

BUILDING BETTER BARRIER ISLANDS –

CONSTRUCTION CHALLENGES IN COASTAL RESTORATION

The Shell Island Project

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WEDA Gulf Coast Chapter
New Orleans, LA



OUTLINE – SHELL ISLAND RESTORATION

- Background and timeline
- LCA design
- Design challenges and final alternative
- Numerical modeling
- Construction design
- Construction challenges

SHELL ISLAND RESTORATION PROJECT



CONSTRUCTION FUNDING SOURCES

Components:

- Emergency Berm (2010 – CPRA)
- Shell Island East Berm to Barrier (2013 – CPRA)
- Shell Island West NRDA (2016-2017 – CPRA/NMFS)



BARATARIA BASIN BARRIER SHORELINE RESTORATION STUDY (LOUISIANA COASTAL AREA) PROJECT SHELL ISLAND COMPONENT (USACE)

Preferred Alternative:

- Dune crest elevation= +6' NAVD88
 - 50 year project life
 - Beach renourishment every 10 years
 - Marsh renourishment every 20 years
-
- Post-construction shoreline retreat rates anticipated:
 - Western lobe: 35 ft/yr
 - Eastern lobe: 12 ft/yr

SHELL ISLAND DESIGN – BIGGER ISLANDS, BIGGER CHALLENGES

Sediment Source

- Gulf of Mexico
- Mississippi River

MR Borrow Area Locations

- West bank
- East bank (navigation channel crossing)

Marsh Design

- Gulf of Mexico borrow, in-situ primary dike construction
- Uncontained marsh sand flat (existing infrastructure limitations)

Project Life

- 20 years
- 50 years

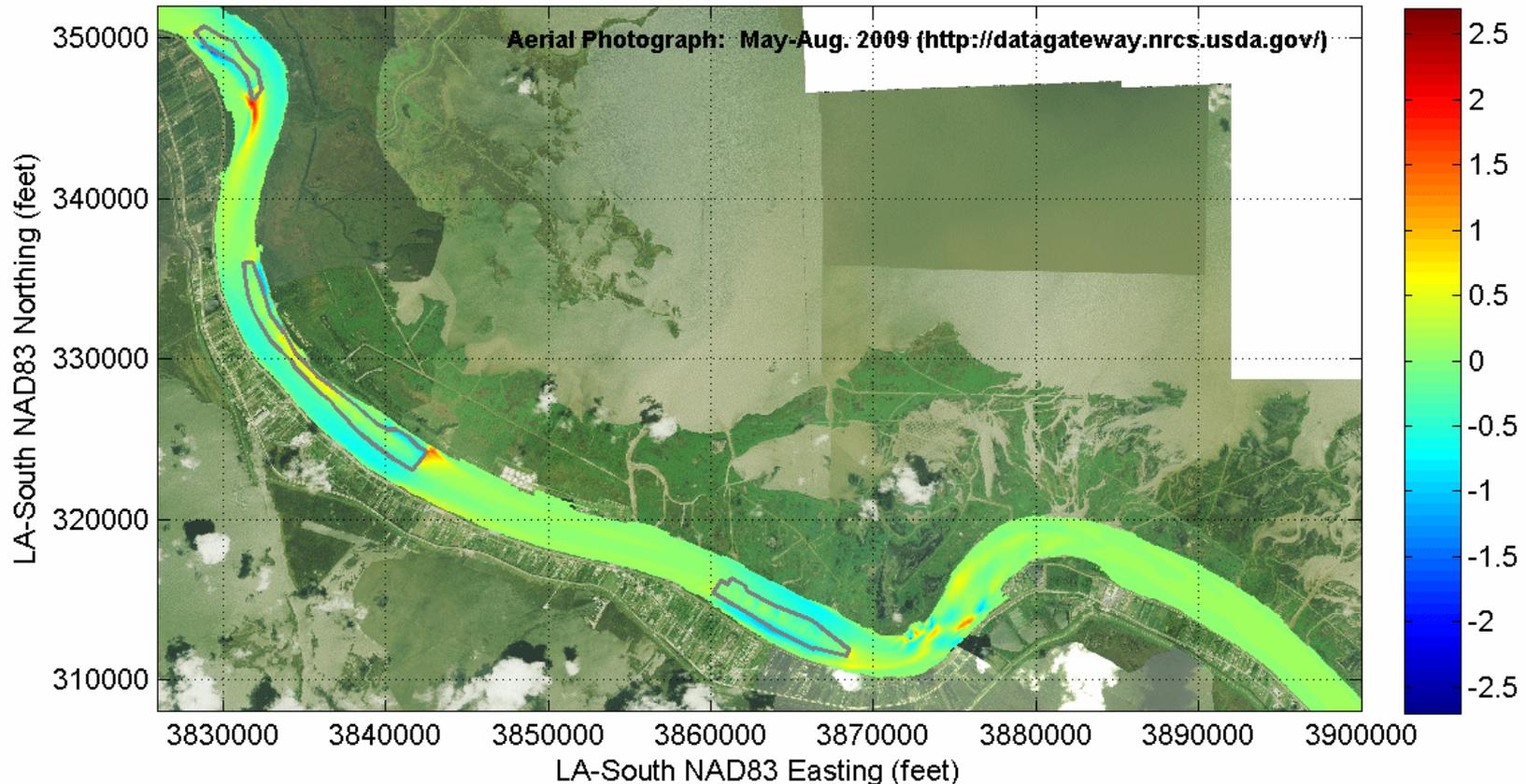
Dune Crest Elevation

- +6' NAVD88
- +8' NAVD88

SHELL ISLAND RESTORATION – NUMERICAL MODELING

Changes in Current Speed (ft/sec)

Change in Current Speed (feet/s) at Year 0 Given Fully Excavated Scenario, Borrow Areas A,B,E Only



Delft3D-FLOW: estimated currents and water levels as well as the resulting sediment transport and bathymetric changes

