COASTAL WEEK WEBINARS

CPRA Marsh Creation Design Guidelines Updates and Improvements

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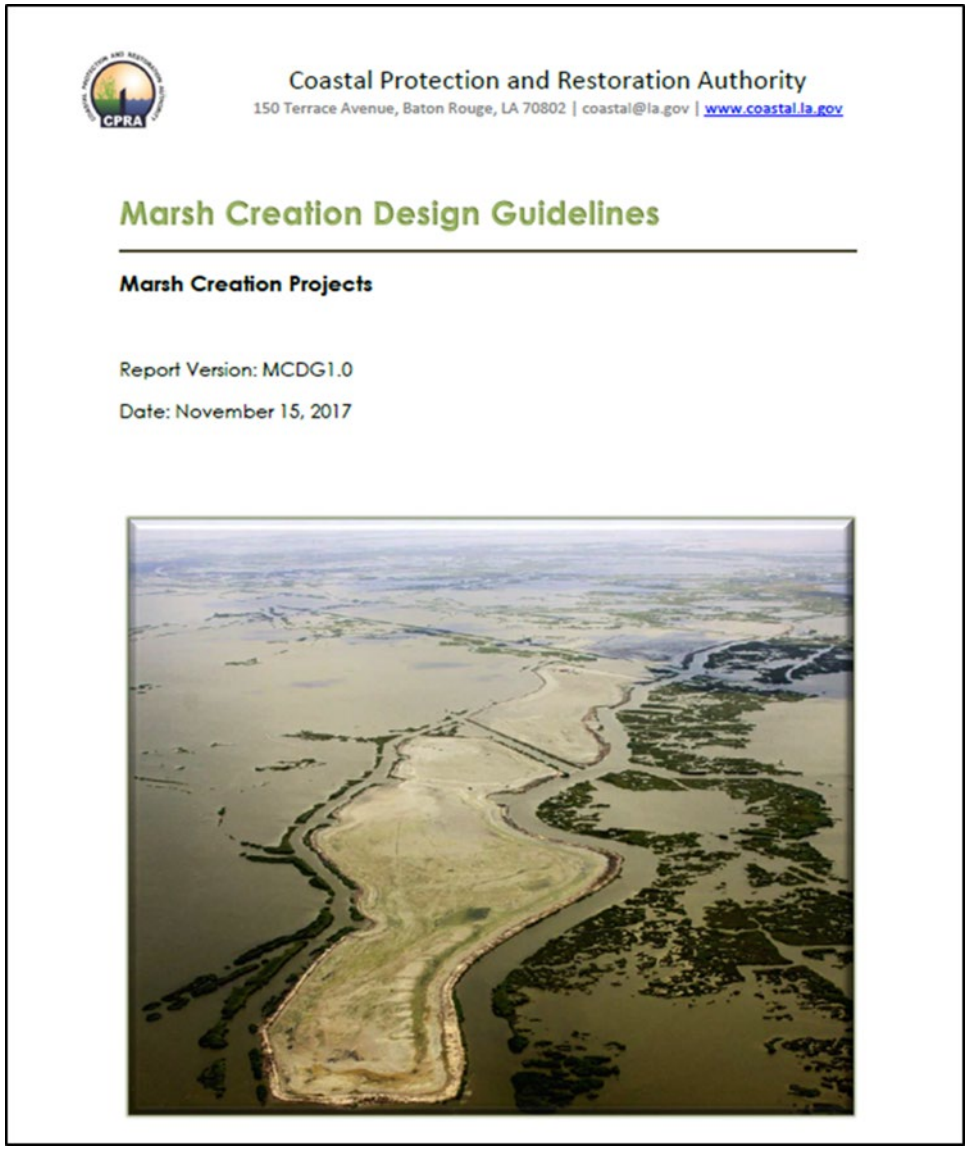
Presentation Outline

- MCDG1.0 Background
- Design Guidance Improvements
- Construction Guidance Updates
- Summary and Challenges
- Discussion

MCDG1.0 Background

MCDG1.0 Purpose

- Developed based on decades of project implementation experience.
- Approved by the CPA Board in 2017.
- Provides a consistent standard of practice for marsh creation design and construction.
- Available on the CPRA WEBSITE:
- https://coastal.la.gov/engineering-and-design-standards/



