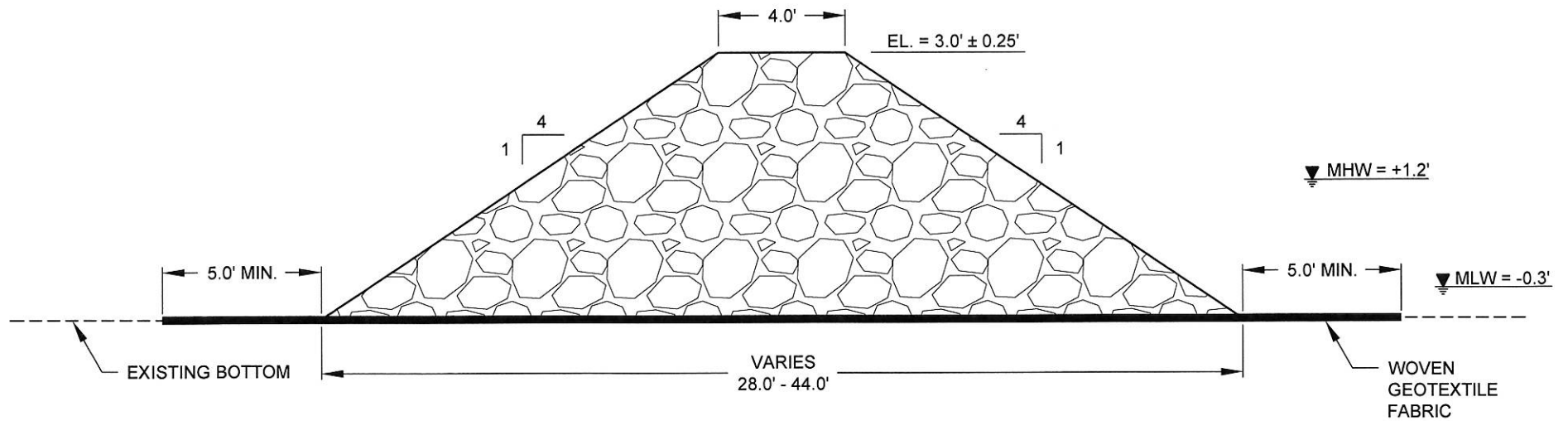


TYPICAL NAVIGATION GAP SECTION
NOT TO SCALE

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL NAVIGATIONAL GAP AND FISH DIP SECTIONS
DRAWN BY: SHANE FAUST	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
		FEDERAL PROJECT NUMBER:	DATE: AUGUST 2015
		SHEET 4 OF 6	

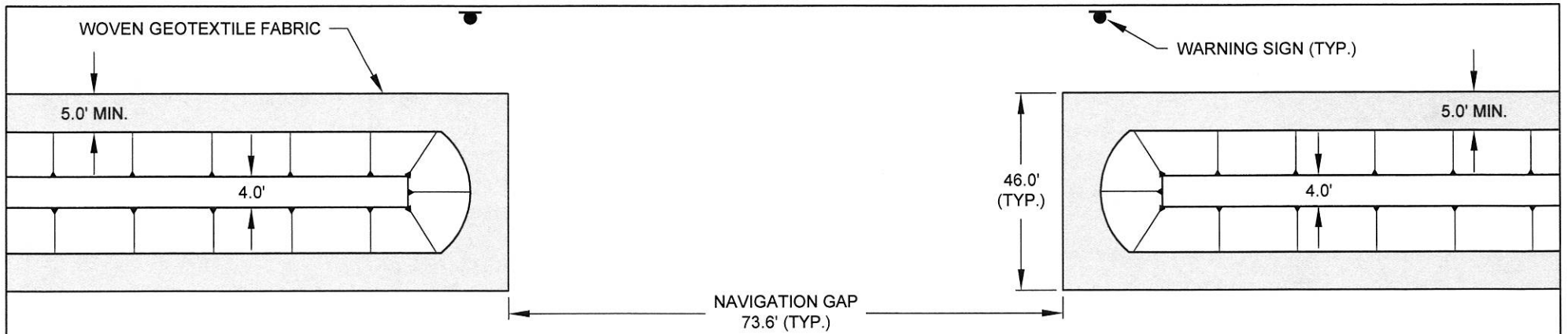


TYPICAL ROCK DIKE
PLAN VIEW - NOT TO SCALE

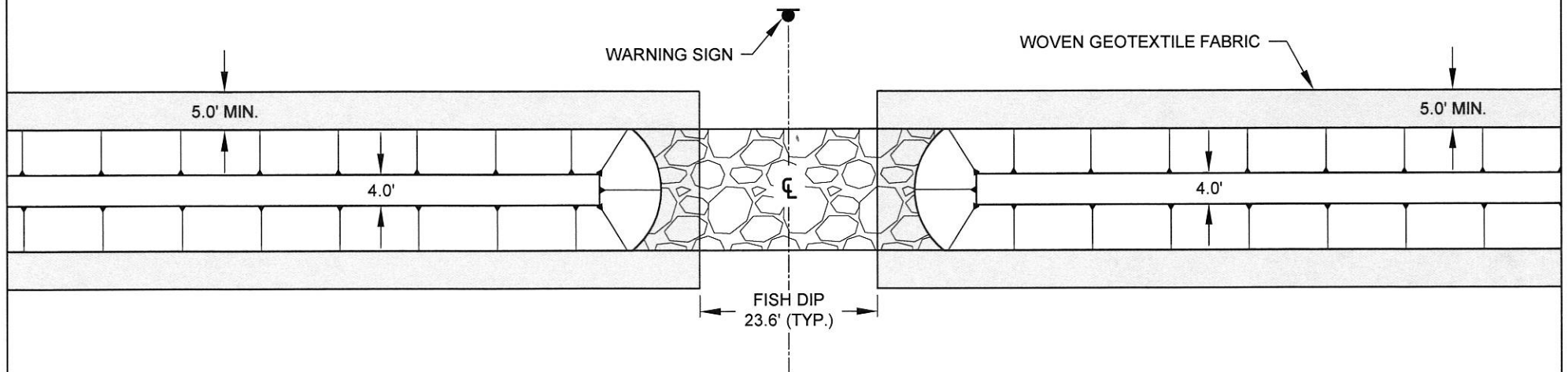


TYPICAL ROCK DIKE
SECTION - NOT TO SCALE

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL ROCK DIKE DETAILS	
DRAWN BY: SHANE FAUST		DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
			FEDERAL PROJECT NUMBER:	SHEET 5 OF 6



TYPICAL NAVIGATION GAP
PLAN VIEW - NOT TO SCALE



TYPICAL FISH DIP
PLAN VIEW - NOT TO SCALE

APPLICATION BY:	COASTAL PROTECTION AND RESTORATION AUTHORITY 450 LAUREL STREET BATON ROUGE, LOUISIANA 70801	SWCLA	TYPICAL NAVIGATIONAL GAP AND FISH DIP DETAILS
DRAWN BY: SHANE FAUST	DESIGNED BY:	APPROVED BY:	STATE PROJECT NUMBER:
		FEDERAL PROJECT NUMBER:	DATE: AUGUST 2015
		SHEET 6 OF 6	