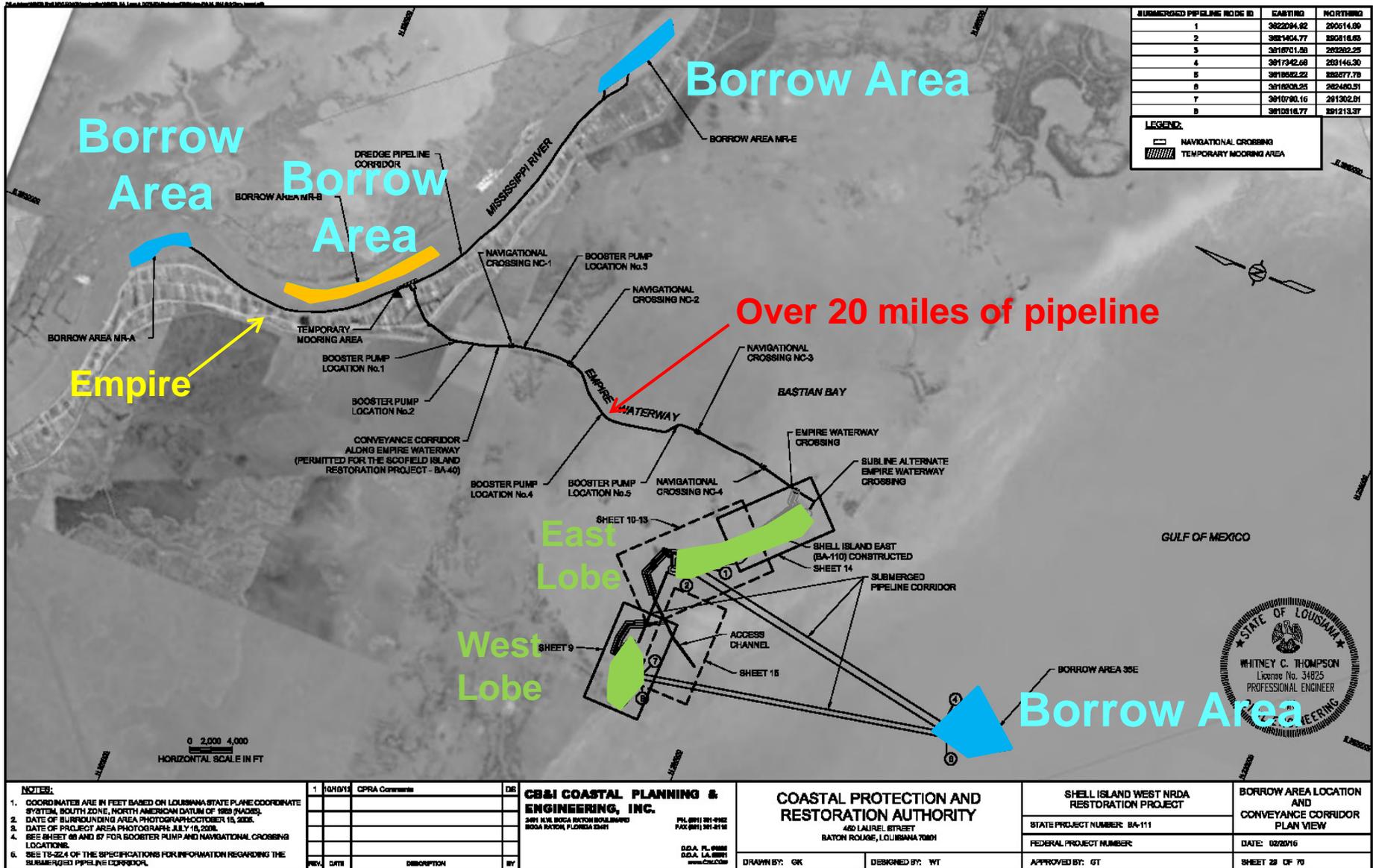
SHELL ISLAND RESTORATION PROJECT



Construction:

- 20 mile sediment pipeline
- 4 booster pumps, including a modified large cutterhead dredge
- Over 5 miles of barrier shoreline restored
- ~10 million cubic yards of fill material dredged
 - Two Mississippi River borrow areas (beach, dune, and marsh)
 - Gulf of Mexico borrow area (marsh)
- 1031 acres of habitat restored
- Approximate \$116,000,000 construction cost

SHELL ISLAND RESTORATION



SUBMERGED PIPELINE NODE ID	EASTING	NORTHING
1	382204.82	20014.00
2	381404.77	20018.85
3	381871.30	20022.25
4	381732.68	20016.30
5	381802.22	20027.70
6	381820.25	20040.51
7	381070.16	20100.81
8	381281.77	20113.37

LEGEND:

	NAVIGATIONAL CROSSING
	TEMPORARY MOORING AREA

NOTES:

- COORDINATES ARE IN FEET BASED ON LOUISIANA STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).
- DATE OF SURROUNDING AREA PHOTOGRAPH: OCTOBER 19, 2005.
- DATE OF PROJECT AREA PHOTOGRAPH: JULY 16, 2008.
- SEE SHEET 68 AND 67 FOR BOOSTER PUMP AND NAVIGATIONAL CROSSING LOCATIONS.
- SEE TS-22.4 OF THE SPECIFICATIONS FOR INFORMATION REGARDING THE SUBMERGED PIPELINE CORRIDOR.

NO.	DATE	DESCRIPTION	BY

CB&I COASTAL PLANNING & ENGINEERING, INC.
 2491 N.W. BOCA RATON BOULEVARD
 BOCA RATON, FLORIDA 33431
 P.O. BOX 381-9982
 PALM BEACH, FLORIDA 33481
 D.D.A. FL 00088
 D.D.A. LA 00091
 www.CB&IE.com

COASTAL PROTECTION AND RESTORATION AUTHORITY
 450 LAUREL STREET
 BATON ROUGE, LOUISIANA 70801

DRAWN BY: GK DESIGNED BY: WT

SHELL ISLAND WEST NRDA RESTORATION PROJECT

STATE PROJECT NUMBER: BA-111
 FEDERAL PROJECT NUMBER:

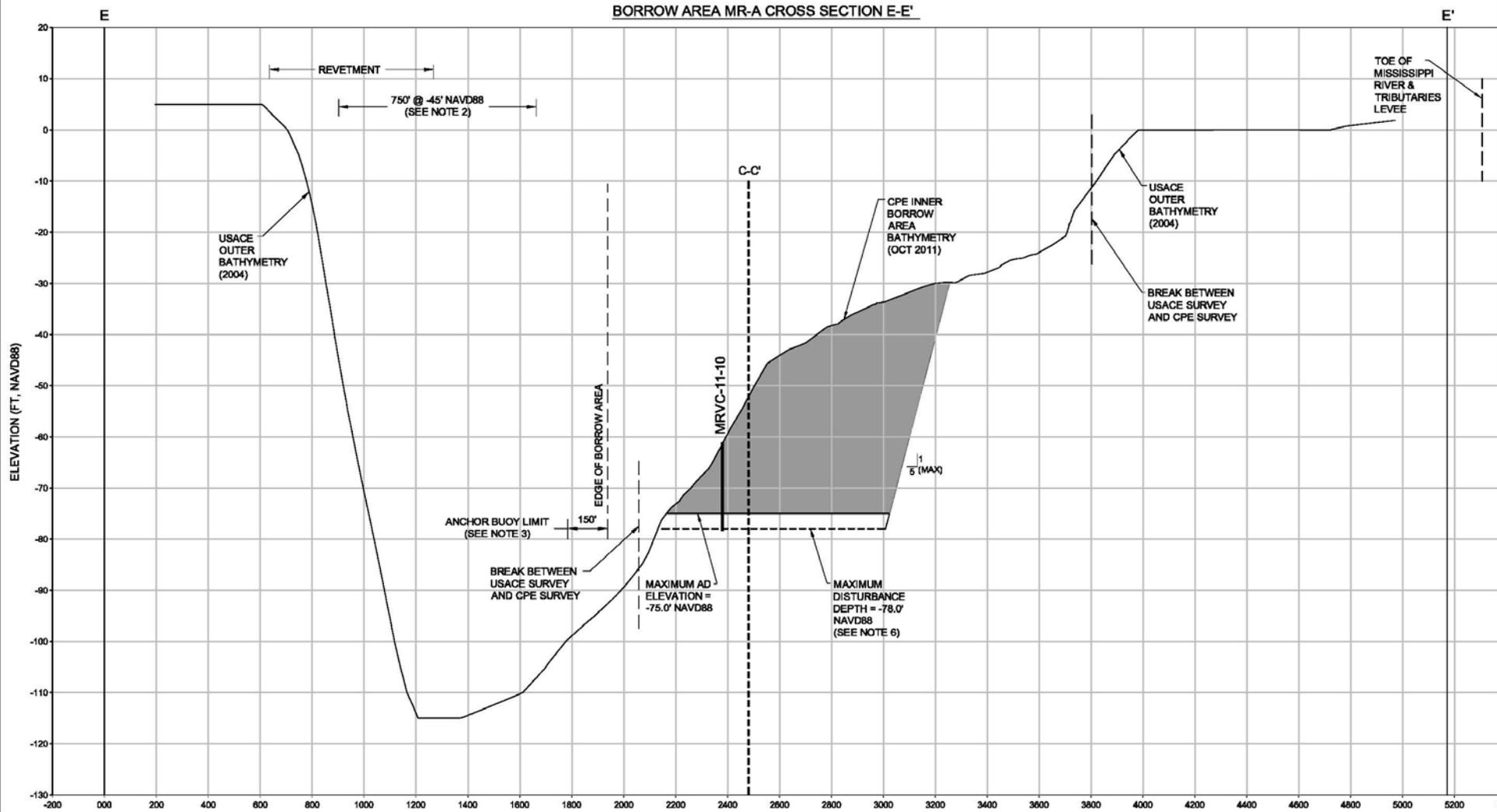
APPROVED BY: GT

BORROW AREA LOCATION AND CONVEYANCE CORRIDOR PLAN VIEW

DATE: 02/20/16
 SHEET 28 OF 70



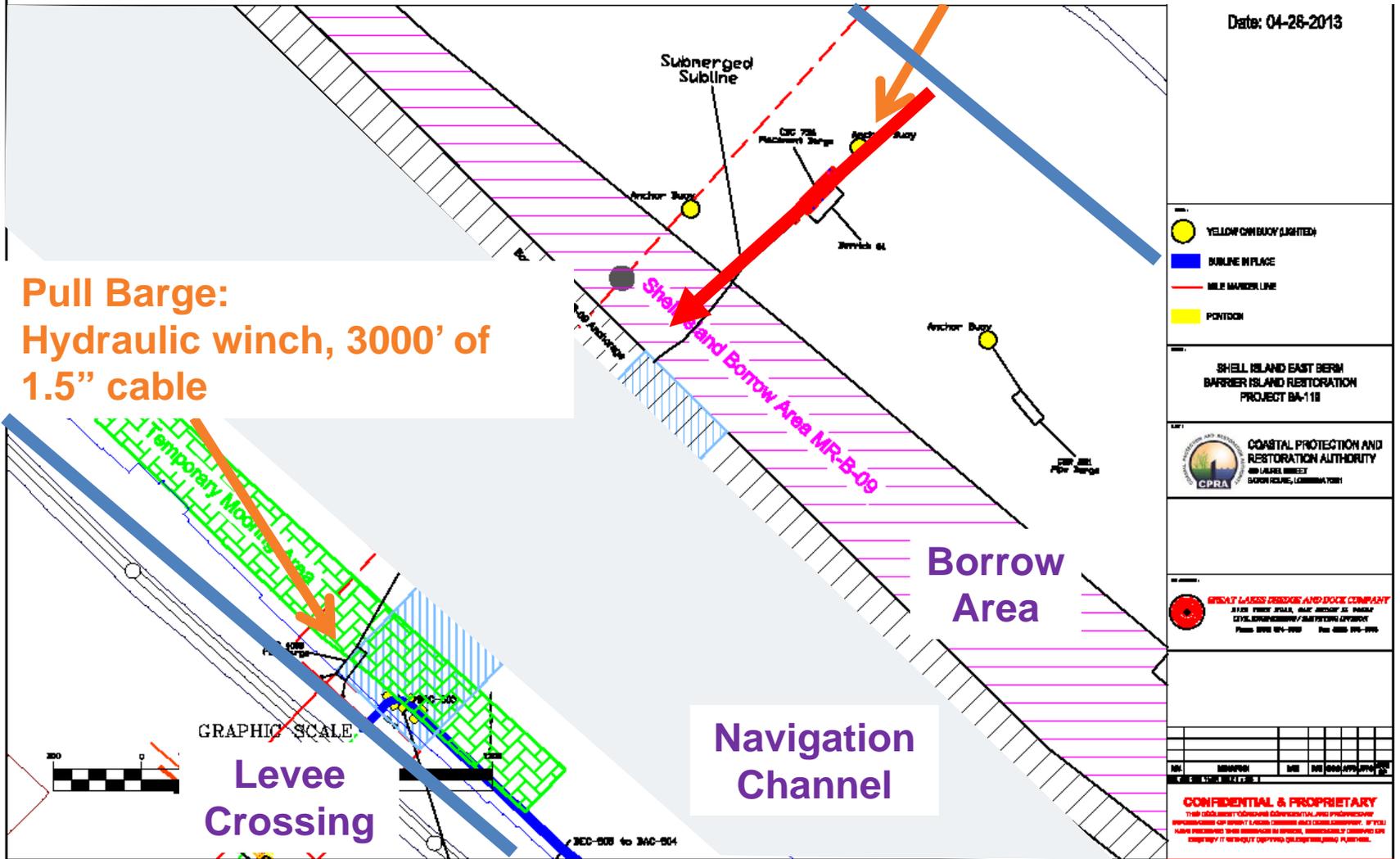
SHELL ISLAND RESTORATION BORROW AREA CROSS SECTION (MR-B)