Coastal Master Plan

$50B total funding

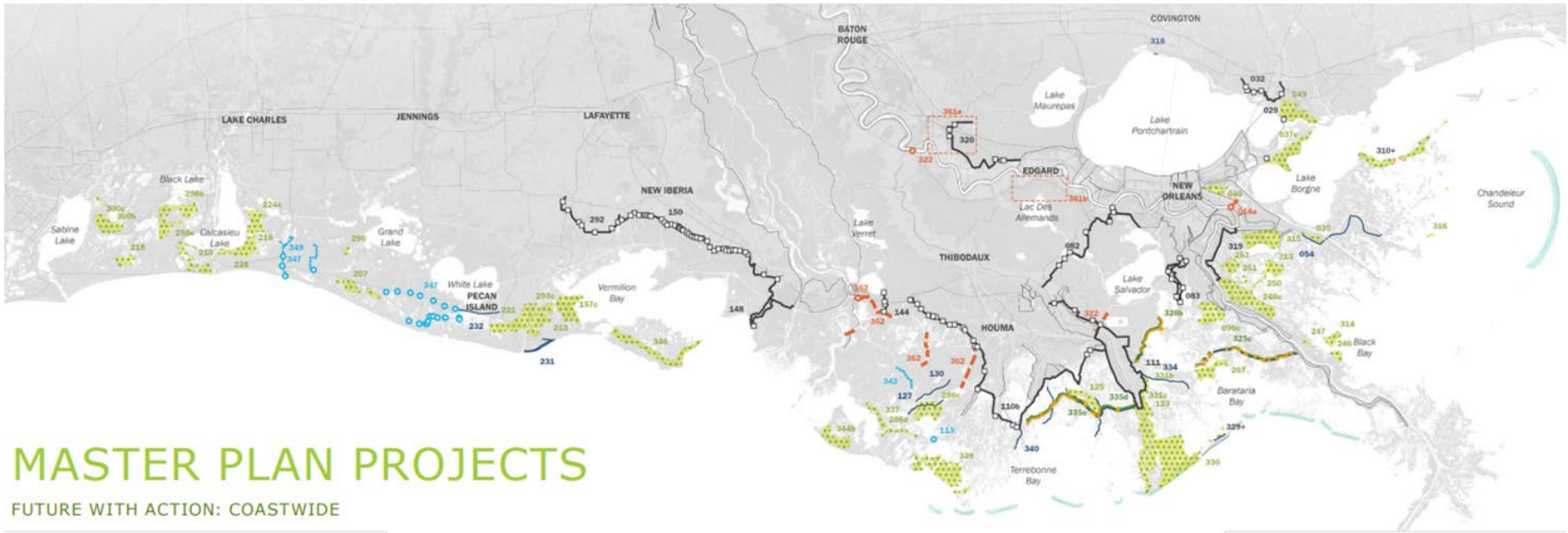
RESTORATION

$25B

RISK REDUCTION

$25B

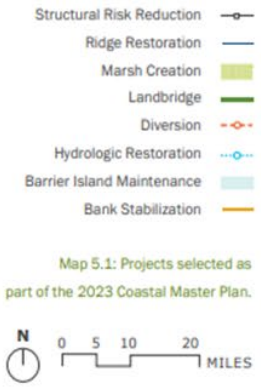
Coastal Master Plan Projects



MASTER PLAN PROJECTS

FUTURE WITH ACTION: COASTWIDE

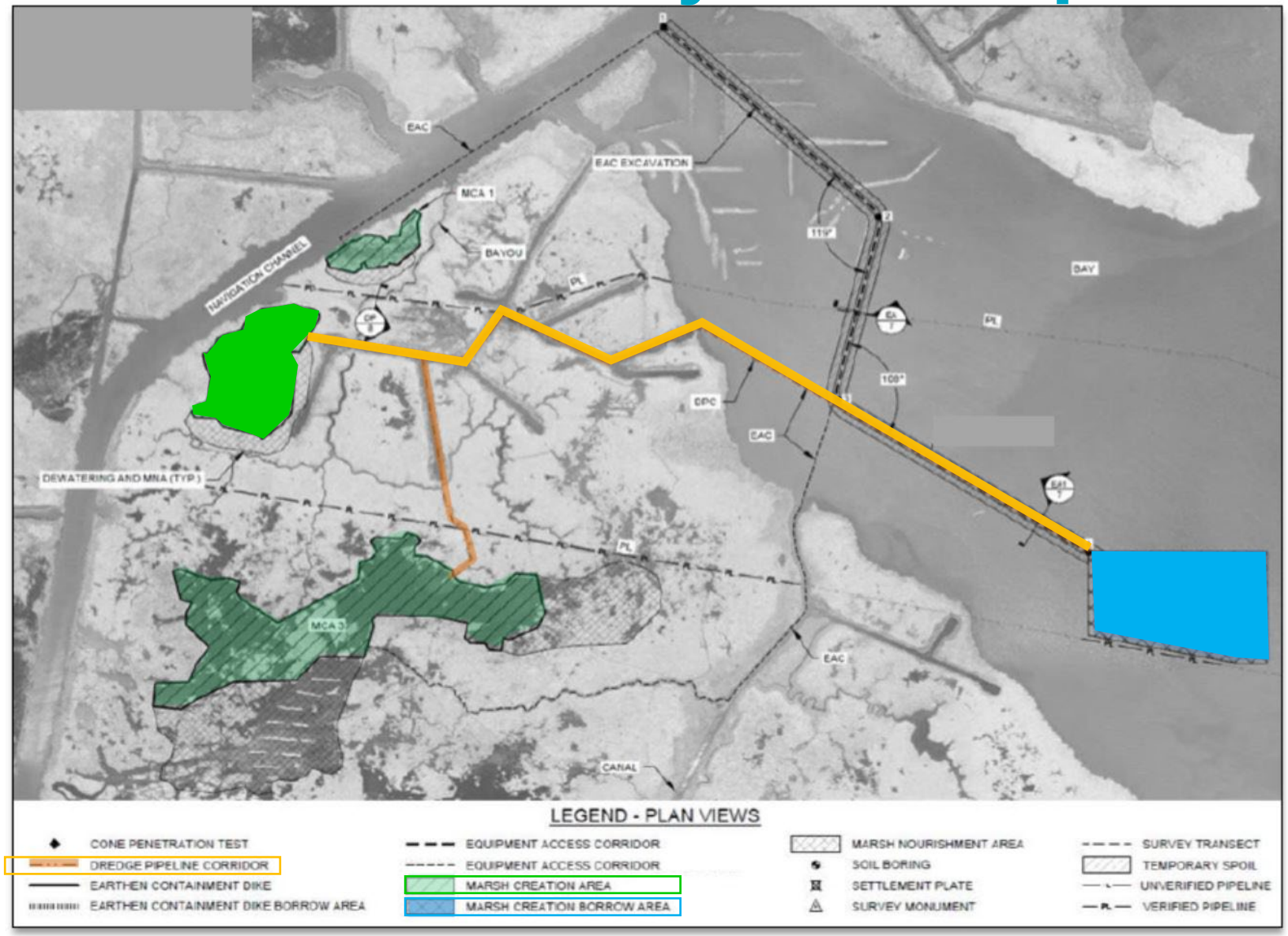
Figure 5.1: Planning Budget Allocation by Project Type in USD.



Map 5.1: Projects selected as part of the 2023 Coastal Master Plan.

2023 COASTAL MASTER PLAN

Marsh Creation Project Components



Marsh Creation Project

DURING CONSTRUCTION

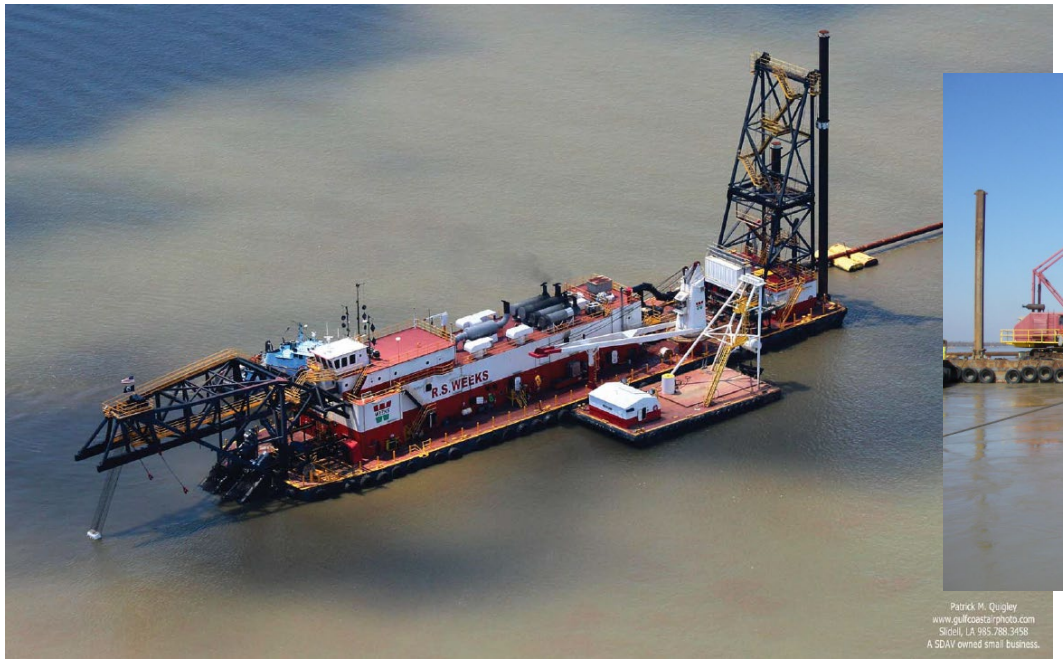
CONSTRUCTION COMPLETE

1-3 YEARS LATER

Marine Construction Equipment

Hydraulic Dredge

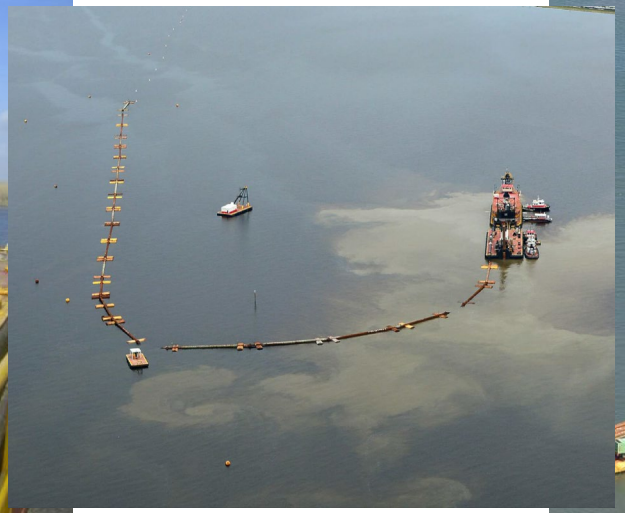
Excavates and moves material from borrow source to fill area via dredge pipe



