A CASE STUDY ON THE ENGINEERING AND DESIGN OF THE LOST LAKE MARSH CREATION AND HYDROLOGIC RESTORATION PROJECT

FUNDED BY THE COASTAL WETLANDS PLANNING, PROTECTION, RESTORATION ACT

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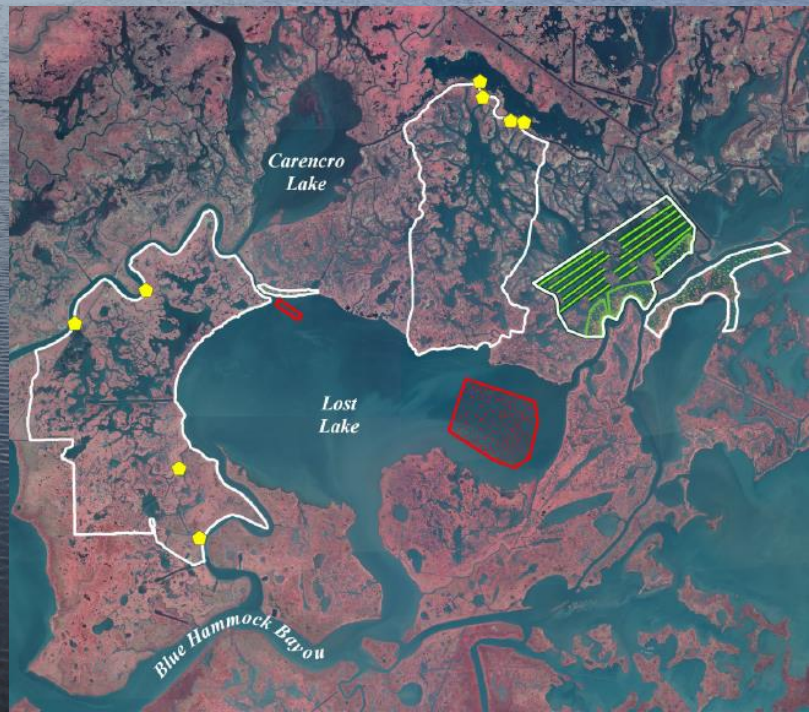
WEDA Dredging Summit and Expo 2015

Project Status

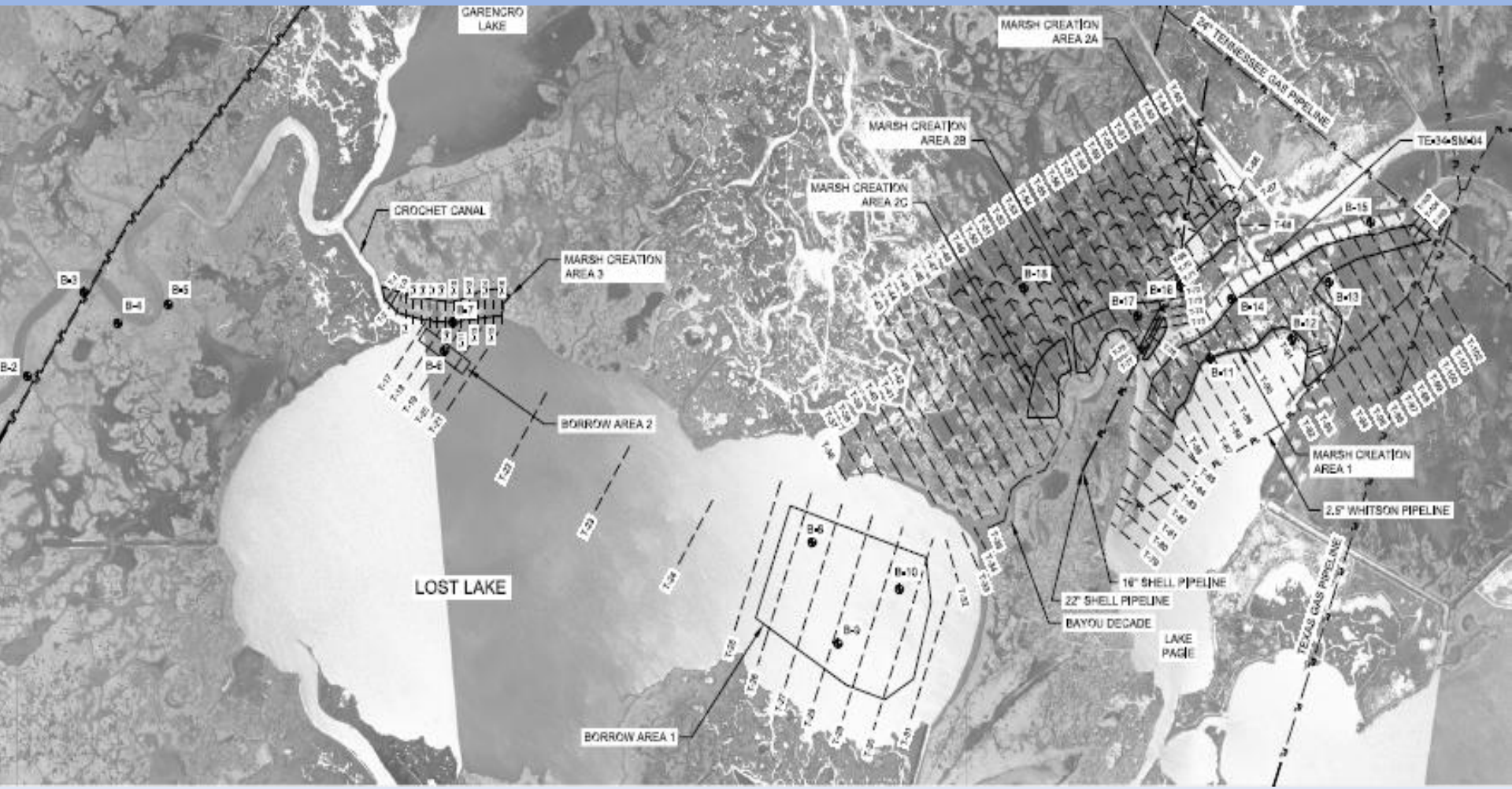
Approved Date: 2010 **Project Area:** 7,312 acres
Approved Funds: $31.4 M **Total Est. Cost:** $34.6 M
Net Benefit After 20 Years: 452 acres
Status: Engineering and Design
Project Type: Marsh Creation
PPL #: 19

Problems

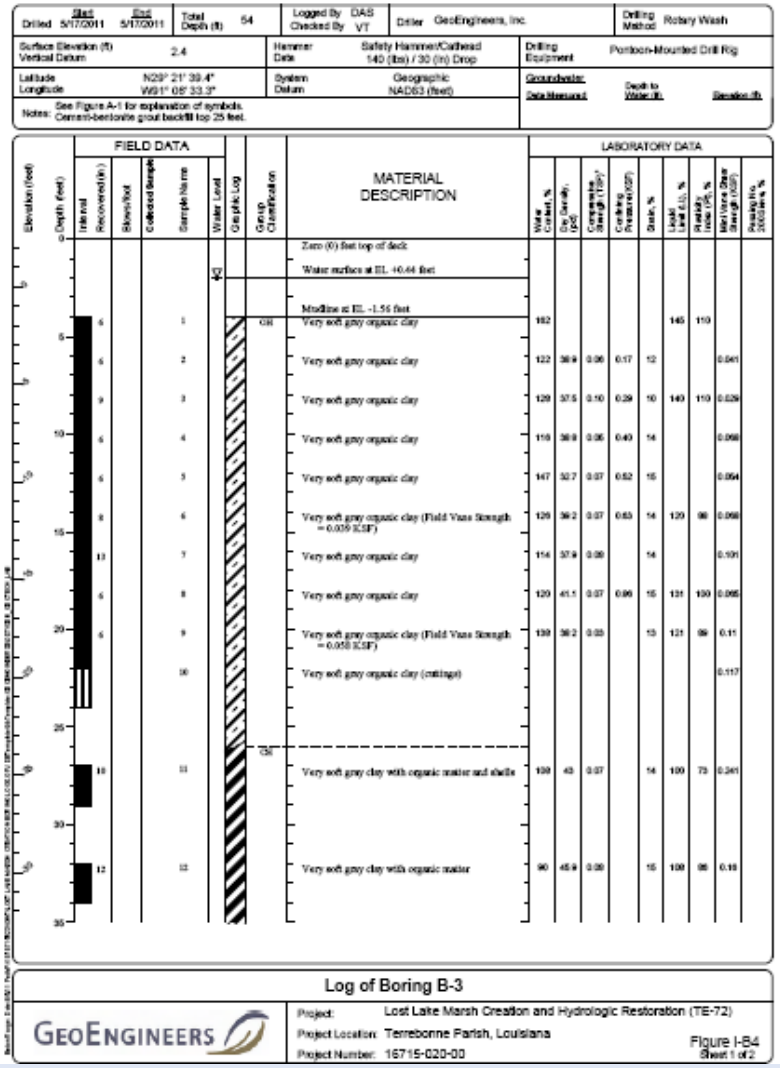
Significant marsh loss has occurred between Lake Pagie and Bayou DeCade to the point that little structural framework remains separating those two waterbodies. Northeast of Lost Lake, interior marsh breakup has resulted in large, interior ponds where wind/wave energy continues to result in marsh loss. West of Lost Lake, interior breakup has occurred as a result of ponding and the periodic entrapment of higher salinity waters during storm events.