MISSISSIPPI RIVER PIPE PULL

Launching Platform:
Spud barge (pipe rollers, winches, welding machines)

SHELL ISLAND EAST RESTORATION - SUBLINE CROSSING



MISSISSIPPI RIVER PIPE PULL



MISSISSIPPI RIVER PIPE PULL



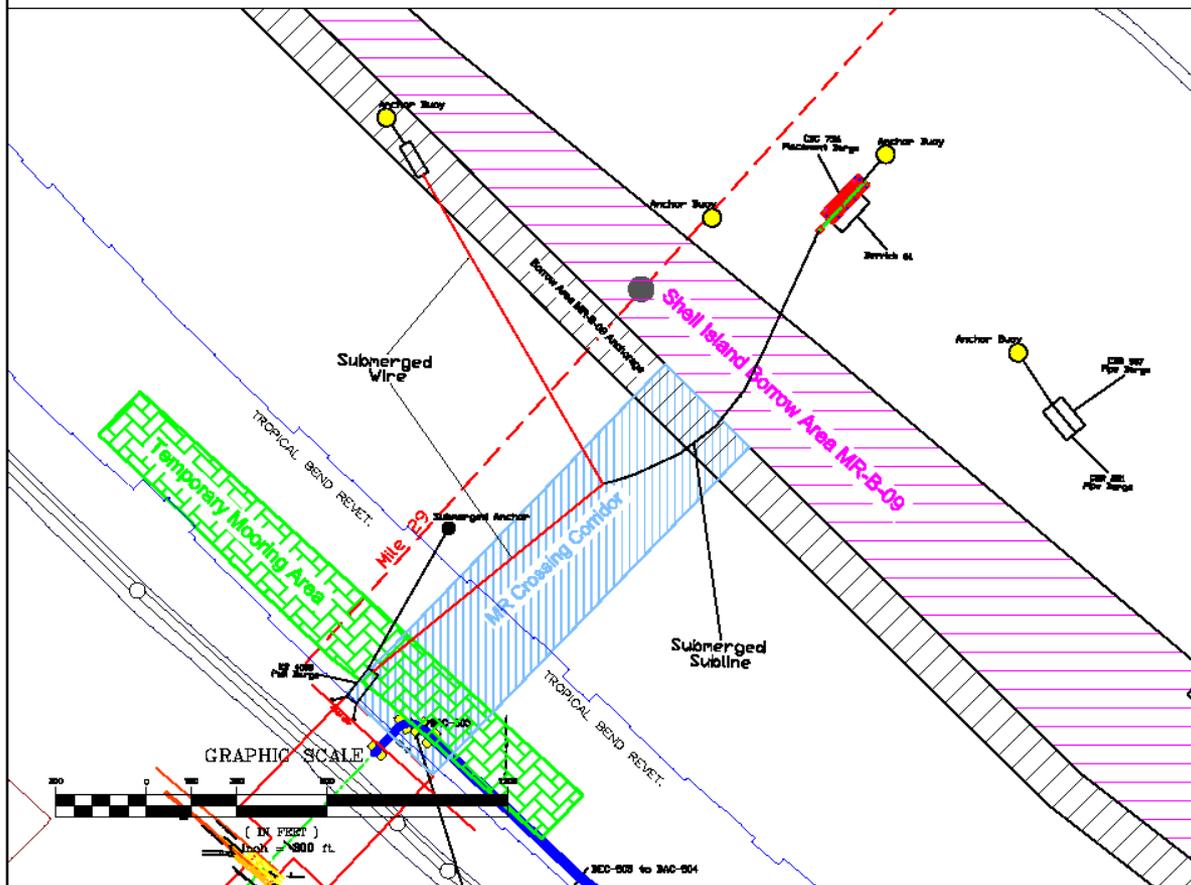
MISSISSIPPI RIVER PIPE PULL



MISSISSIPPI RIVER PIPE PULL

SHELL ISLAND EAST RESTORATION - SUBLINE CROSSING AREA

Date: 04-28-2013



- YELLOW COWBUOY (LIMITED)
- SUBLINE IN PLACE
- MILE MARKER LINE
- PONDION

SHELL ISLAND EAST BERM
BARRIER ISLAND RESTORATION
PROJECT DA-118