Marine Construction Equipment

Dredge Pipe

Placed along dredge pipeline corridor from borrow area to marsh creation area

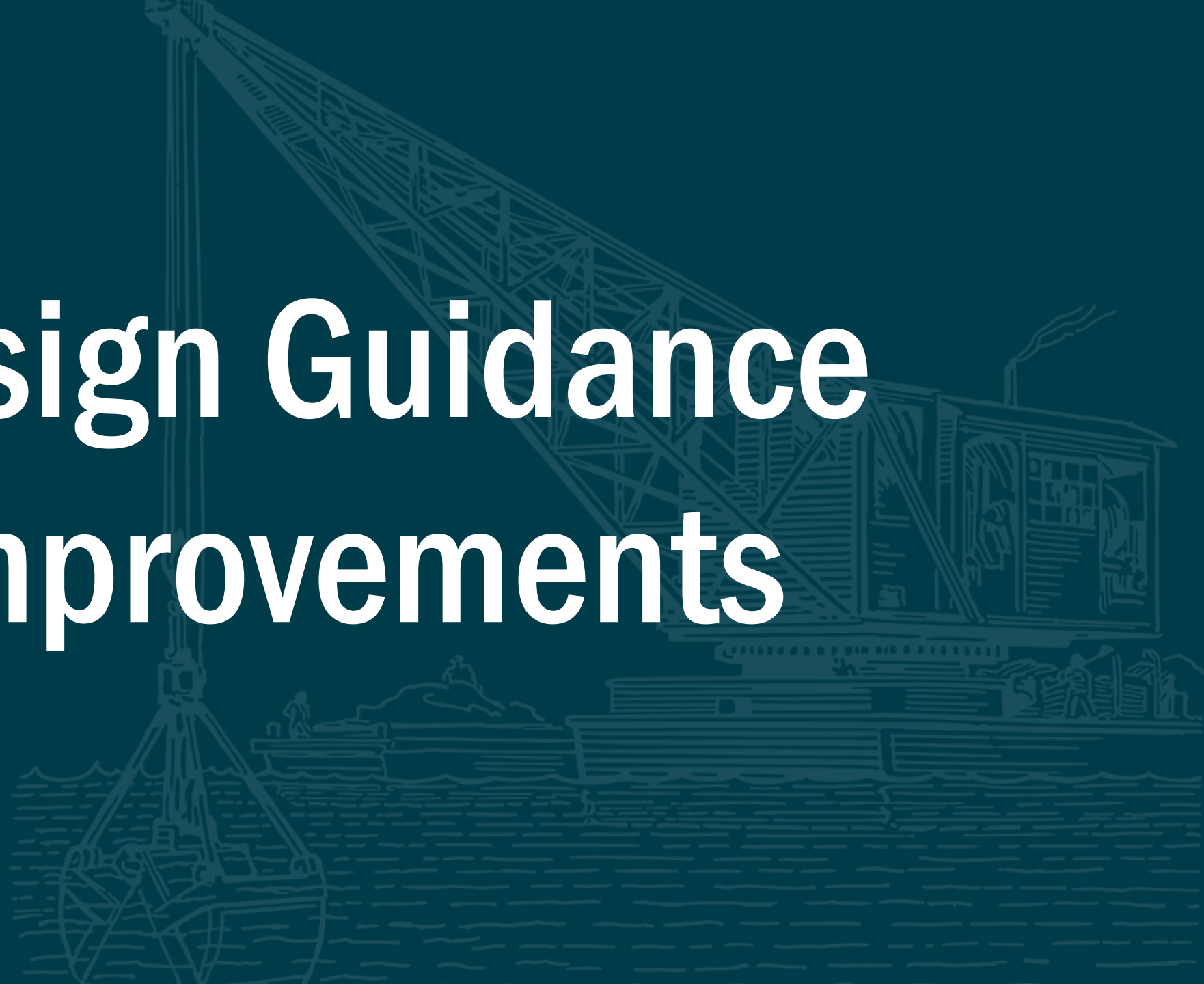


Marine Construction Equipment

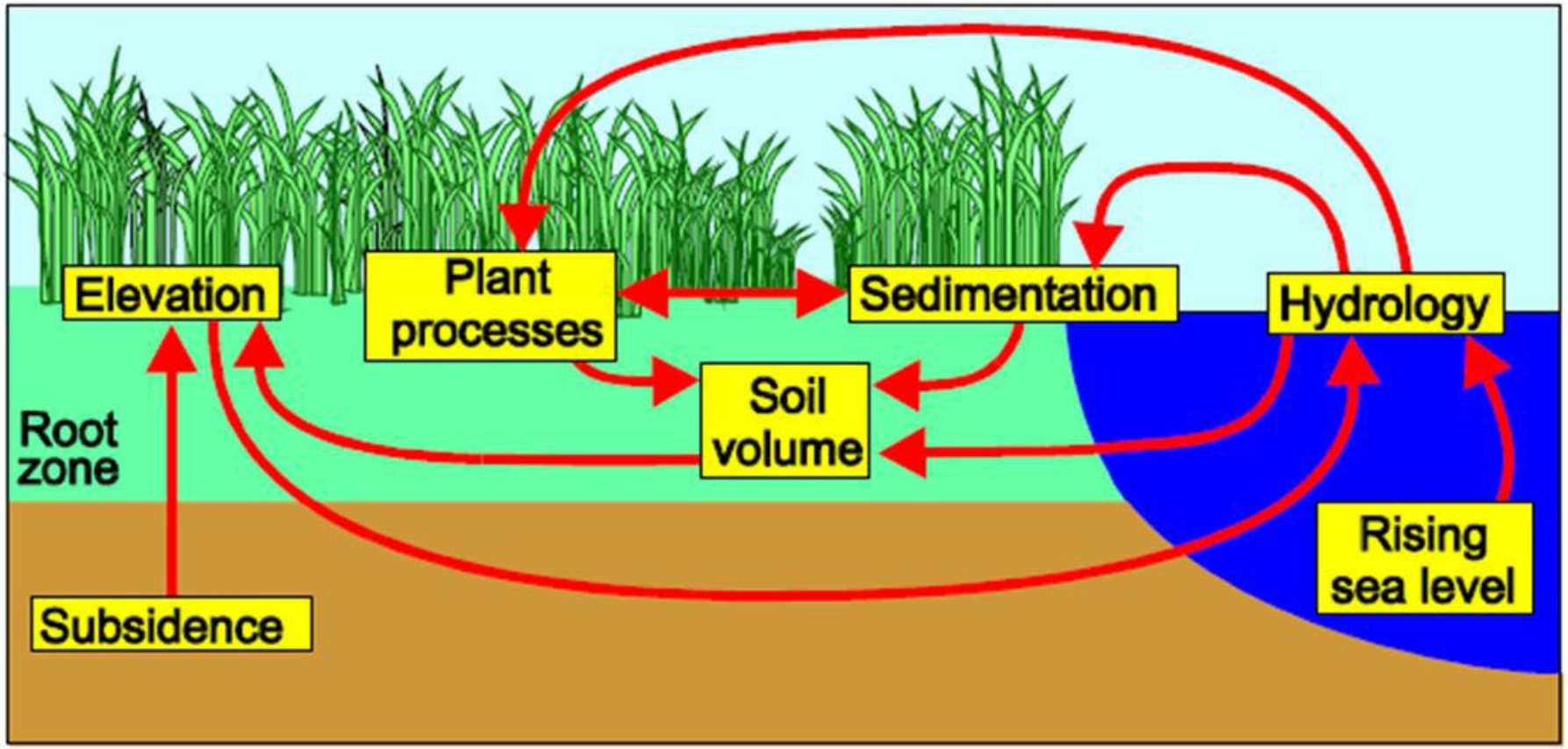
Mechanical Dredges

Tracked or barge mounted marine equipment that excavates places adjacent to borrow source.