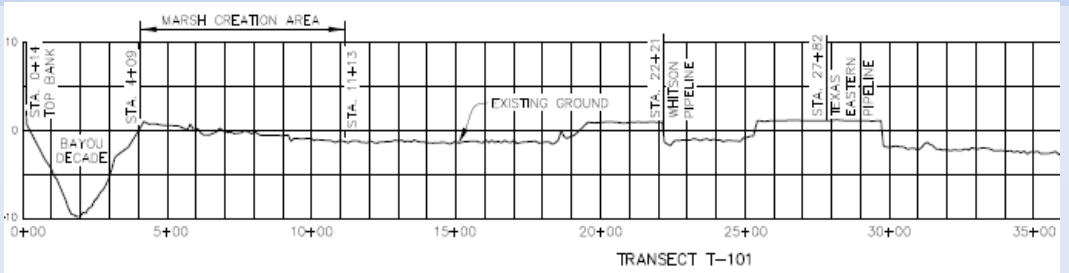


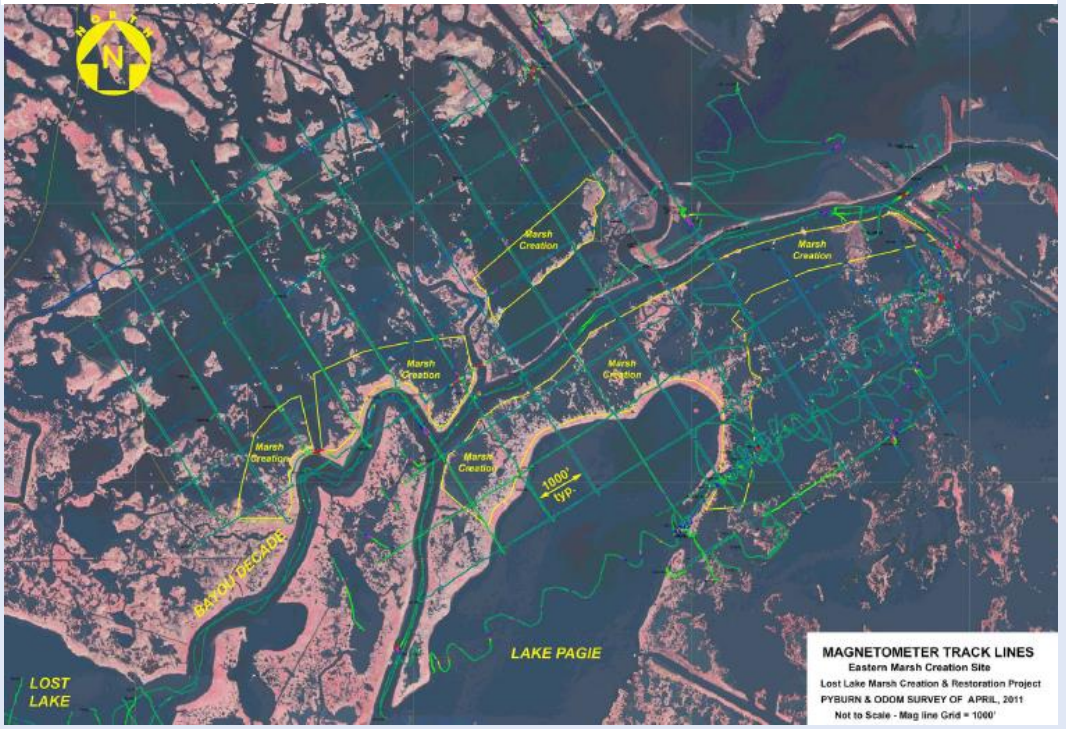
Geotechnical Boring and Survey Layout



Field Data


Log of Boring B-3
GeoEngineers
Project: Lost Lake Marsh Creation and Hydrologic Restoration (TE-72)
Project Location: Terrebonne Parish, Louisiana
Project Number: 16715-020-00
Figure I-B4
Sheet 1 of 2


MARSH CREATION AREA
STA. 0+14 TOP BANK
STA. 1+09
STA. 11+13
STA. 22+21 WHITSON PIPELINE
STA. 27+82 TEXAS EASTERN PIPELINE
BAYOU DECADE
EXISTING GROUND
0+00
5+00
10+00
15+00
20+00
25+00
30+00
35+00
TRANSECT T–101


Marsh Creation
1000' typ.
BAYOU DECADE
LAKE PAGIE
LOST LAKE
MAGNETOMETER TRACK LINES
Eastern Marsh Creation Site
Lost Lake Marsh Creation & Restoration Project
PYBURN & ODOM SURVEY OF APRIL, 2011
Not to Scale - Mag line Grid = 1000'

Tidal Datum

Using the Modified Range Ratio Method (NOAA 2003)

Tidal Datum Calculations (USGS Gage 0738165067)	FT NAVD88
MHW_C= 19 Year Mean High Water At Control Station	1.38
MTL_C= 19 Year Mean Tide Level At Control Station	0.83
MLW_C= 19 Year Mean Low Water At Control Station	0.29
MR_C= 19 Year Mean Tide Range At Control Station	1.09
TL_C= Mean Tide Level For The Observation Period At Control Station	0.88
R_C= Mean Tide Range For The Observation Period At Control Station	1.04
TL_S= Mean Tide Level For The Observation Period At Subordinate Station	0.90
R_S= Mean Tide Range For The Observation Period At Subordinate Station	1.12

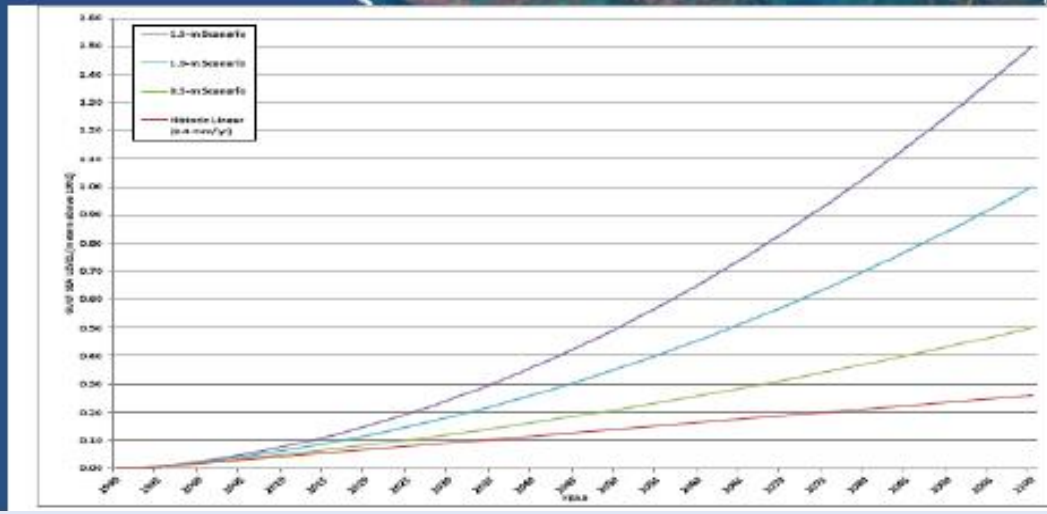
Existing healthy marsh at +1.14 Ft. NAVD88

Relative Sea Level Rise

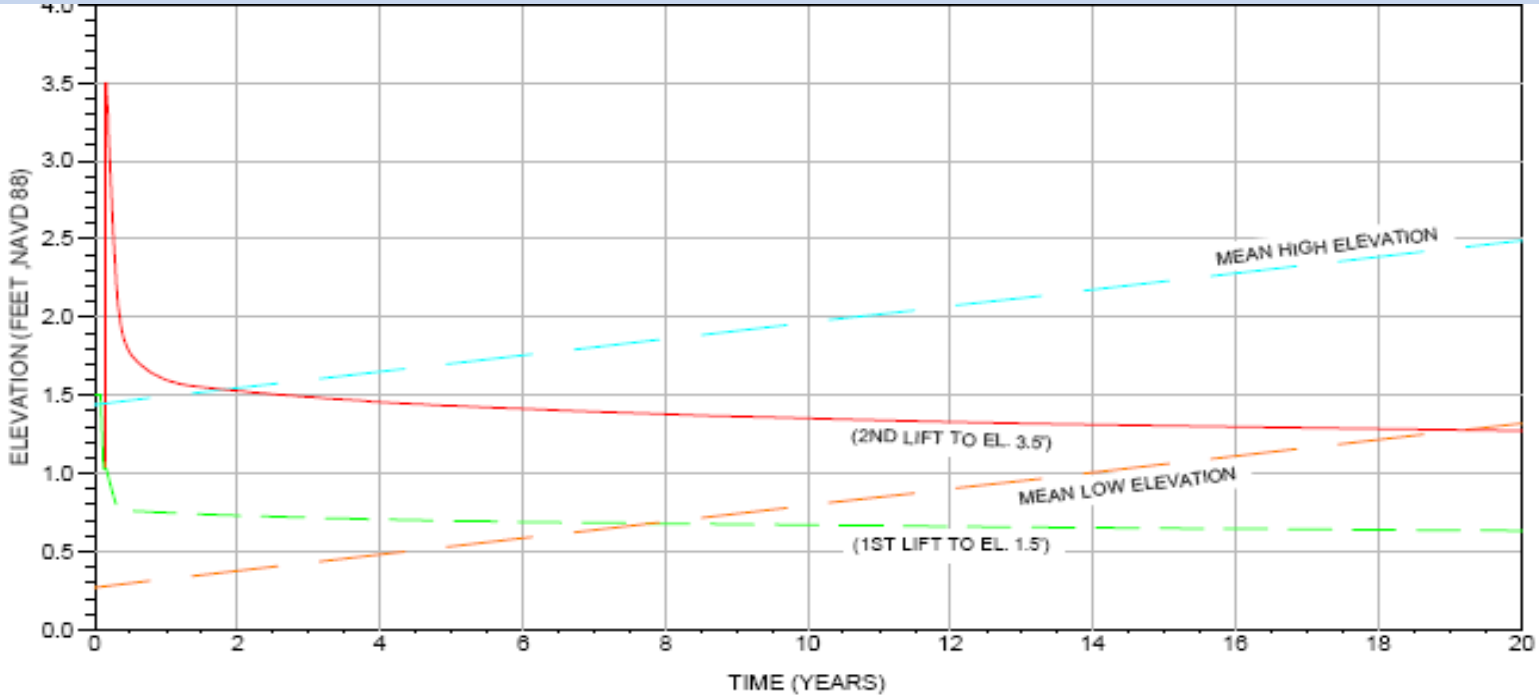
(DeMarco et. al. 2012)