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2105 FERRY LANE, SUITE 200, HOUMA, LA 70309
CIVIL ENGINEERING / SURVEYING OFFICE
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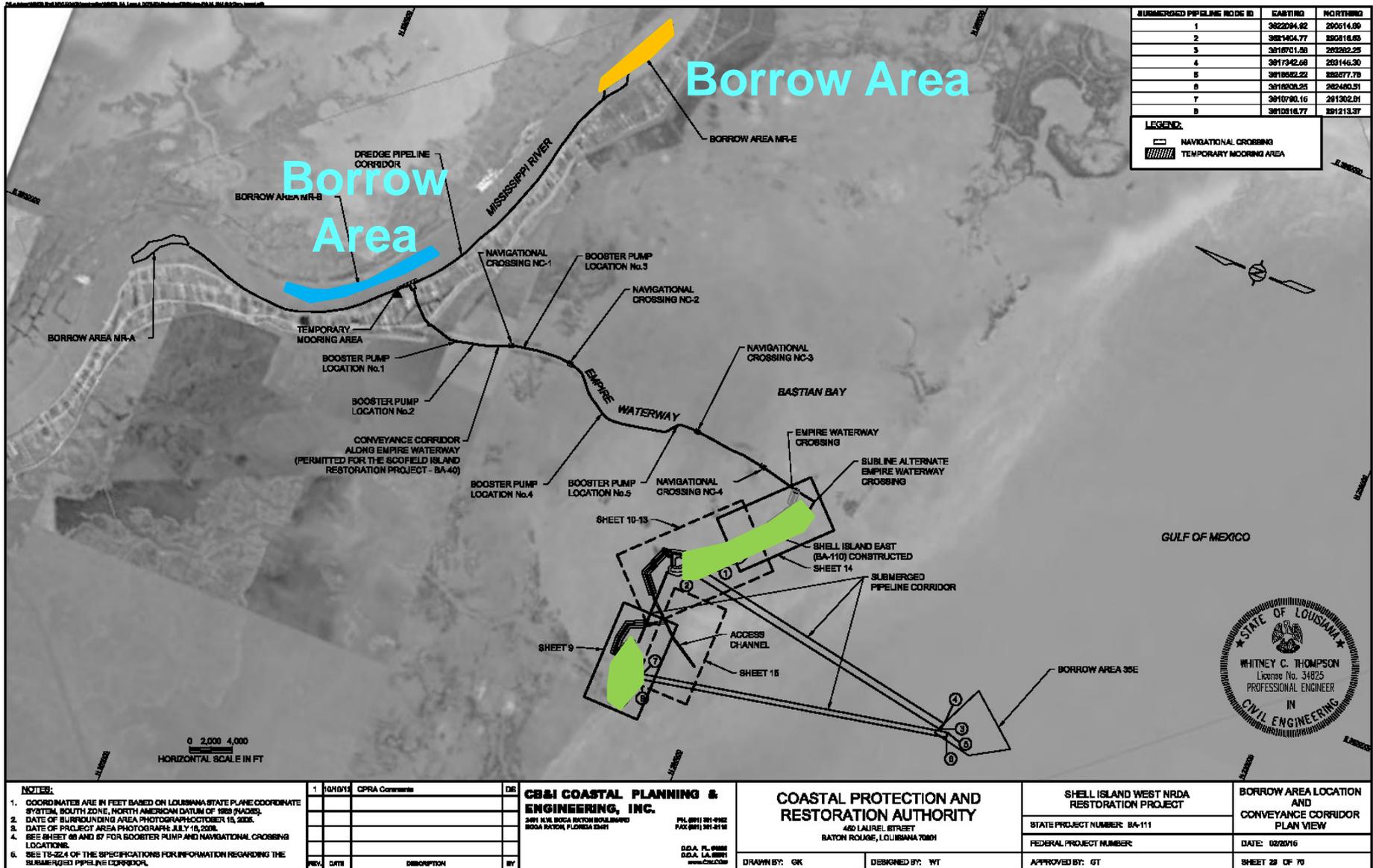
NO.	REVISION	DATE	BY	CHKD	APP'D

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MISSISSIPPI RIVER PIPE PULL



SHELL ISLAND RESTORATION

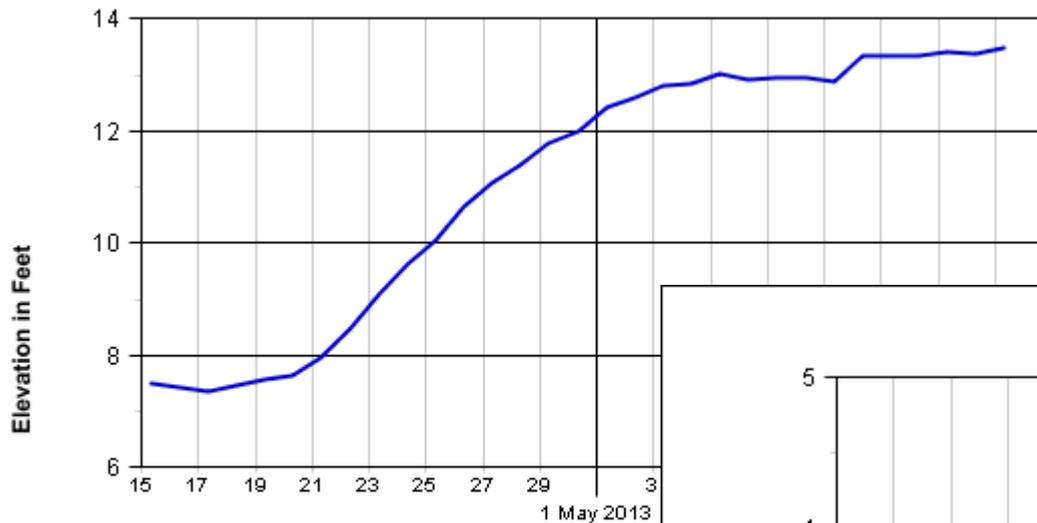


SHELL ISLAND RESTORATION PROJECT



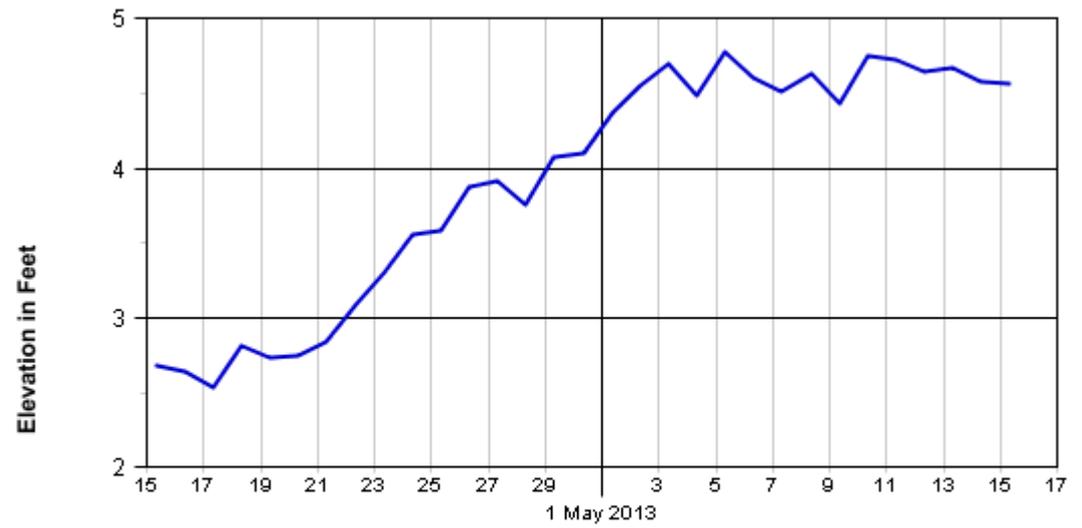
MISSISSIPPI RIVER PIPE PULL SPRING 2013

Mississippi River at New Orleans (Carrollton) (01300)
From 04/15/2013 To 05/15/2013