Design Guidance Improvements



Marsh Creation Processes



MCDG1.0 Design Criteria

- Project Management
- Data Gap Analyses
- Cultural Resources Investigation
- Land rights Investigation
- Survey and Geotechnical Data Acquisition
- Marsh Creation Area Design
- Borrow Area Design
- Dredge Pipeline Corridor Design
- Permitting
- Construction

MCDG1.0 Design Criteria Improvements

- 3.0 Marsh Creation Design Criteria
  - *3.5.1 Survey Data Acquisition*
  - *3.5.3 Geotechnical Subsurface Investigation*

- 3.6 Marsh Creation Area Design
  - 3.6.2 Marsh Fill Elevation
  - 3.6.3 ECD Design
  - 3.6.4 MCA Sensitivity Analyses

- 3.7 Marsh Creation Borrow Area Design
  - 3.7.2.1 Borrow Area Evaluation
- 3.10 Construction

3.5.1 Data Acquisition – Surveying Risks

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)

- Pipeline Owner
  - Injury, Safety, Loss of Product, Court Costs, Public Perception, etc.
- Contractor
  - Injury, Safety, Increased Construction Duration, Court Costs, Public Perception, etc.
- CPRA
  - Injury, Safety, Court Costs, Public Perception, etc.
- Engineer of Record/PLS
  - Injury, Safety, Loss of Licensure, Court Depositions, Public Perception, etc.

What is the Standard of Practice?

3.5.1 Data Acquisition - Surveying

Identifying Existing Oil/Gas Infrastructure and Utilities (CI/ASCE 38-02)

Standard Guideline
for the
Collection and Depiction
of
Existing Subsurface Utility Data

ASCE American Society of Civil Engineers

CI/ASCE 38-02

3.5.1 Data Acquisition - Surveying

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)

Since 2017, the CPRA has utilized the ASCE/CI 38-02 subsurface utility engineering guidance document for pipeline Operator and utility identification.

- Promotes safety during construction operations.
- Provides a consistent standard of practice for the Surveyor for locating and collecting survey field data.
- Provides a consistent deliverable format for the Surveyor, CPRA designer, and Contractor for both design and construction surveys.

3.5.1 Data Acquisition - Surveying

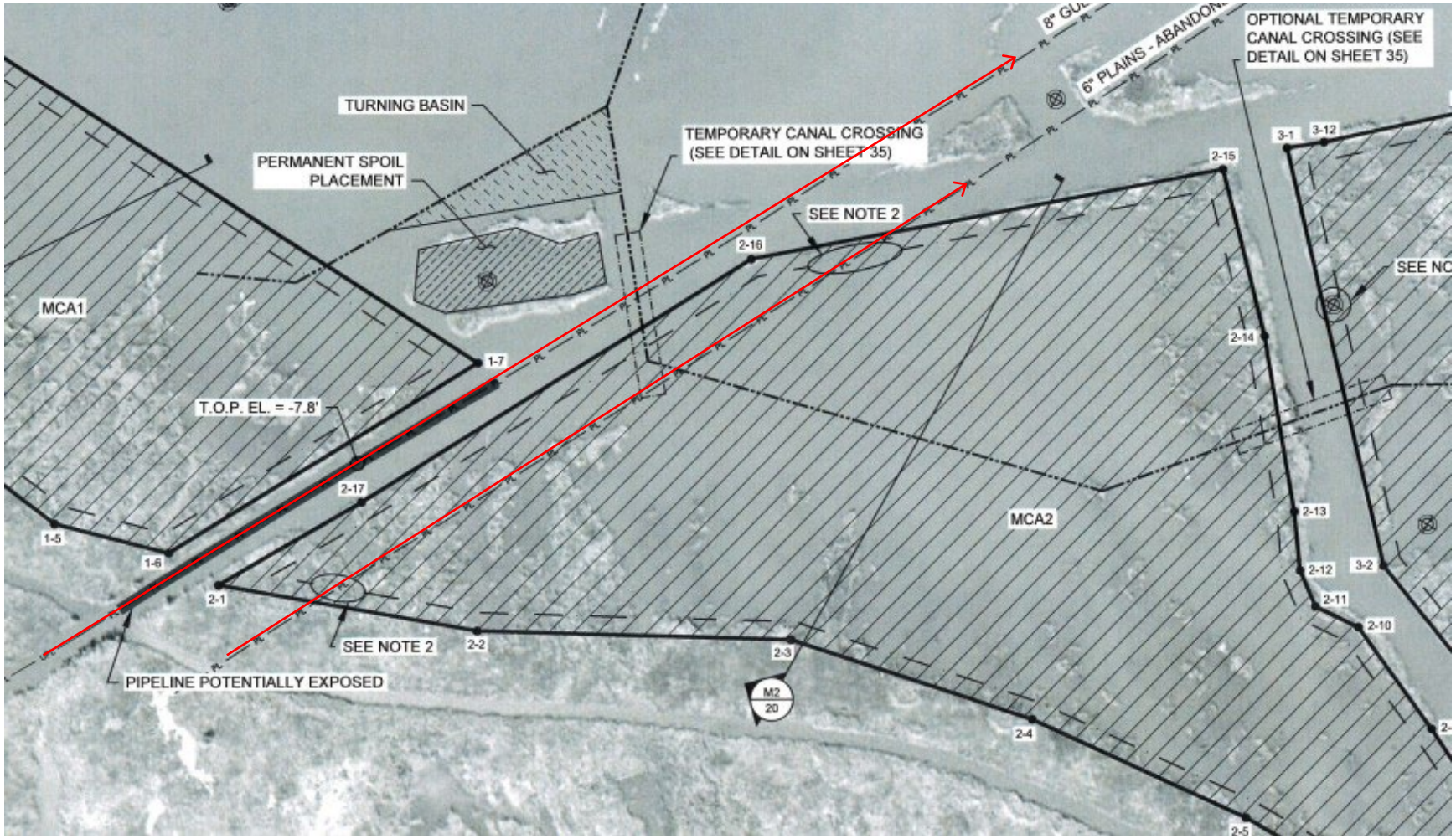
Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)

Magnetometer Data Requirements:

- Exact location coordinates (x,y minimum; x,y,z at Work locations)
- Depth of cover
- Pipeline operator
- Pipeline Status
- Product/contents
- Size (diameter)