Subsidence Ranges
(2012 Master Plan)

- 1, 0 mm/yr
- 2, 2-5 mm/yr
- 3, 2-9 mm/yr
- 4, 2-10 mm/yr
- 5, 2-35 mm/yr
- 6, 3-35 mm/yr
- 7, 2-35 mm/yr
- 8, 2-35 mm/yr
- 9, 6-35 mm/yr
- 10, 6-25 mm/yr
- 11, 3-10 mm/yr
- 12, 15-35 mm/yr
- 13, 6-20 mm/yr
- 14, 3-10 mm/yr
- 15, 1-15 mm/yr
- 16, -3 - -2 mm/yr (Salt Domes)
- 17, 1-6 mm/yr (S.W. Polders)



Combined Settlement of Marsh Fill Self Weight and Subgrade



ELEVATION (FEET, NAVD 88)								
	0 DAYS	60 DAYS	6 MONTHS	1 YEAR	5 YEARS	10 YEARS	20 YEARS	LONG TERM
1ST LIFT	1.50	1.02	0.76	0.75	0.70	0.66	0.63	0.59
2ND LIFT		3.50	1.73	1.58	1.43	1.34	1.26	1.16

SETTLEMENT
ELEVATION VS. TIME (B-7)

Lost Lake Marsh Creation and Hydrologic Restoration Project (TE-72)
Terrebonne Parish, Louisiana

GeoEngineers

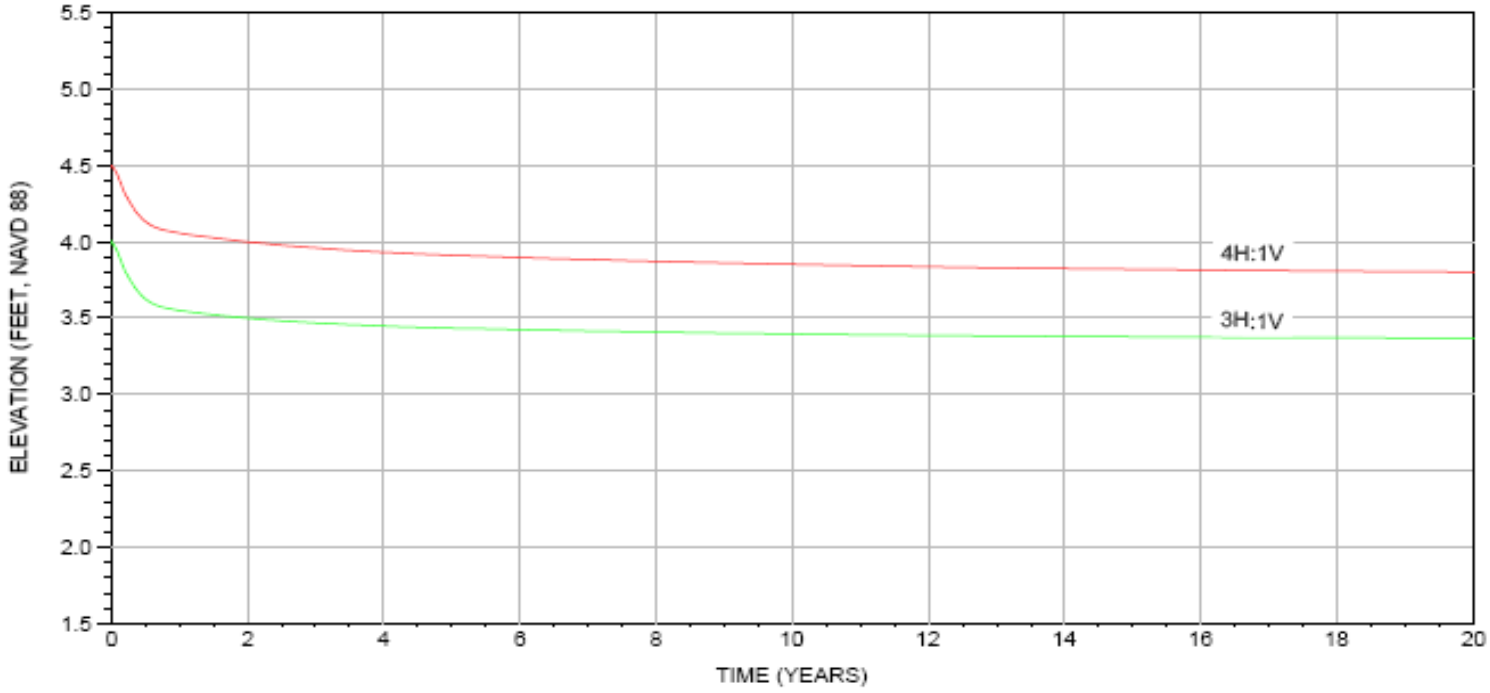
Figure 1

Marsh Construction Fill Elevations

Marsh Creation Area	Construction Marsh Fill Elevation (Feet NAVD 88)		Vertical Tolerance (Inches)
	Lift 1	Lift 2	
1	+1.5 (Maximum)	+3.5 (Maximum)	-6.0
2A	+1.5 (Maximum)	+3.5 (Maximum)	-6.0
2B	+1.5 (Maximum)	+3.5 (Maximum)	-6.0
2C	+1.5 (Maximum)	+3.5 (Maximum)	-6.0
3	+2.5 (Maximum)	N/A	-6.0

Earthen Containment Dike Settlement

One Dimensional Consolidation Theory



ELEVATION (FEET, NAVD 88)								
RATIO	0 DAYS	6 MONTHS	1 YEAR	2 YEAR	5 YEAR	10 YEAR	20 YEAR	LONG TERM
4H:1V	4.5	4.10	4.05	4.00	3.91	3.84	3.80	3.78
3H:1V	4.0	3.59	3.55	3.50	3.43	3.39	3.37	3.36

CONTAINMENT DIKE SETTLEMENT
ELEVATION VS. TIME (B-13)

Lost Lake Marsh Creation and Hydrologic Restoration Project (TE-72)
Terrebonne Parish, Louisiana