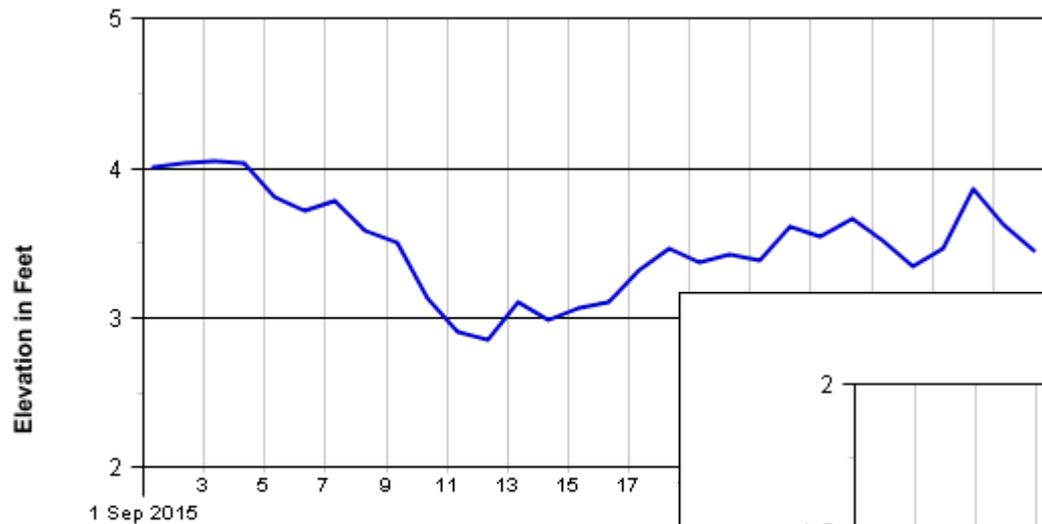
Gage Zero = 0 Ft. Gage

Mississippi River at Empire (01440)
From 04/15/2013 To 05/15/2013



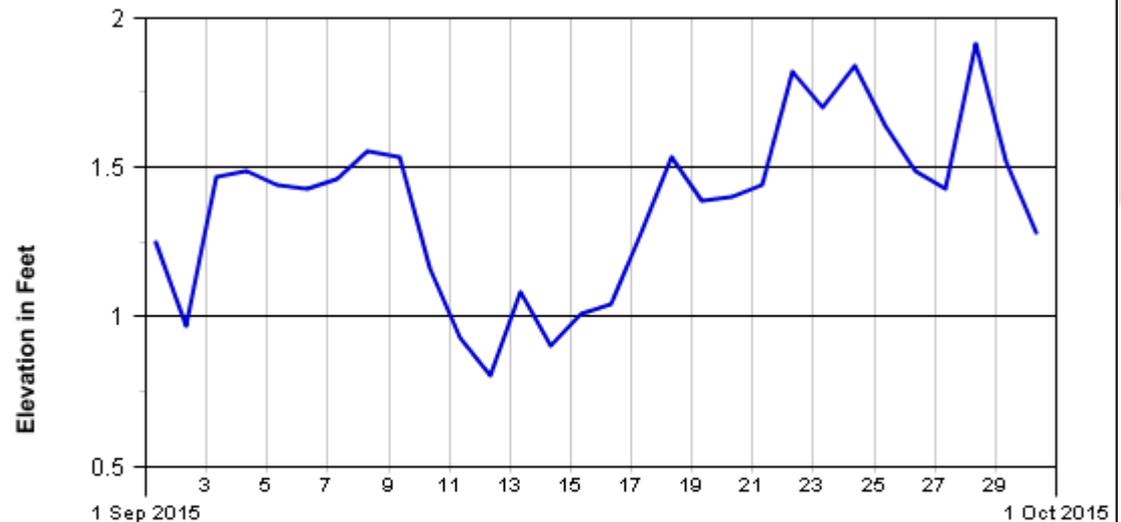
MISSISSIPPI RIVER PIPE PULL FALL 2015

Mississippi River at New Orleans (Carrollton) (01300)
From 09/01/2015 To 09/30/2015



Gage Zero = 0 Ft. Gage

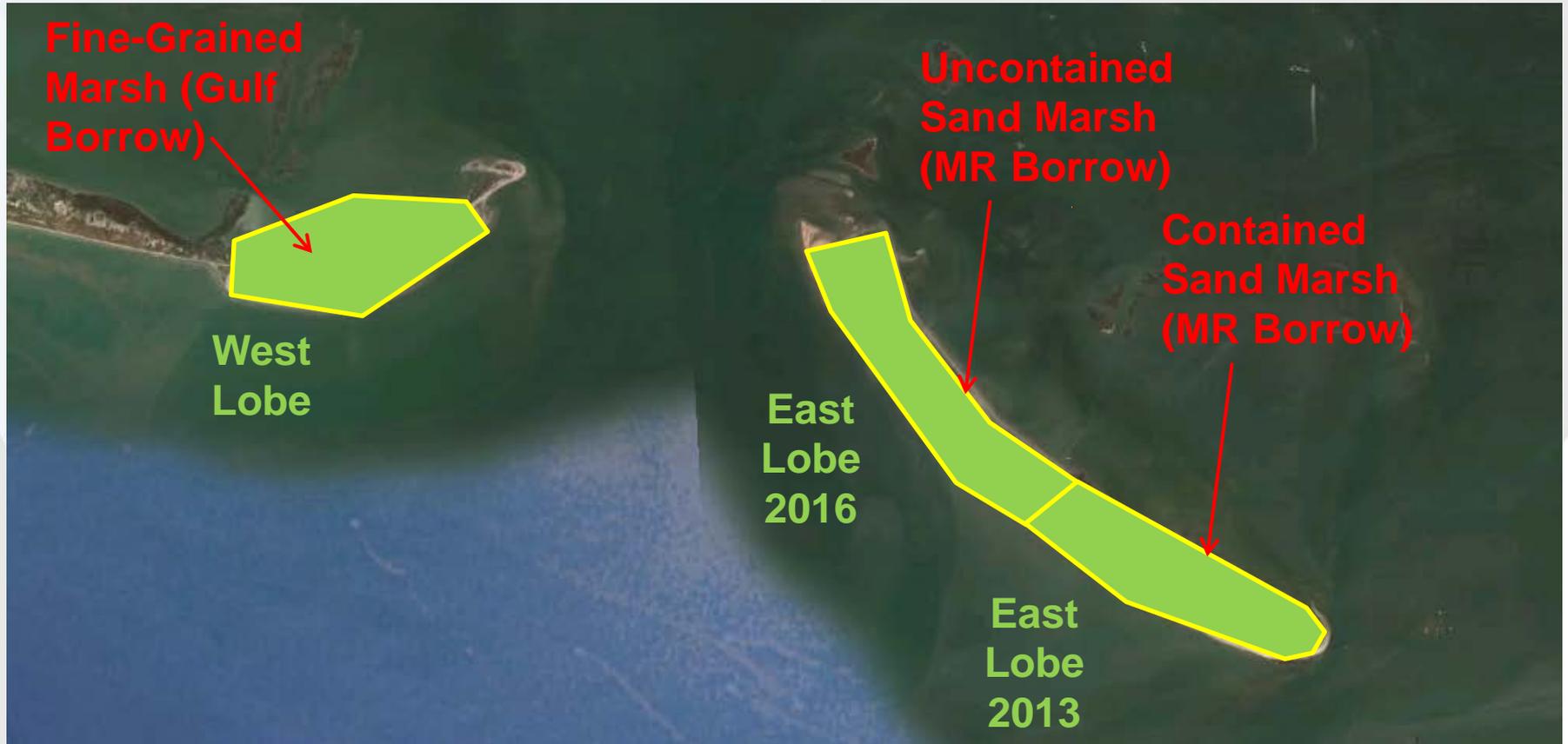
Mississippi River at Empire (01440)
From 09/01/2015 To 09/30/2015