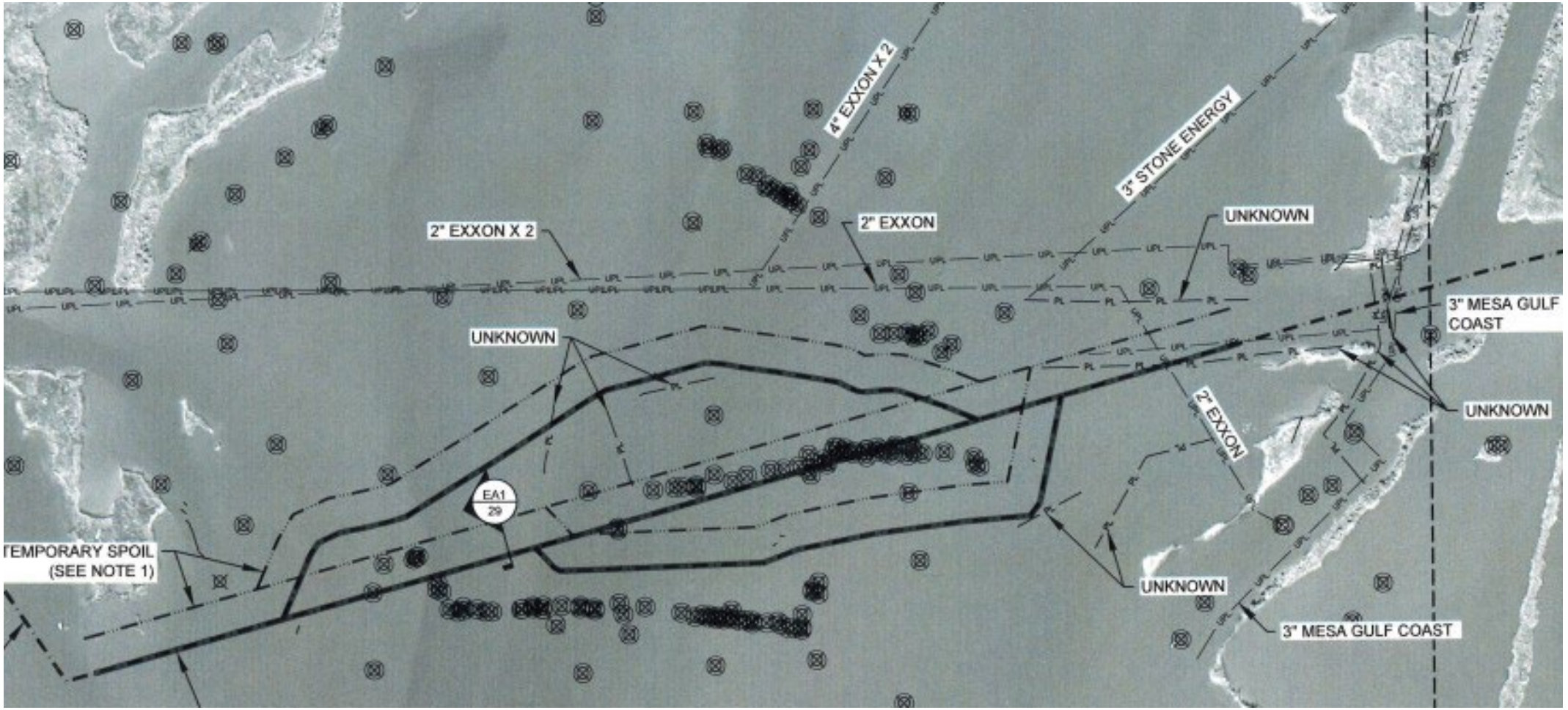
3.5.1 Magnetometer Data Example

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)



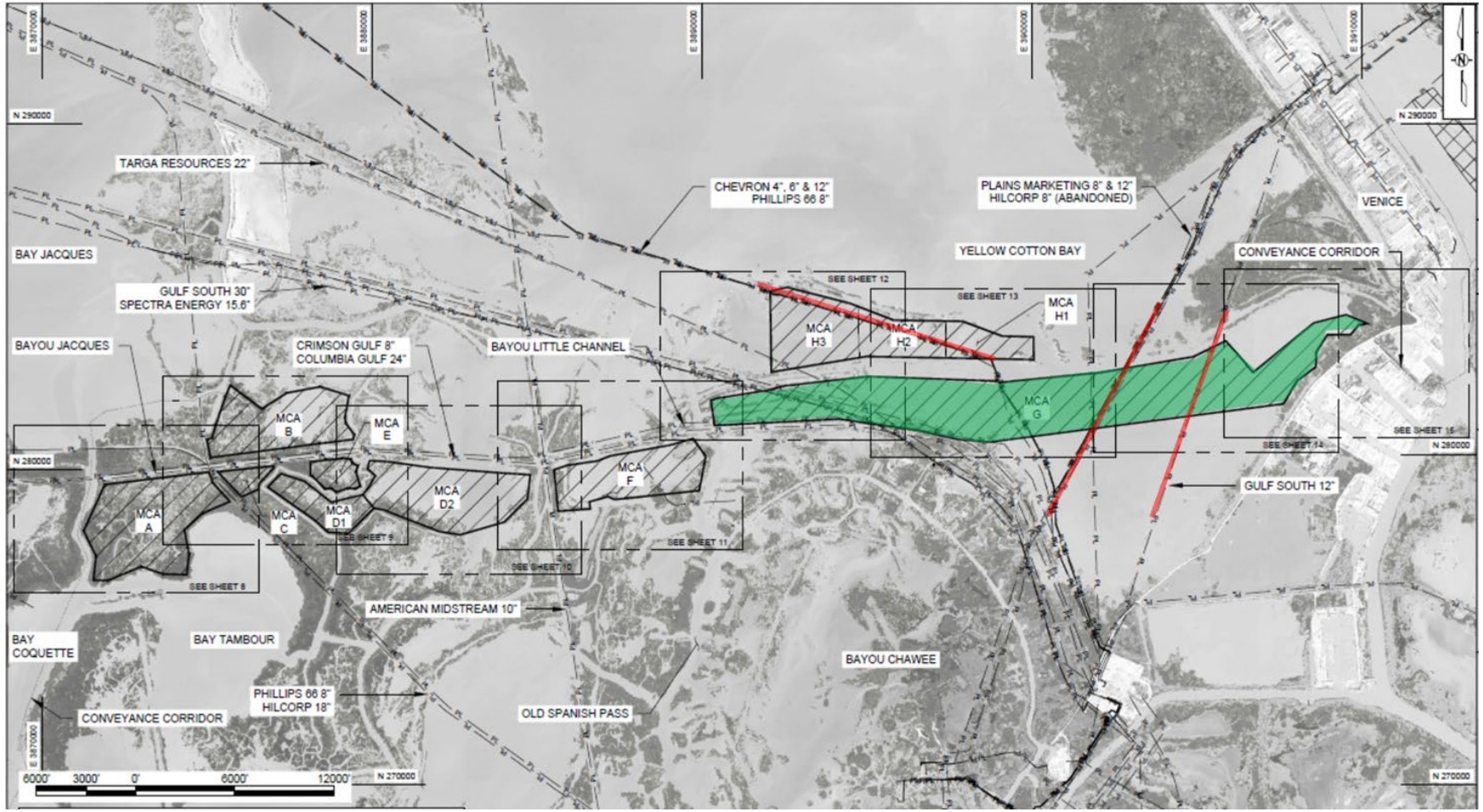
3.5.1 Magnetometer Data Example

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)



3.5.1 Magnetometer Data Example

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)