GeoEngineers

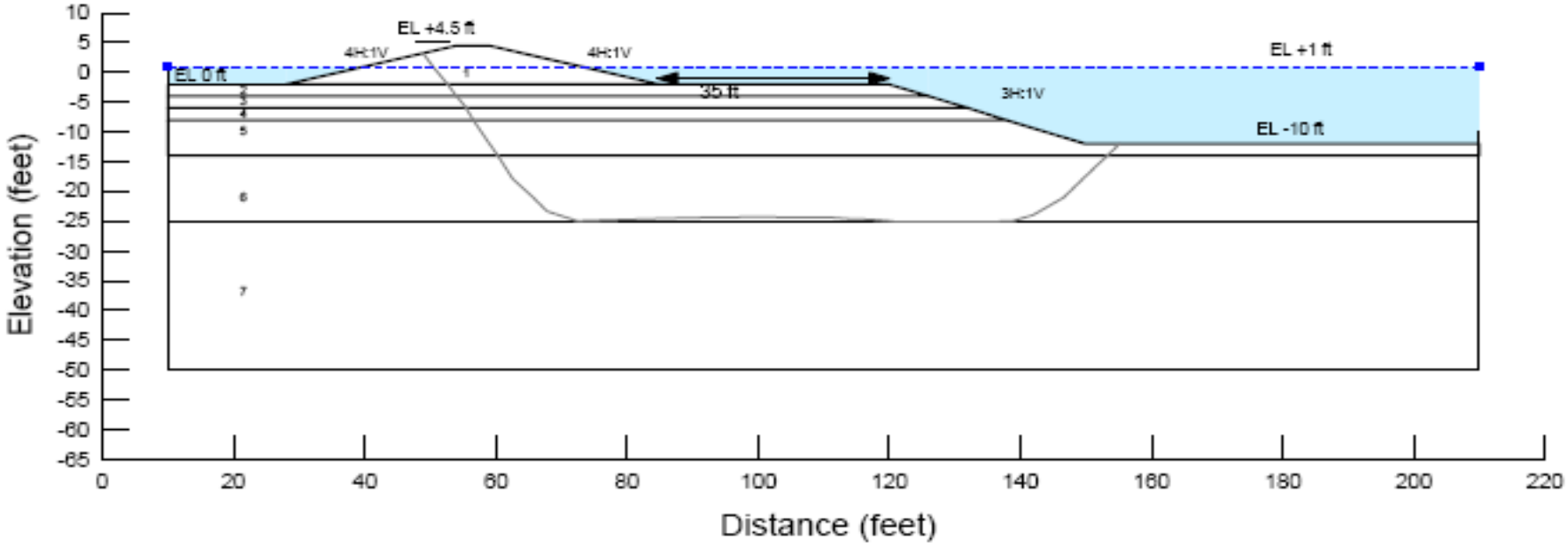
Figure II-B14

Slope Stability of Containment Dikes and Terraces

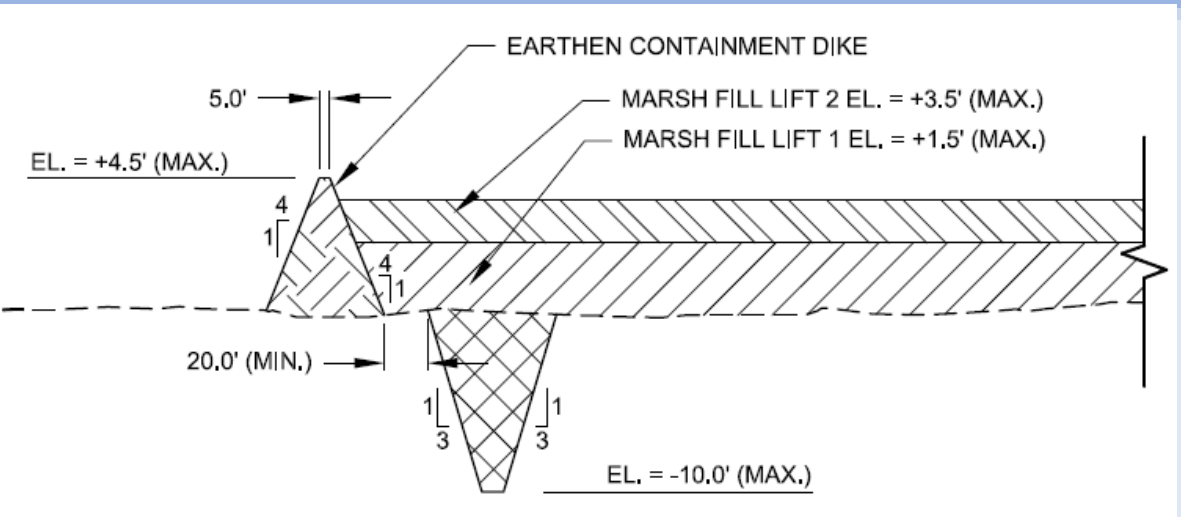
Spencer's Method

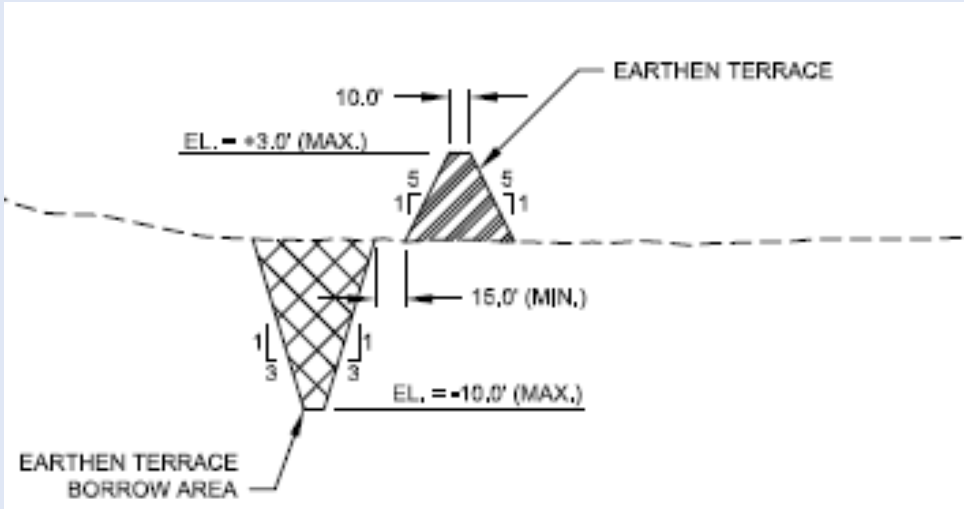
Name: 1. Containment Dike Fill Unit Weight: 85 pcf Cohesion': 60 psf Phi': 0 °
Name: 2. Clay-1 Unit Weight: 105 pcf Cohesion': 370 psf Phi': 0 °
Name: 3. OL-1 Unit Weight: 80 pcf Cohesion': 110 psf Phi': 0 °
Name: 4. Peat Unit Weight: 80 pcf Cohesion': 110 psf Phi': 0 °
Name: 5. Clay - 2 Unit Weight: 92 pcf Cohesion': 80 psf Phi': 0 °
Name: 6. Clay -3 Unit Weight: 92 pcf Cohesion': 80 psf Phi': 0 °
Name: 7. Clay - 4 Unit Weight: 92 pcf Cohesion': 170 psf Phi': 0 °