SHELL ISLAND RESTORATION PROJECT – EAST LOBE



SHELL ISLAND RESTORATION PROJECT

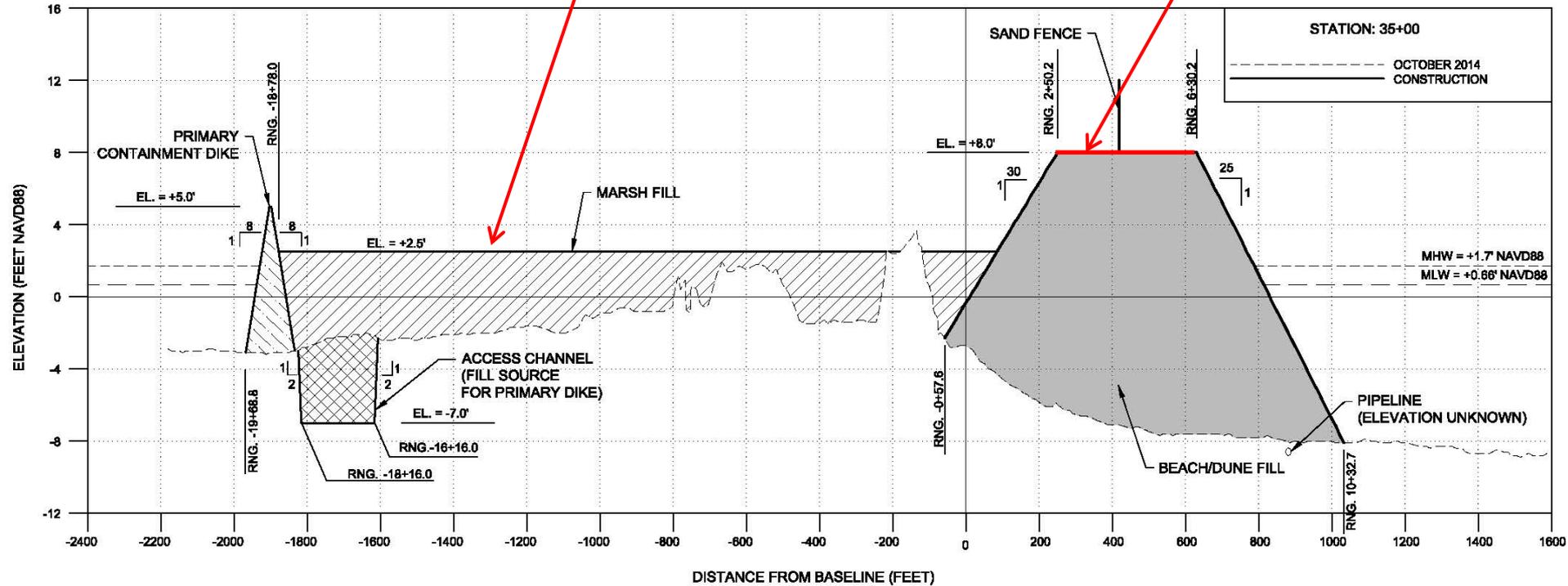


Google Earth, 2016

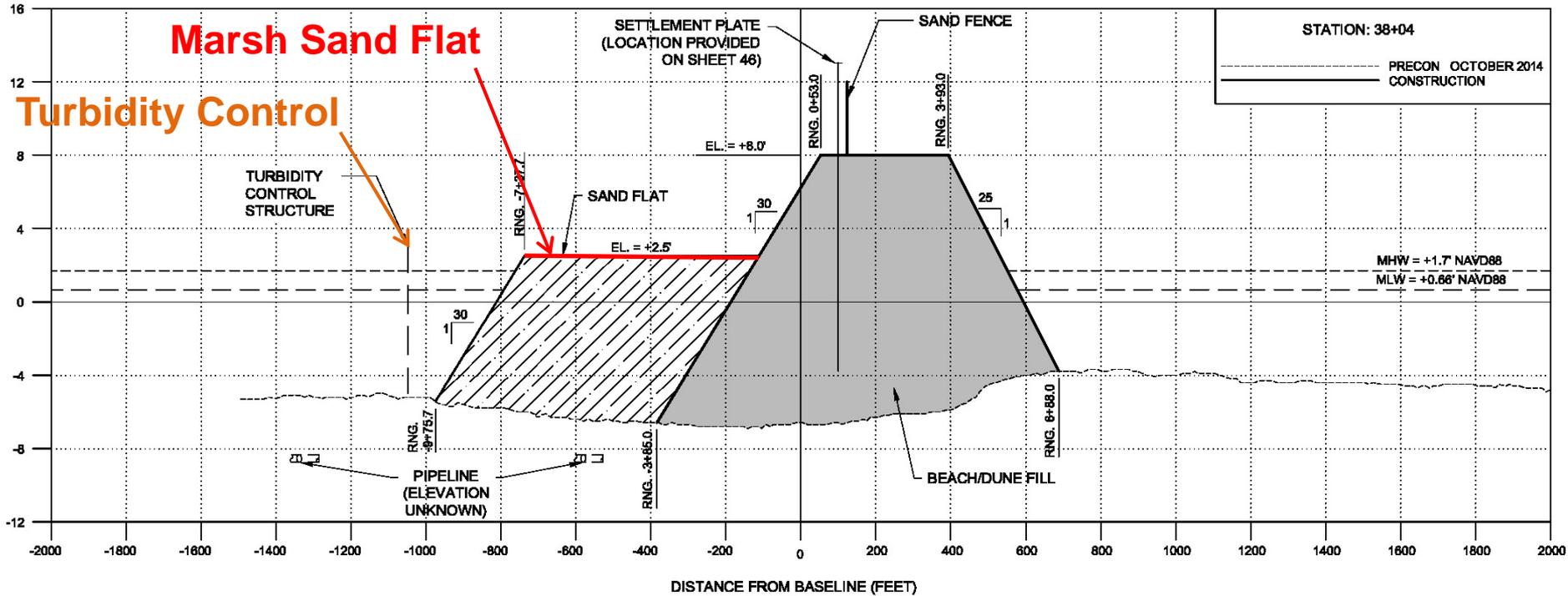
SHELL ISLAND RESTORATION PROJECT – WEST LOBE

**Contained
Gulf of Mexico
Marsh Fill**

**380' Dune Crest
+8' NAVD88**

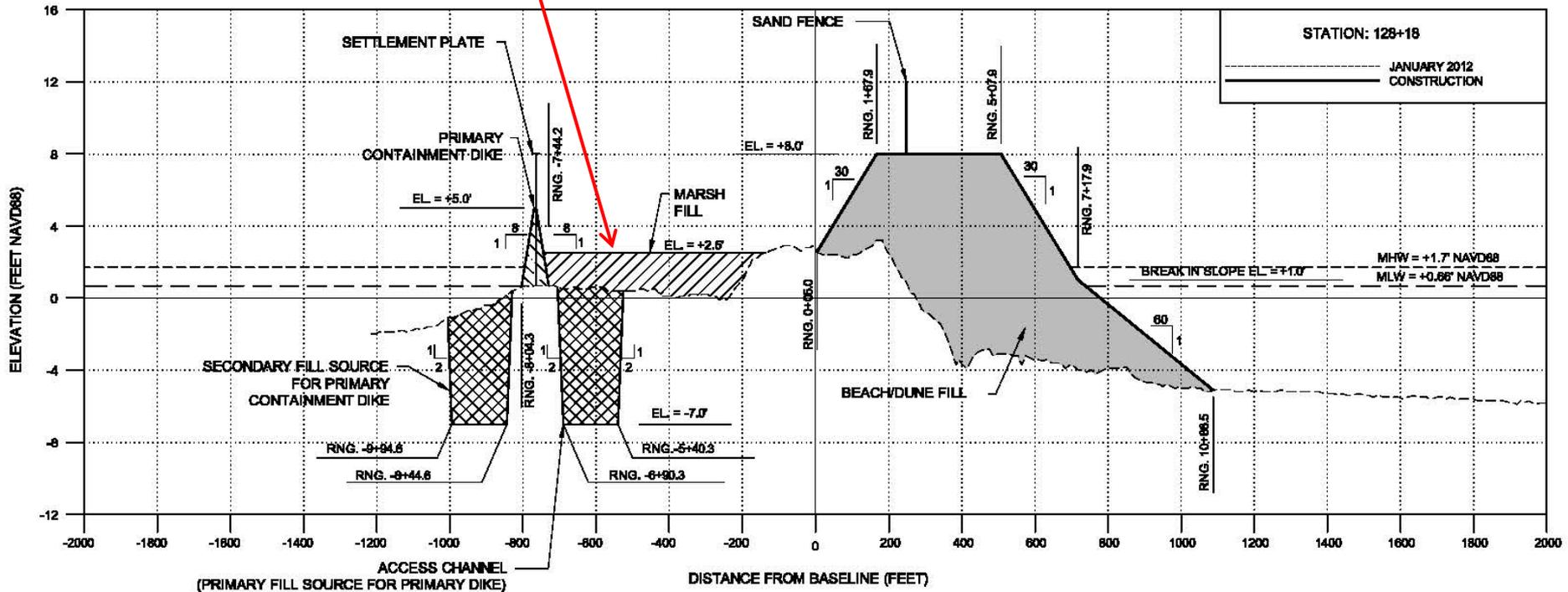


SHELL ISLAND RESTORATION PROJECT – EAST LOBE DUNE AND MARSH SAND FLAT



SHELL ISLAND RESTORATION PROJECT – EAST LOBE DUNE AND CONTAINED MARSH SAND FLAT

**Contained
Sandy Marsh**



SHELL ISLAND RESTORATION PROJECT – EAST LOBE



Credit: Louisiana Coastal Protection and Restoration Authority

SHELL ISLAND RESTORATION PROJECT – WEST LOBE



Credit: Louisiana Coastal Protection and Restoration Authority

SHELL ISLAND RESTORATION PROJECT – WEST LOBE



Credit: Louisiana Coastal Protection and Restoration Authority

THREE DIFFERENT MARSH DESIGN STRATEGIES



**Uncontained Sand Marsh
(Year 2)**

**Contained Sand Marsh
(Year 5)**

THREE DIFFERENT MARSH DESIGN STRATEGIES



**Uncontained
Sand Marsh
(Year 2)**

THREE DIFFERENT MARSH DESIGN STRATEGIES



**Contained Sand Marsh
(Year 5)**

**Uncontained Sand Marsh
(Year 2)**

SUMMARY

- More complex designs
- Larger design, longer project life
- Reduced retreat rates
- Constructability of fine vs. large grained marsh fill

ACKNOWLEDGEMENTS

- Louisiana Coastal Protection and Restoration Authority
- NOAA/NMFS Restoration
- Great Lakes Dredge and Dock

- APTIM Team:
 - Chris Paul, EI
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 - Andy Wycklendt, PE
 - Julien Devisse, PE



THANK YOU!

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