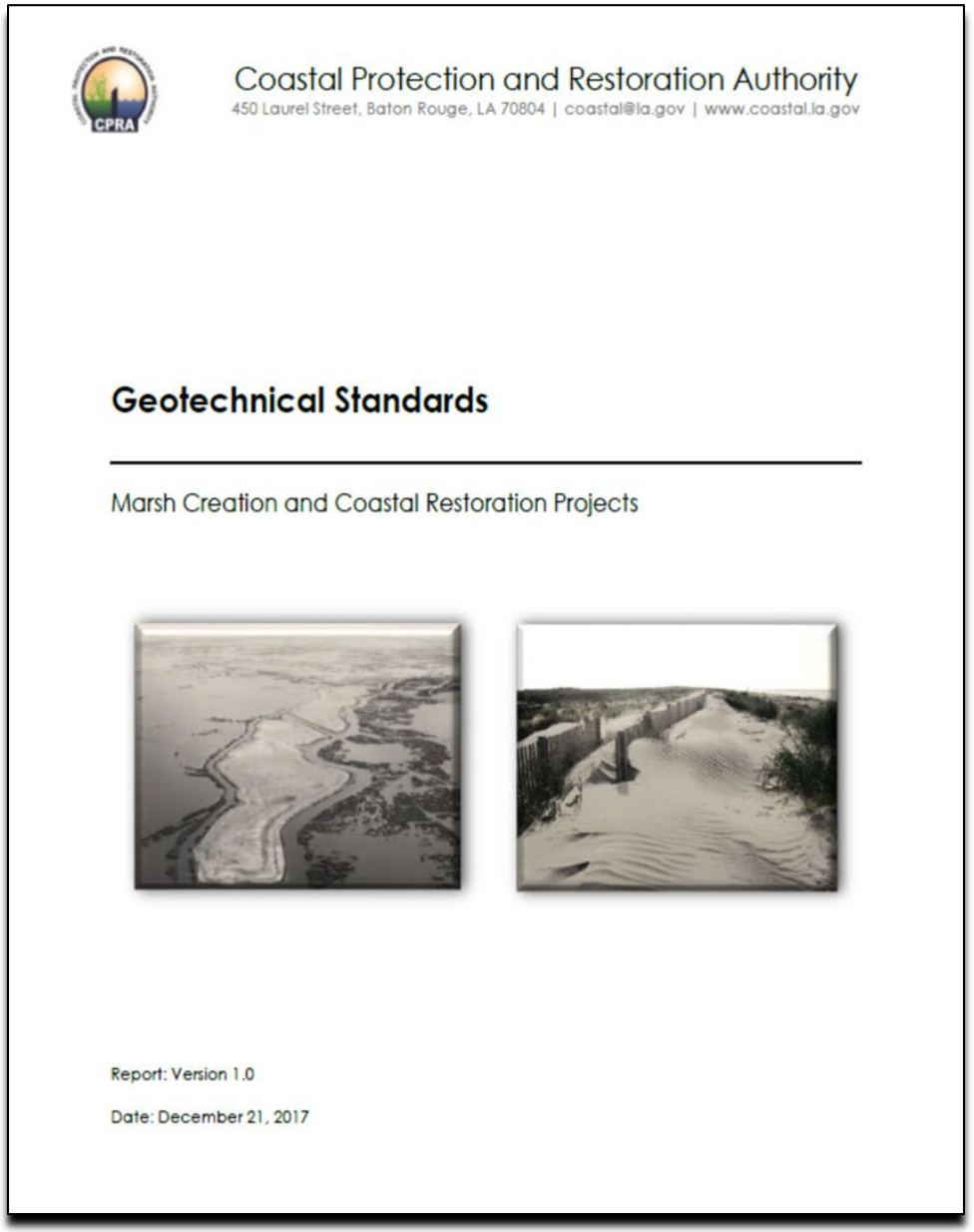


3.5.1 Magnetometer Data Example

Identifying Existing Oil/Gas Infrastructure and Utilities (ASCE/CI 38-02)

THE PIPELINE INFORMATION SHOWN ON THE PLANS IS A COMPILATION OF PRIOR MAGNETOMETER SURVEYS MEETING ASCE CI 38-02 QUALITY LEVEL B, TOP OF PIPE PROBINGS, AND GIS PIPELINE LOCATION RECORDS MEETING ASCE CI 38-02 QUALITY LEVEL D. THE PIPELINE LOCATIONS SHALL BE CONSIDERED APPROXIMATE AND CANNOT BE CONFIRMED FOR ACCURACY AND COMPLETENESS, THEREBY REQUIRING THE CONTRACTOR TO PROVIDE AN INDEPENDENT MAGNETOMETER SURVEY PRIOR TO CONSTRUCTION, WHICH CONFIRMS HORIZONTAL AND VERTICAL LOCATIONS OF VERIFIED AND/OR UNVERIFIED PIPELINES IN THE PROJECT WORK AREAS AS PER THE SPECIFICATIONS. A VERIFIED PIPELINE SHALL MEAN A PIPELINE WHOSE LOCATION IS DISCOVERED OR CONFIRMED VIA MAGNETOMETER SURVEYS. AN UNVERIFIED PIPELINE SHALL MEAN PIPELINES WHOSE LOCATIONS WERE NOT DISCOVERED/VERIFIED VIA MAGNETOMETER SURVEYS, BUT THERE IS EXISTING DOCUMENTATION FROM OIL/GAS DATABASES TO SUPPORT THE PRESENCE OF A POTENTIAL PIPELINE.

Appendix B: Geotechnical Guidance



Coastal Protection and Restoration Authority
450 Laurel Street, Baton Rouge, LA 70804 | coastal@la.gov | www.coastal.la.gov

Geotechnical Standards

Marsh Creation and Coastal Restoration Projects

Report: Version 1.0

Date: December 21, 2017

Appendix B: Geotechnical Guidance

3.5.3 Data Acquisition - Geotechnical

Geotechnical Subsurface Investigations – Revised Table B-1

Suggested Soil Boring Spacing, CPT Spacing, layout, and depths:

- Appendix B: Table B-1 was updated in February, 2019 based on field observations.
- Provides a consistent, optimized geotechnical subsurface investigation layout and testing requirements.
- Provides a consistent deliverable format enabling optimized review, approval, and usability for the CPRA designer.

Soil Boring and CPT Spacing and Depth

Soil Borings, CPT's, and vibracores should be spaced in accordance with Table B-1 for marsh creation projects and coastal restoration projects.

Table B- 1: Suggested Soil Boring Spacing, CPT Spacing, and Depth for Restoration Projects (revised 2.2019).

Restoration Project Feature	Soil Boring & CPT Location	Type	Soil Boring & CPT Spacing (ft.)	Soil Boring & CPT Depth (ft.)
Marsh Creation (MC) Area	Proposed MCA	3" Undisturbed Boring	2 Soil Borings per MCA	30' max.
Earthen Containment Dike (ECD)	Centerline	CPT/ 3" Undisturbed Boring	2,500' CPT's; 5,000' Soil Borings	30', 2@50' max.
MC "Inland" Borrow Area	Proposed Borrow Area	*Vibracore / 3" General Type Boring	1 per 25 acres of borrow area	‡ 25'
MC "Offshore" Borrow Area	Proposed Borrow Area	*Vibracore / 3" General Type Boring	1 per 25 acres of borrow area	‡ 25'
"Mississippi River" Borrow Area	Identified Borrow Area	3" General Type Boring/ *Vibracore / CPT	10 per borrow area	‡ 60'
Barrier Island Beach Dune	Centerline	CPT / 3" Undisturbed Boring	2,500' CPT's; 5,000' Soil Borings	40', 2@60' max.
Oyster Barrier Reef	Centerline	CPT / 3" Undisturbed Boring	2,000' CPT's; 4,000' Soil Borings	30', 2@50' max.
Shoreline Protection	Centerline	CPT / 3" Undisturbed Boring	2,000' CPT's; 4,000' Soil Borings	40', 2@60' max.
Ridge Restoration	Centerline	CPT / 3" Undisturbed Boring	2,500' CPT's; 5,000' Soil Borings	40', 2@60' max.
Earthen Terraces	Centerline	CPT / 3" Undisturbed Boring	1 per 75 acres	30' max.