FOS: 1.16

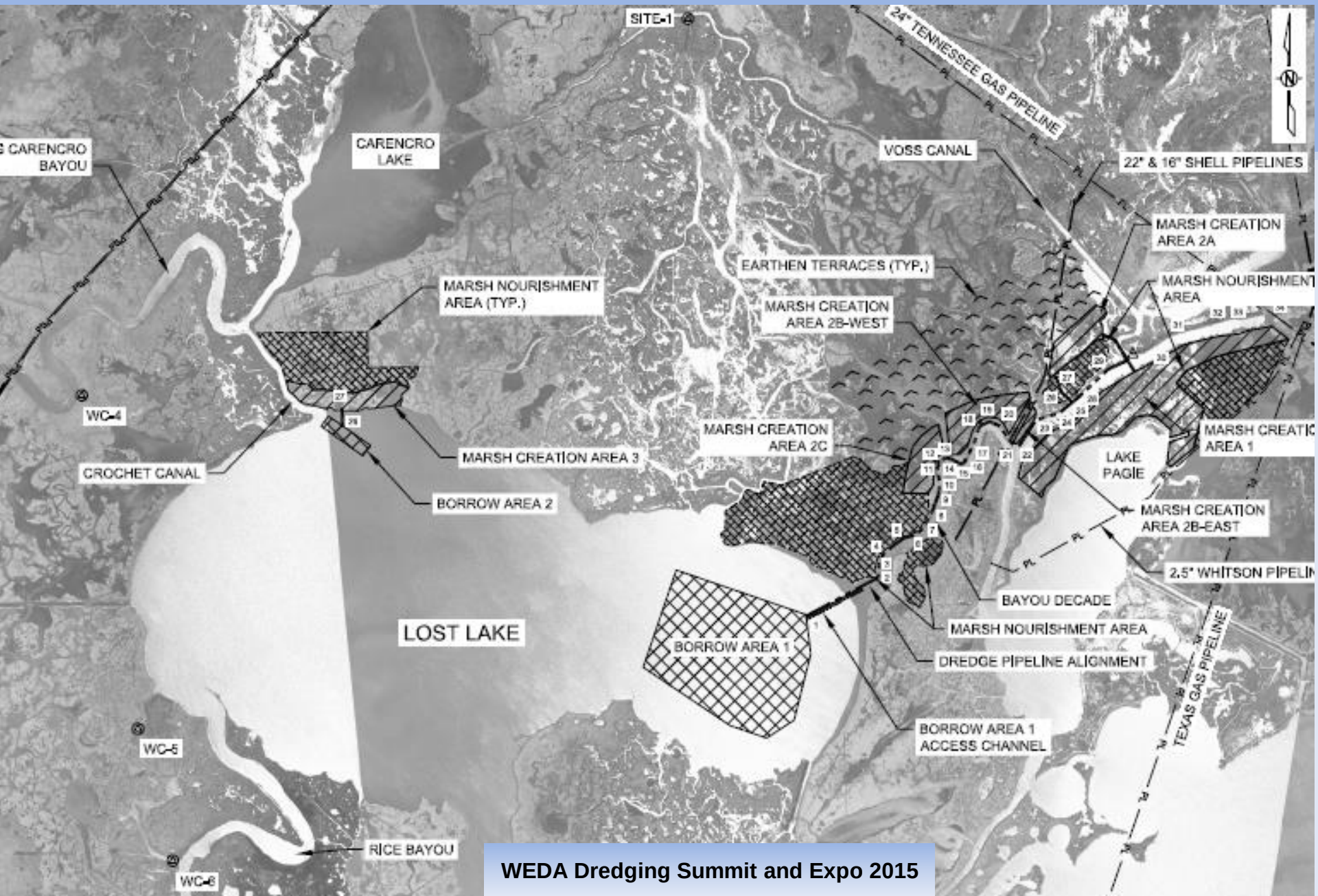


Marsh Creation Area and Terrace Profiles

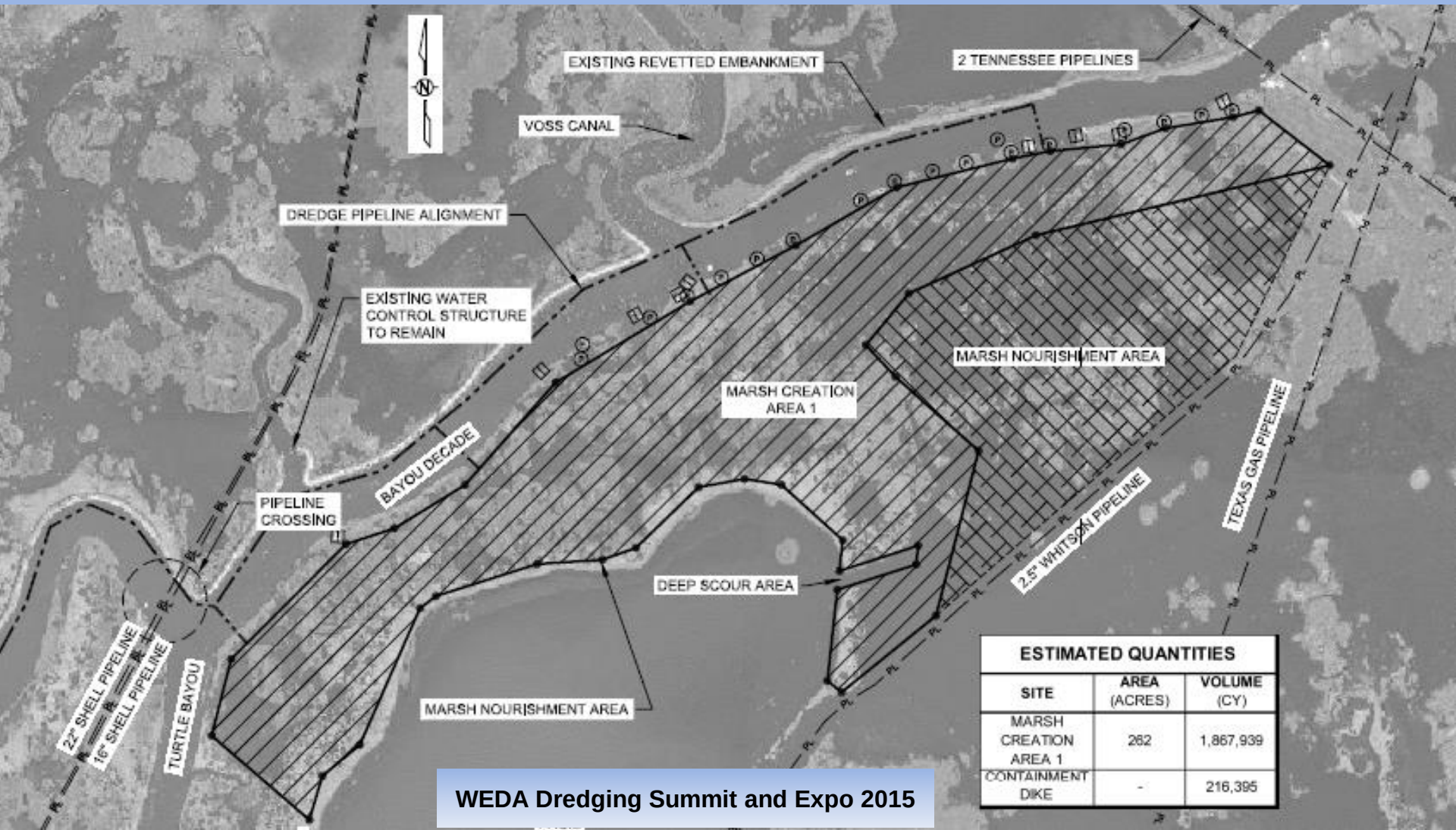




Project Plan



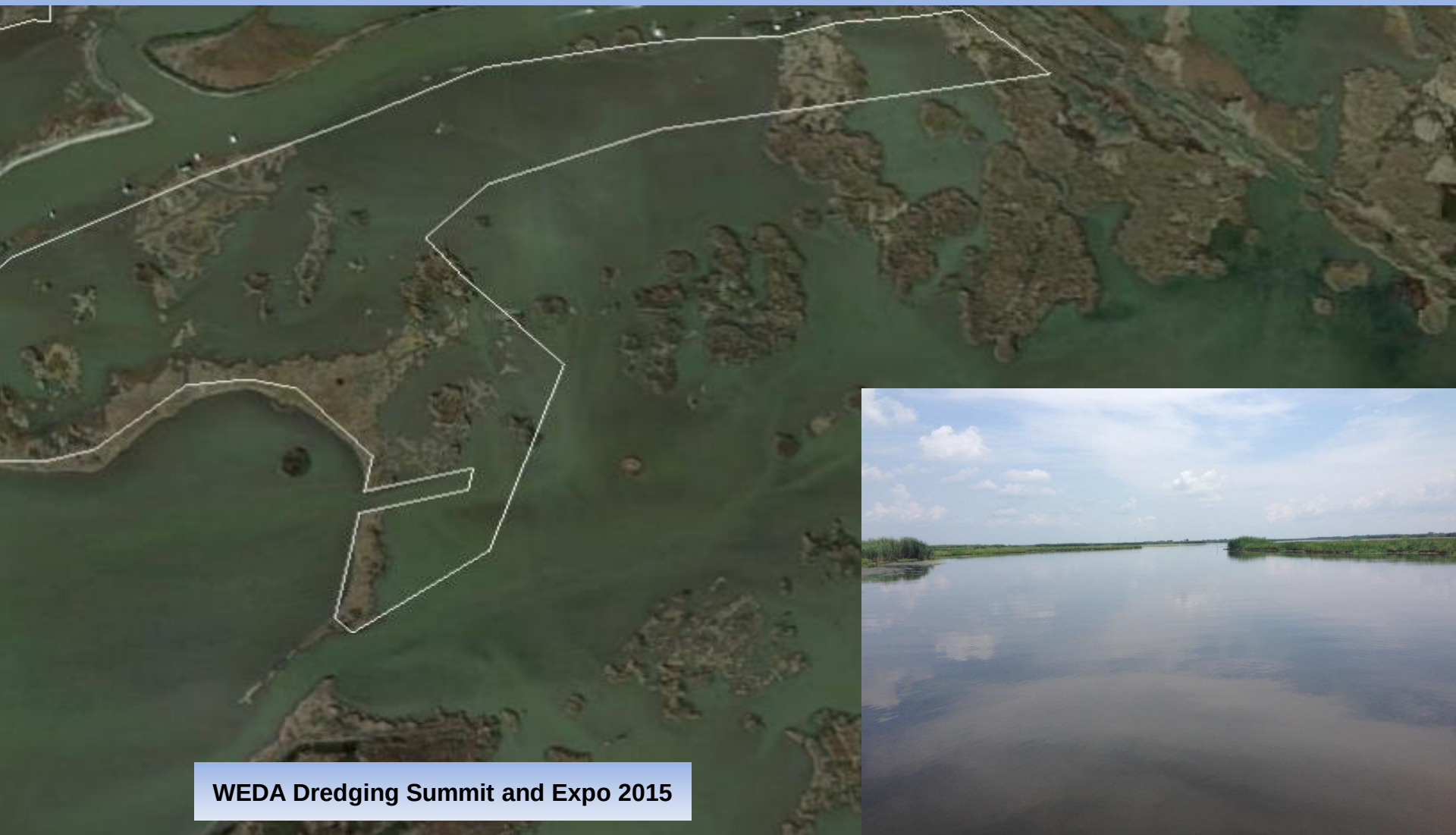
Fill Area 1



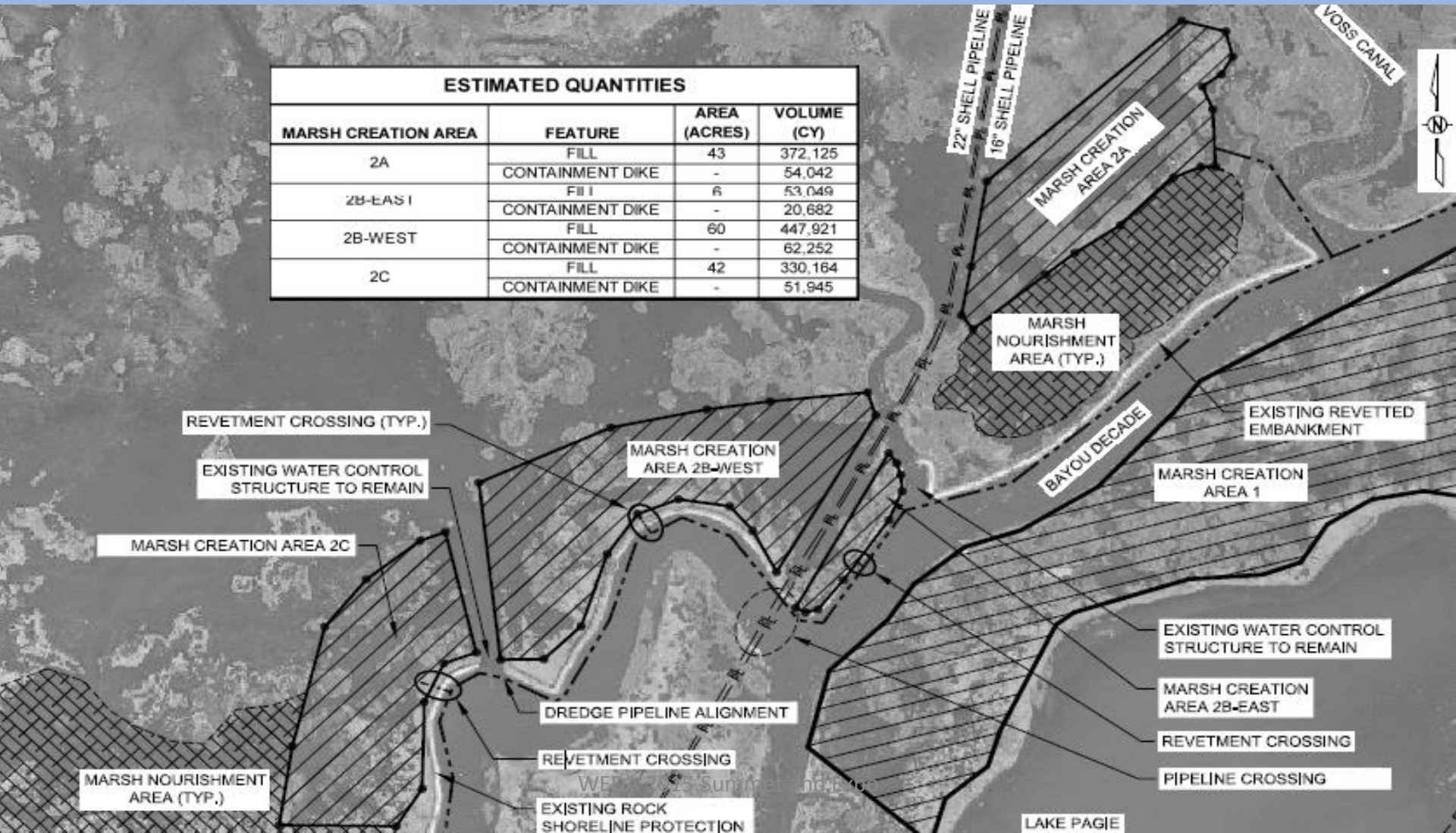
ESTIMATED QUANTITIES

SITE	AREA (ACRES)	VOLUME (CY)
MARSH CREATION AREA 1	262	1,867,939
CONTAINMENT DIKE	-	216,395

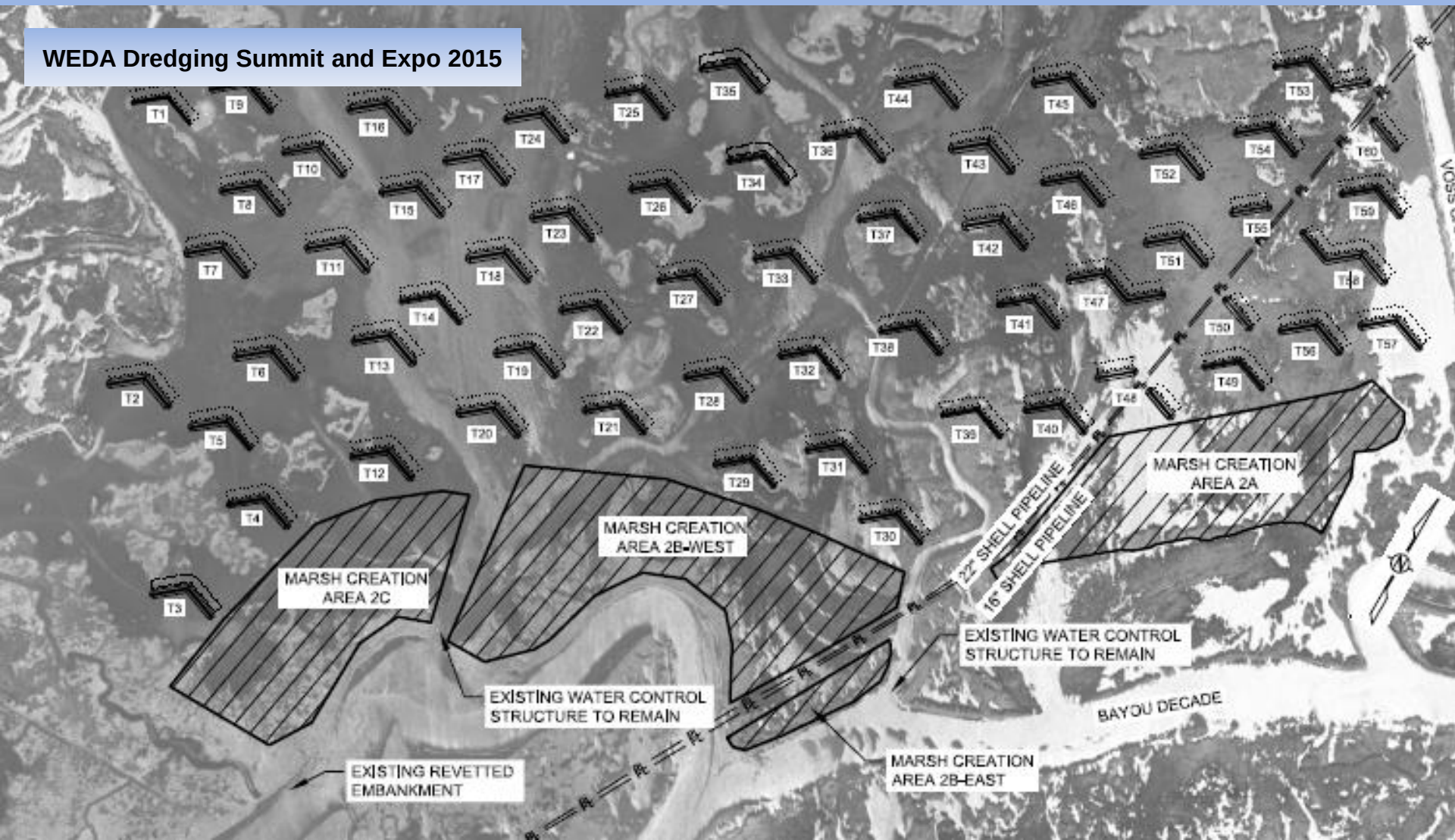
Fill Area 1



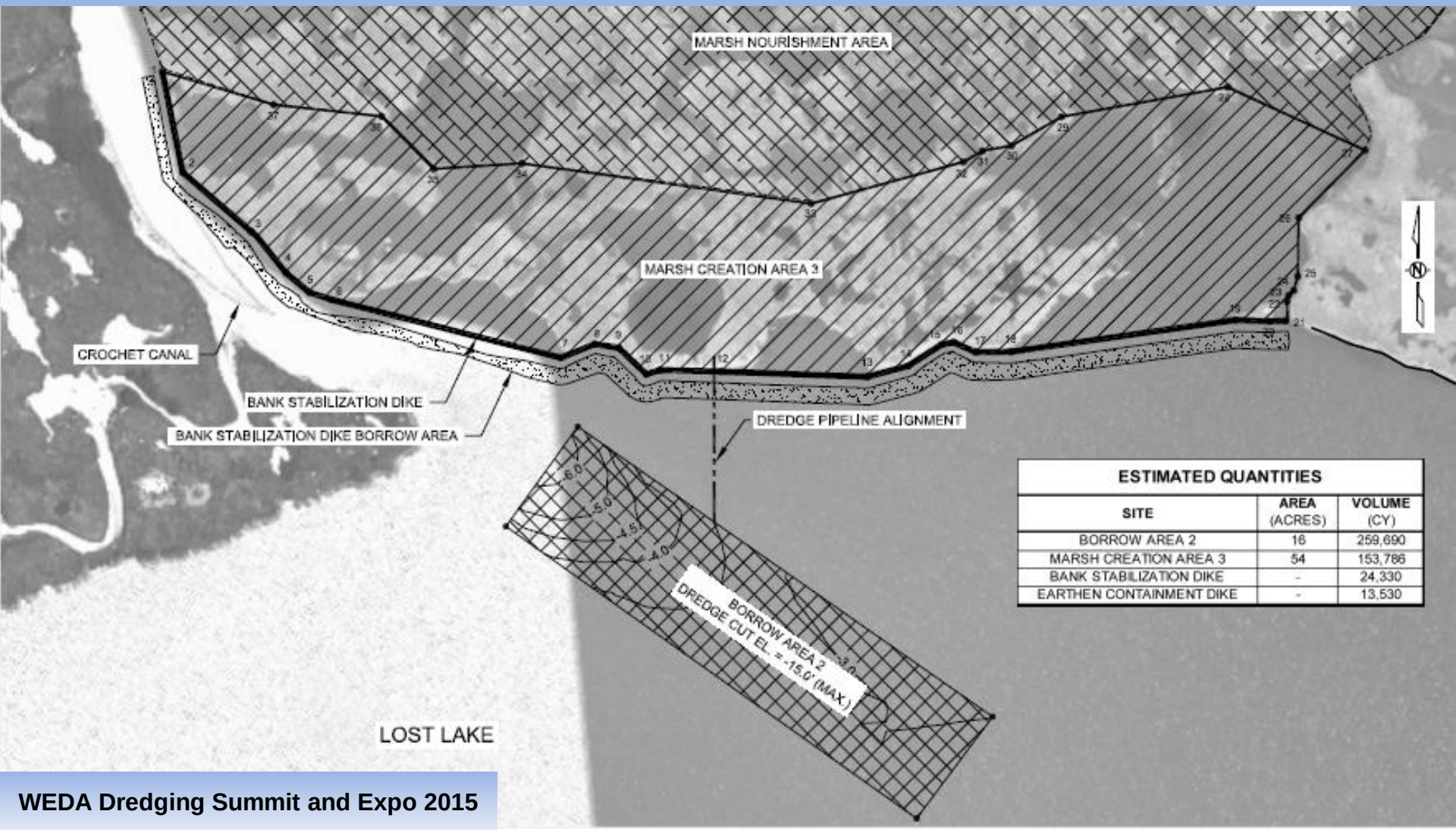
Fill Areas 2A, 2B and 2C



Earthen Terraces

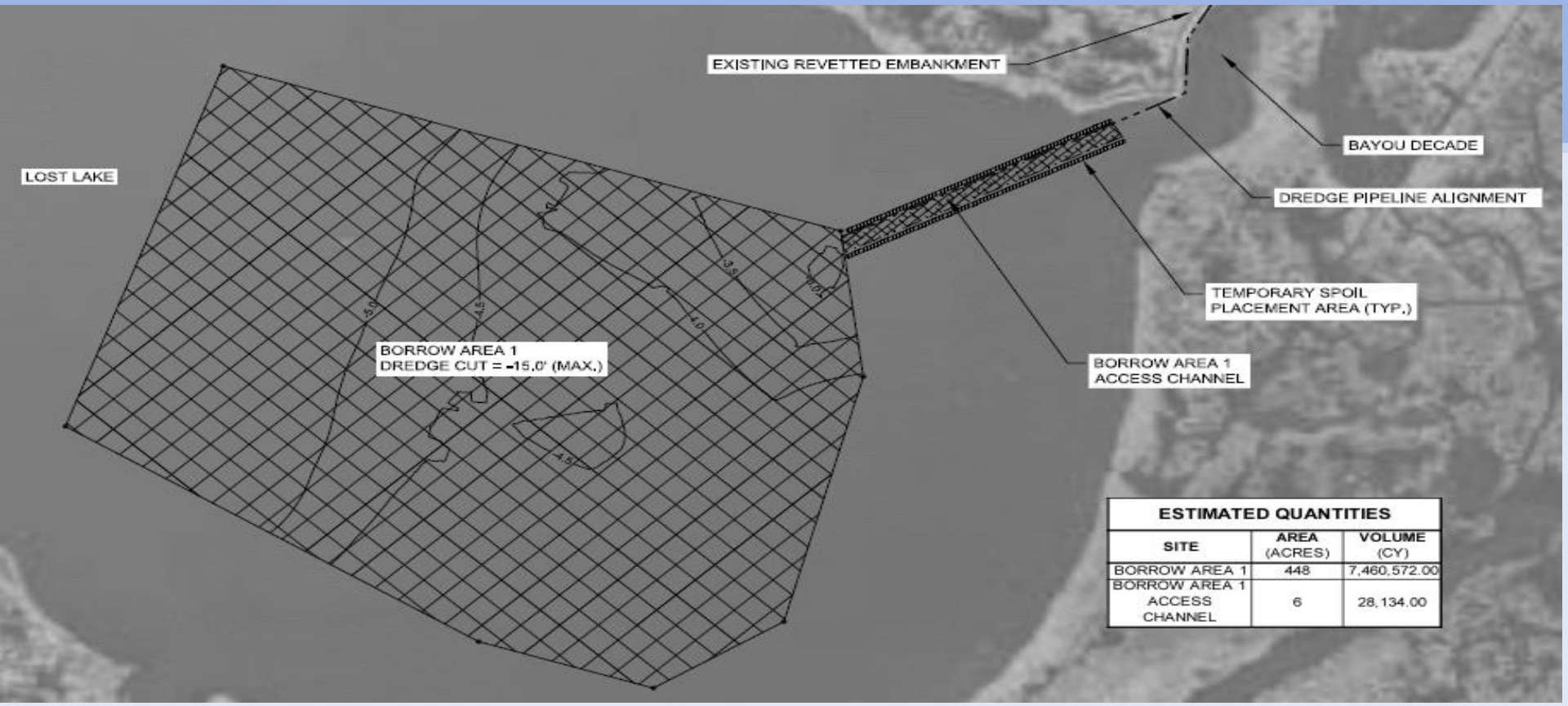