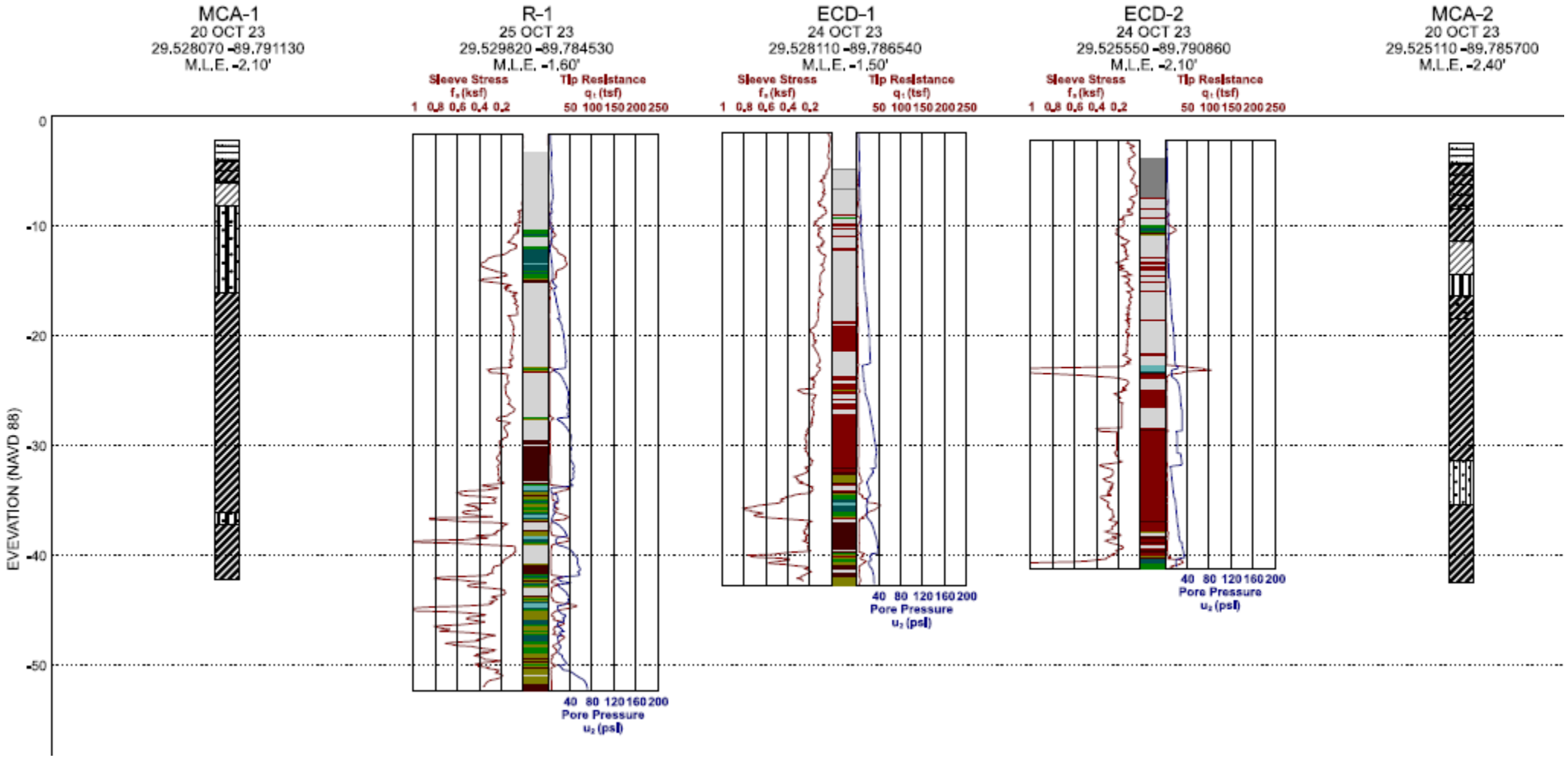
Note: *Vibracores may be taken in conjunction with soil borings if disturbed soil samples are required to determine material properties required for hydraulic dredging.
**See current version of the CPRA General Guidelines, Exploration for Sediment Resources for Coastal Restoration.
‡ The soil boring depth should be advanced to the maximum extent of the proposed dredging/excavation Work.

3.5.3 Data Acquisition - Geotechnical

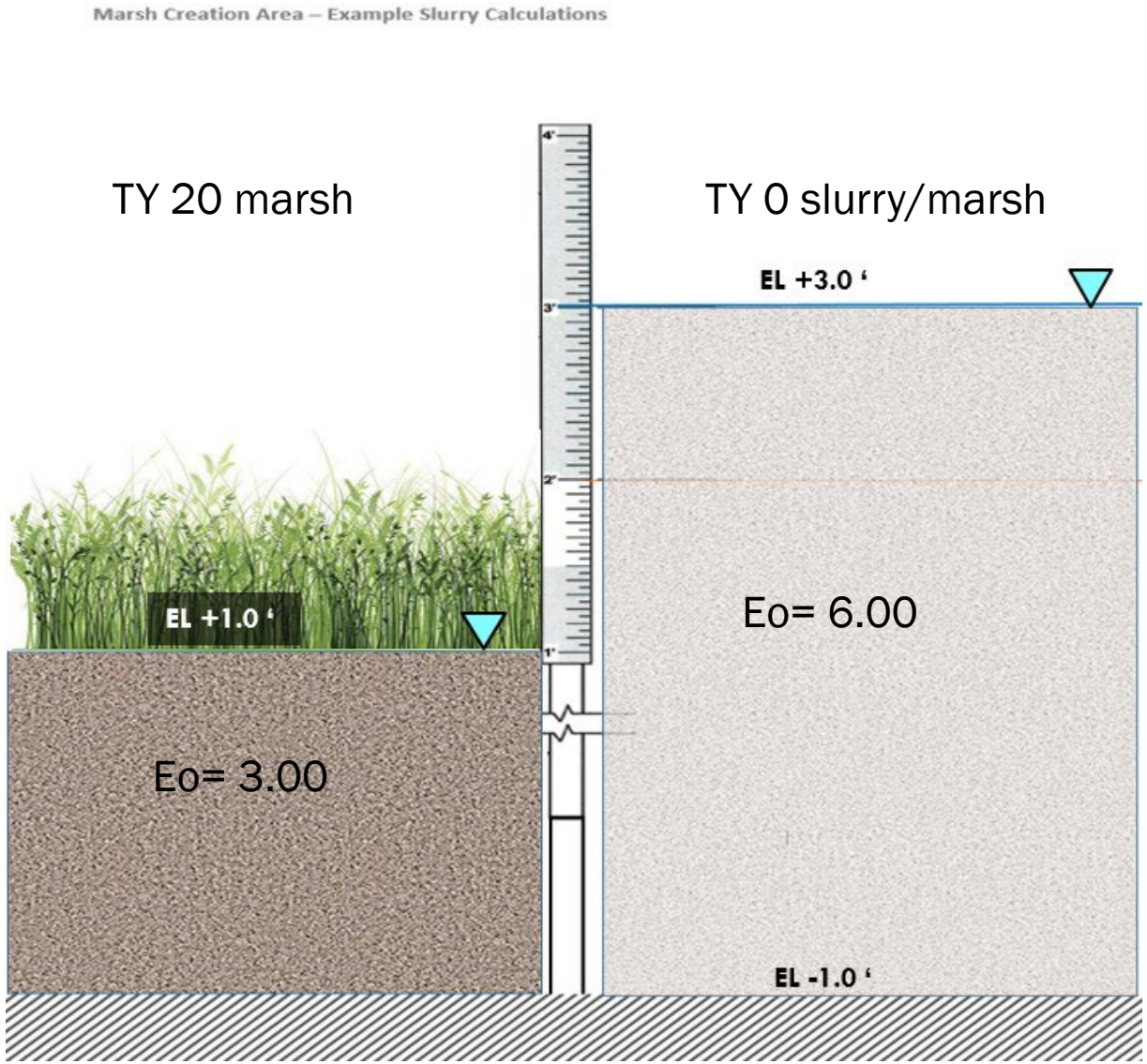
Geotechnical Subsurface Investigations Layout Example