Fill Area 3 / Borrow Area 2



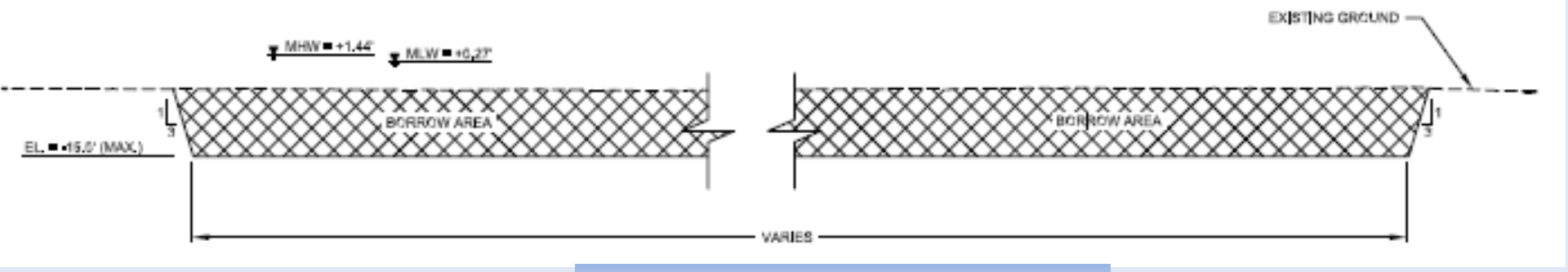
ESTIMATED QUANTITIES		
SITE	AREA (ACRES)	VOLUME (CY)
BORROW AREA 2	16	259,690
MARSH CREATION AREA 3	54	153,786
BANK STABILIZATION DIKE	-	24,330
EARTHEN CONTAINMENT DIKE	-	13,530

Borrow Area 1 and Access Channel



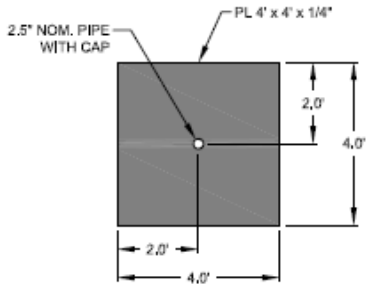
ESTIMATED QUANTITIES

SITE	AREA (ACRES)	VOLUME (CY)
BORROW AREA 1	448	7,460,572.00
BORROW AREA 1 ACCESS CHANNEL	6	28,134.00

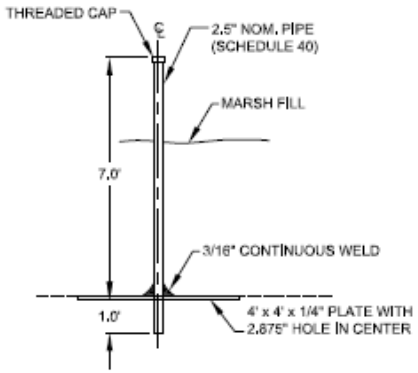


Hydraulic Dredge Access to Borrow Area 1

Settlement Plates

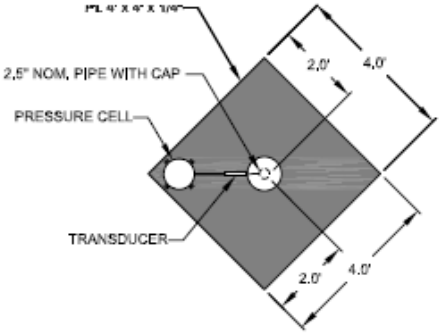


PLAN VIEW

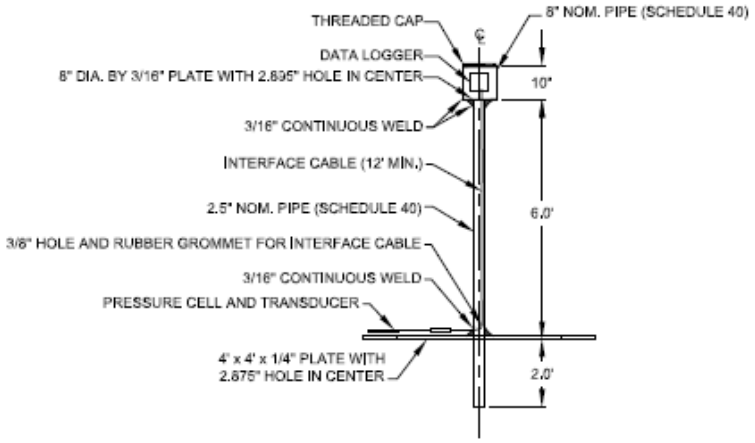


PROFILE VIEW

MARSH CREATION AREA
SETTLEMENT PLATE
NOT TO SCALE



PLAN VIEW

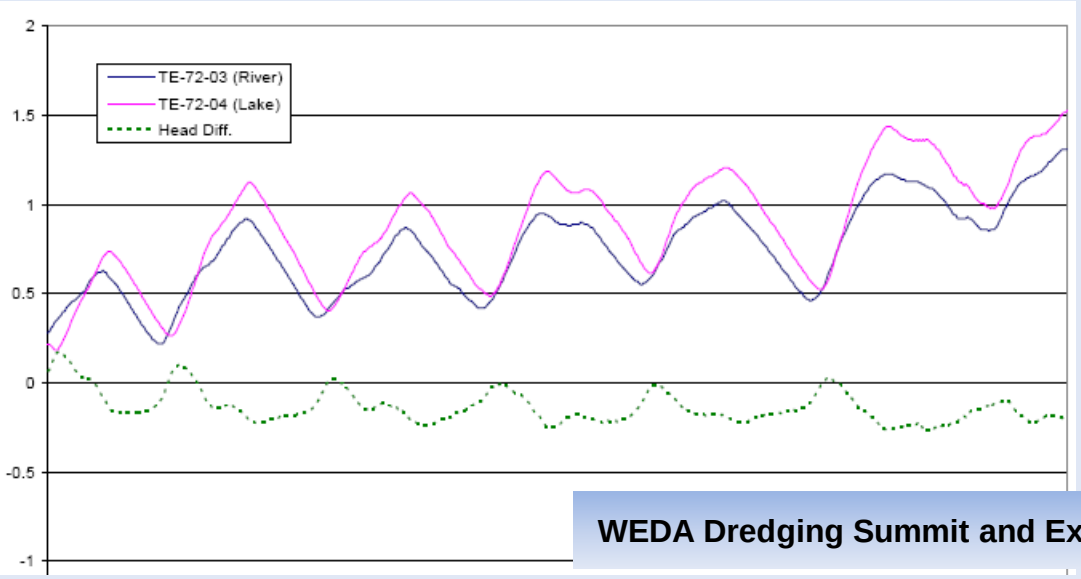


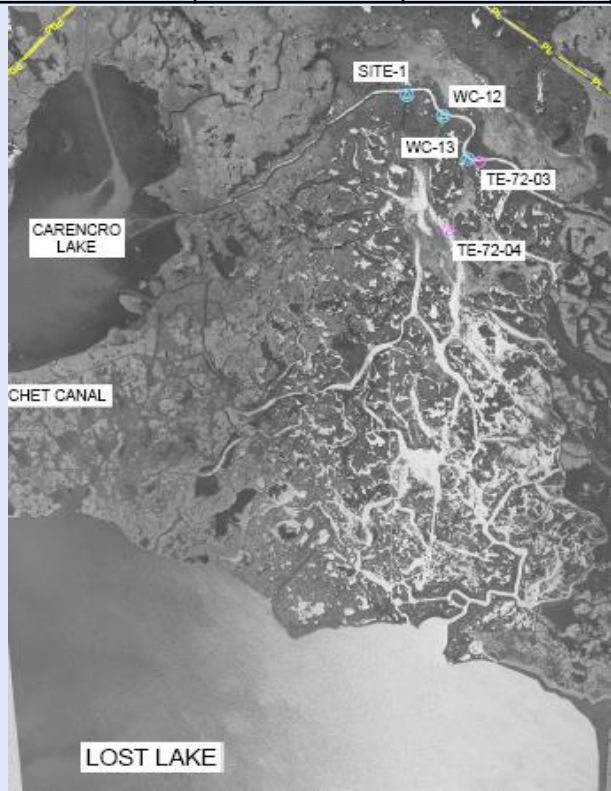
PROFILE VIEW

INSTRUMENTED
SETTLEMENT PLATE
NOT TO SCALE

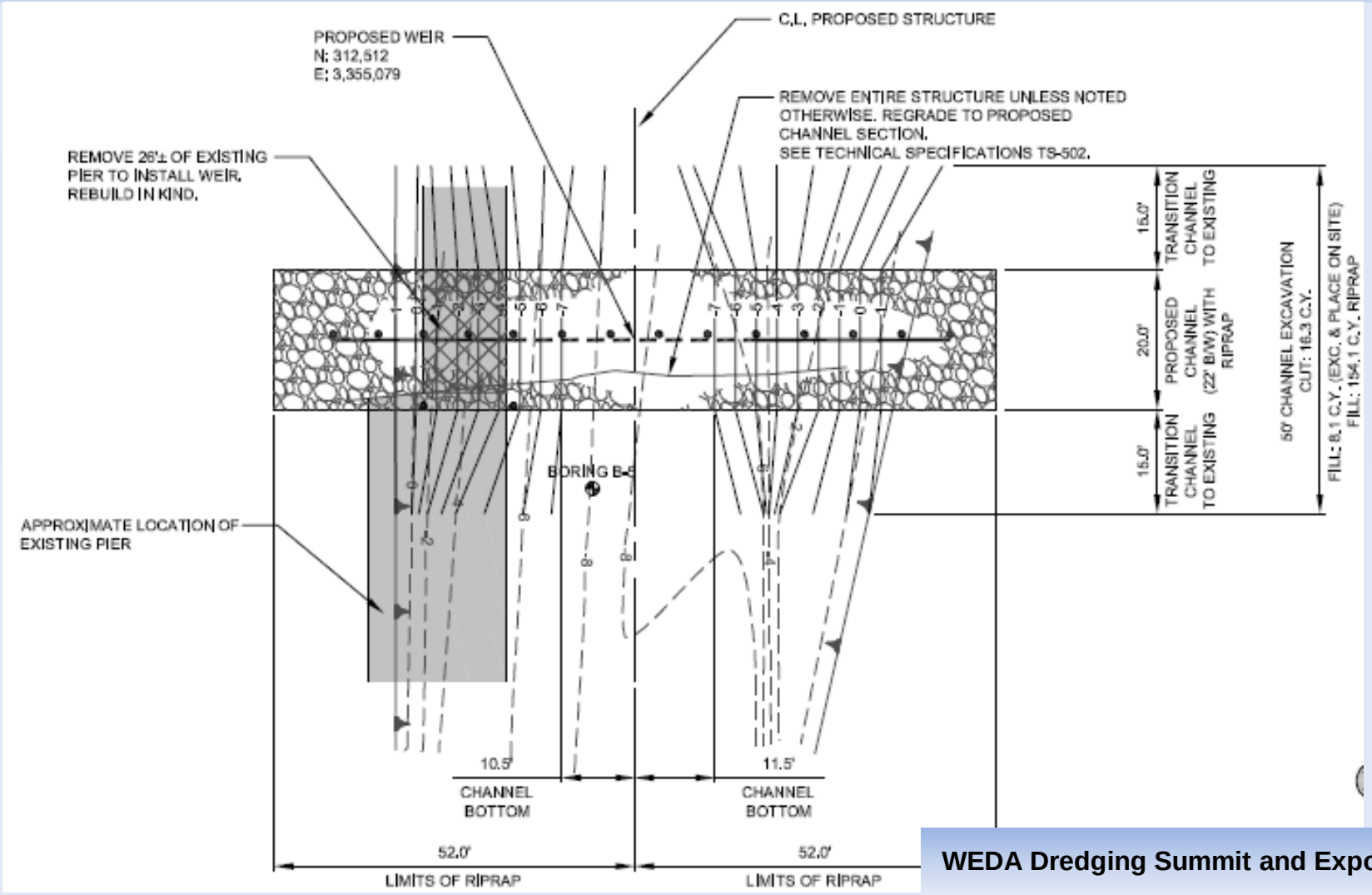
Water Control Structures

Water Level Collected 2011-2012					
Water Control Structure	Average Flow (cfs)	Average Positive Flow (cfs)	Max Positive Flow (cfs)	Average Negative Flow (cfs)	Max Negative Flow (cfs)
WC-1	1	28	350	27	497
WC-4	0	7	182	7	260
WC-5	229	610	1,981	380	1,675
WC-6	(2)	39	564	42	803

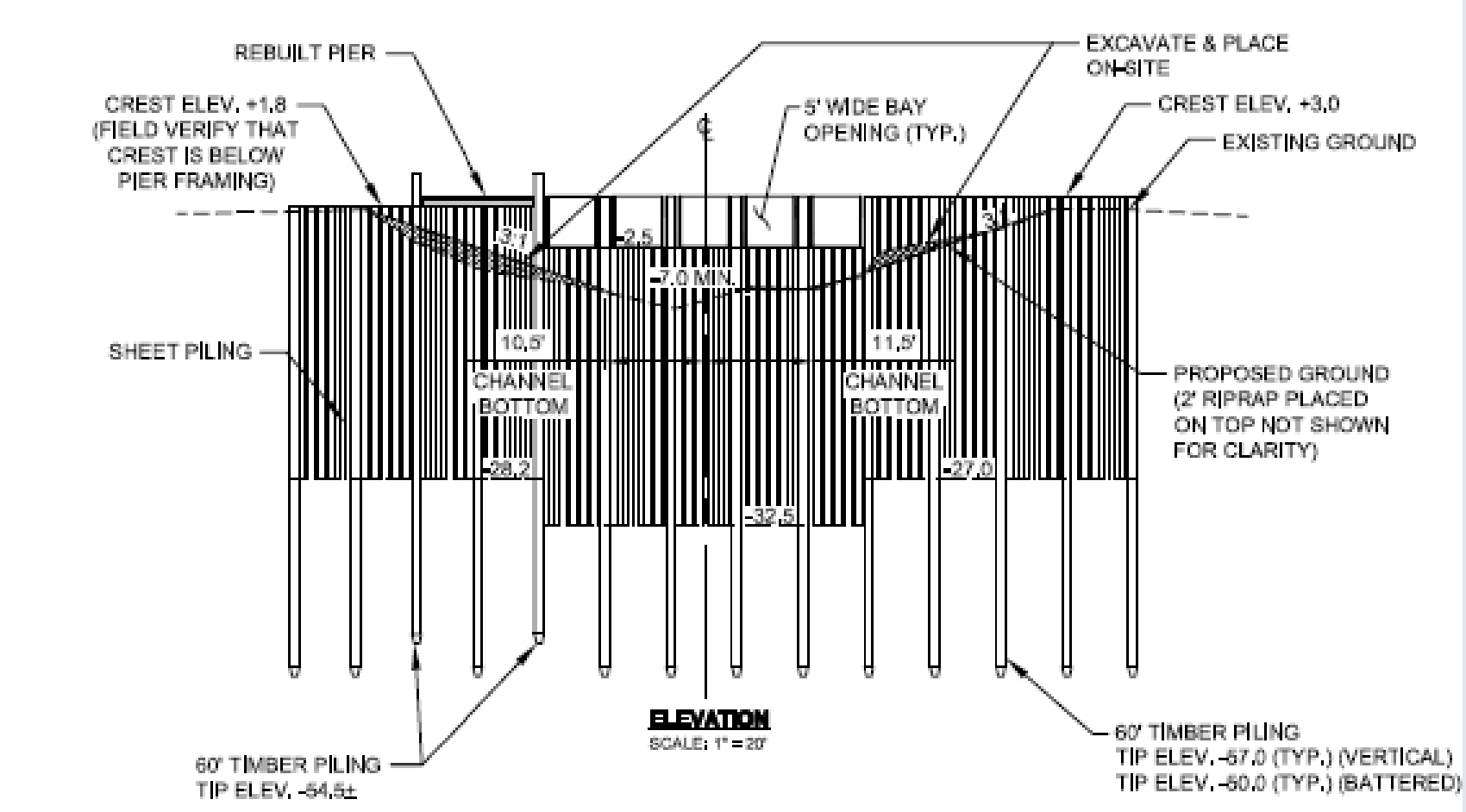




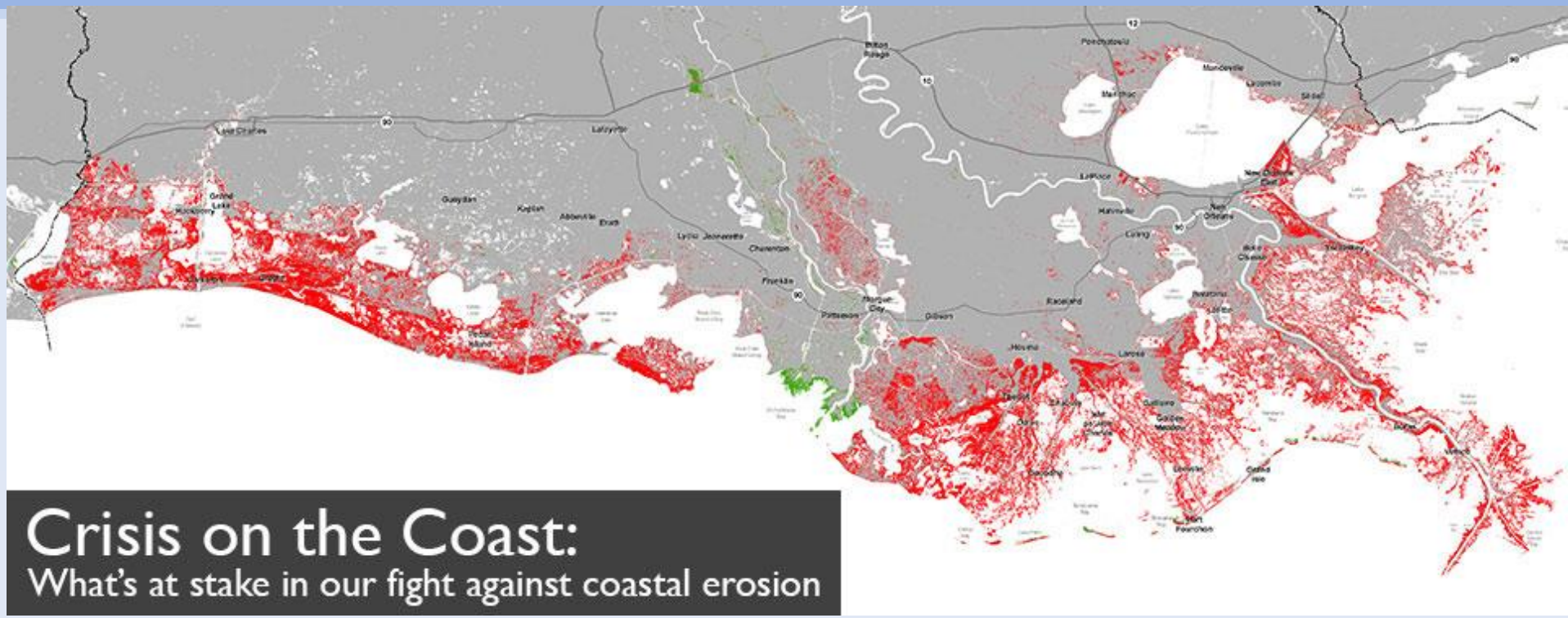
Typical Water Control Structure Plan



Typical Water Control Structure Profile



Questions



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