3.5.3 Data Acquisition - Geotechnical

Geotechnical Subsurface Investigations CPT Data Example

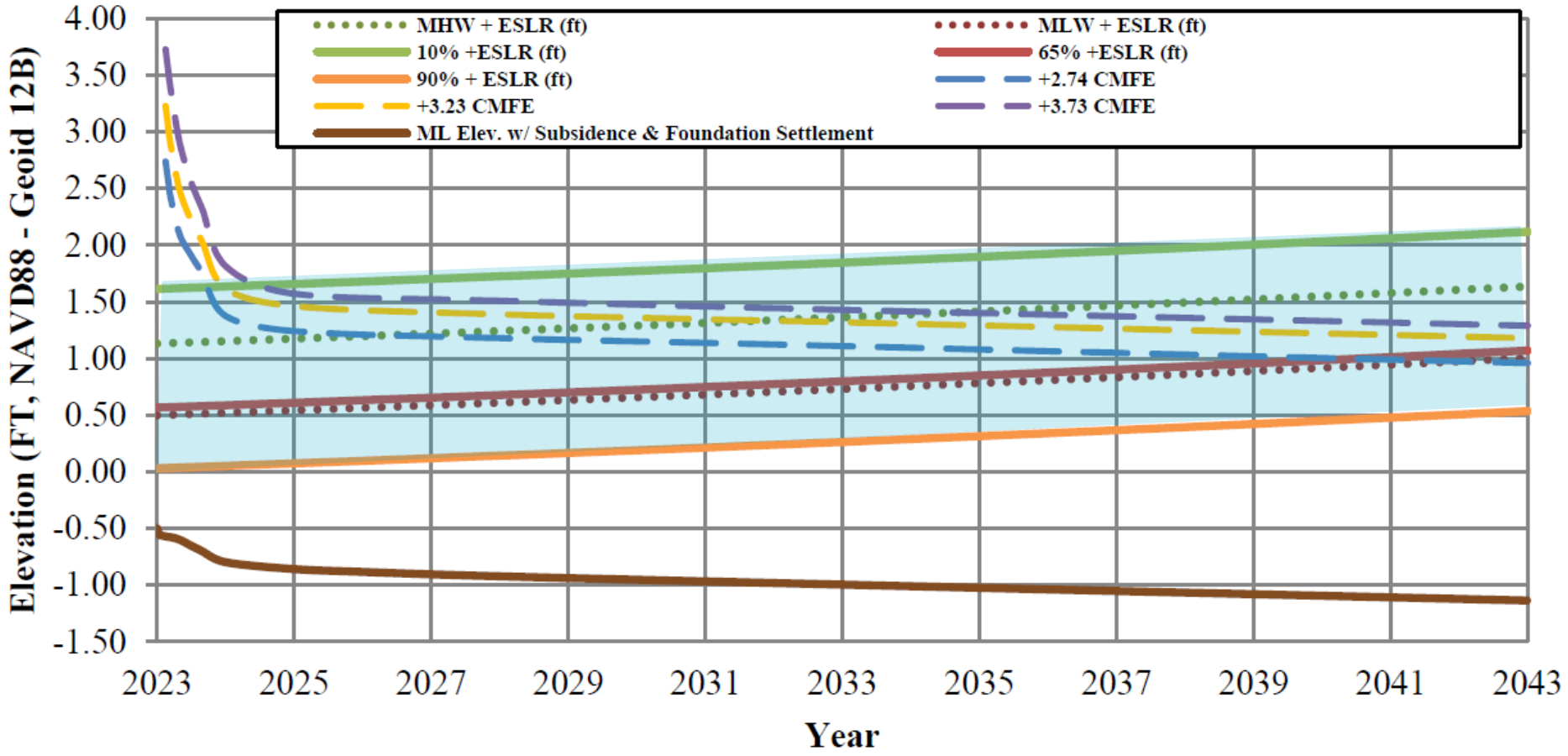


Appendix B: Geotechnical Guidance



3.6 Marsh Creation Area Design

Marsh Fill Elevation – Consolidation Settlement Estimate Example

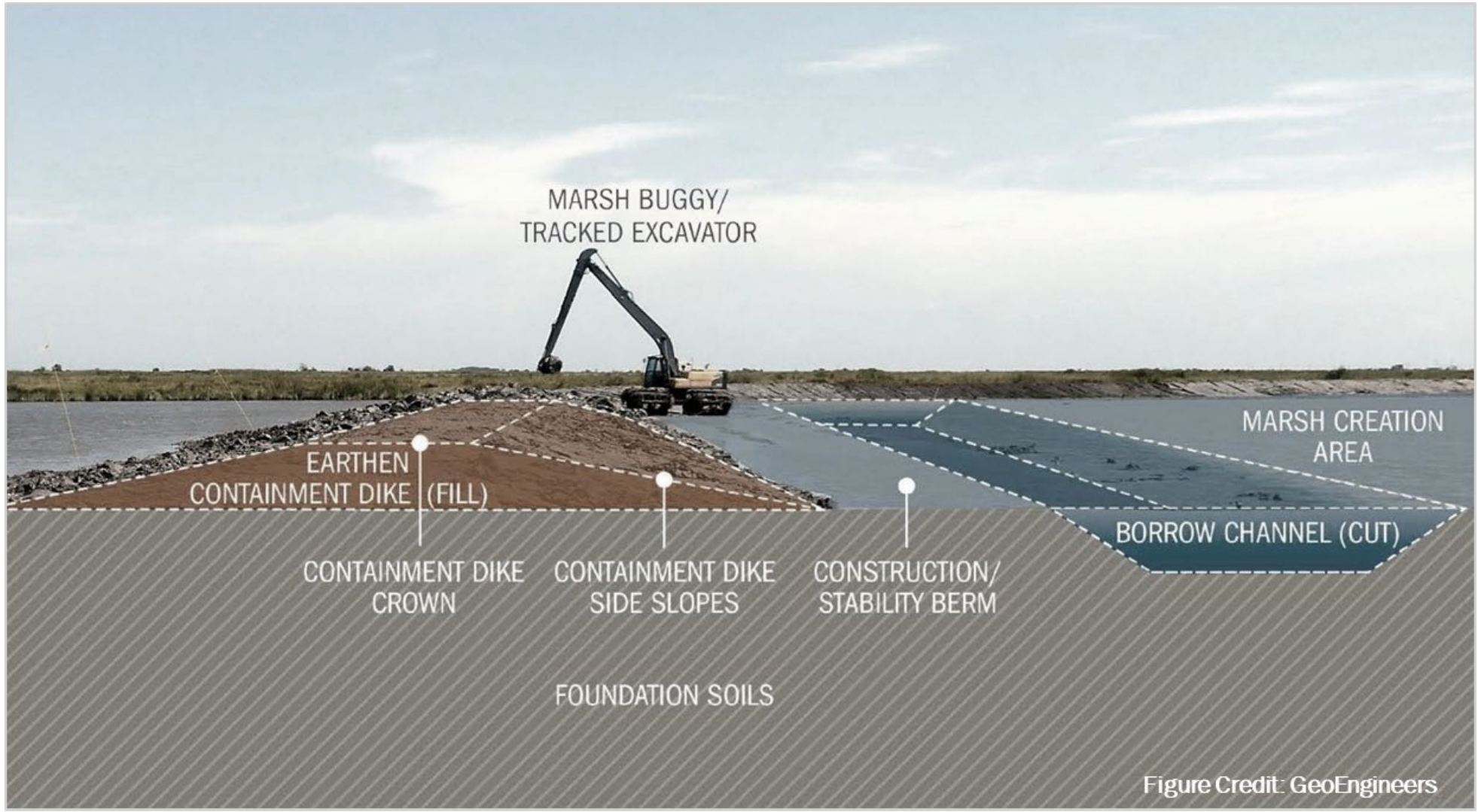


3.6 Marsh Creation Area Design

Marsh Fill Elevation – Estimating MCA Volumes

- The total volume of each MCA should be estimated by using the following:
  - *Utilize the current survey data and the TY20 constructed marsh elevation to achieve the proposed project benefits. (+1.0 to +1.3)*
  - *Utilize borrow area average eo and the TY20 eo to develop cut-to-fill ratio for volume estimation.*
- Optimize each MCA post construction authorization feature layout with new field survey data if required.

Earthen Containment Dikes



3.6.3 ECD Design

Geotechnical Slope Stability Analyses: Table B-5

EARTHEN CONTAINMENT DIKE (ECD) AND BORROW AREA GEOMETRIES TABLE												
			ECD				ECD BORROW			ECD DESIGN	
ECD #	MC AREA #	CMF EL. (FT.)	CREST WIDTH W (FT.) (5 ft. min.)	CREST EL. H (FT.) (1 ft. to 2 ft. min. freeboard above Max CMF EL.)	SIDE SLOPES 1:X_1 (X_1 = 4 to 6)	BENCH OFFSET B (FT.) (20 ft. min.)	BOTTOM WIDTH (FT.) (varies)	MAX. CUT EL. C (FT.) (Typ. -8.0 to -10.0 ft.)	SIDE SLOPES 1:X_2 (X_2 = 2 to 4)	CASE NO.	Stability Analyses FOS (FOS min=1.20)

Table B-5: ECD and borrow area geometries table for stability analyses. Typical and minimums values are shown in parentheses (This is a typical summary table for the GER)

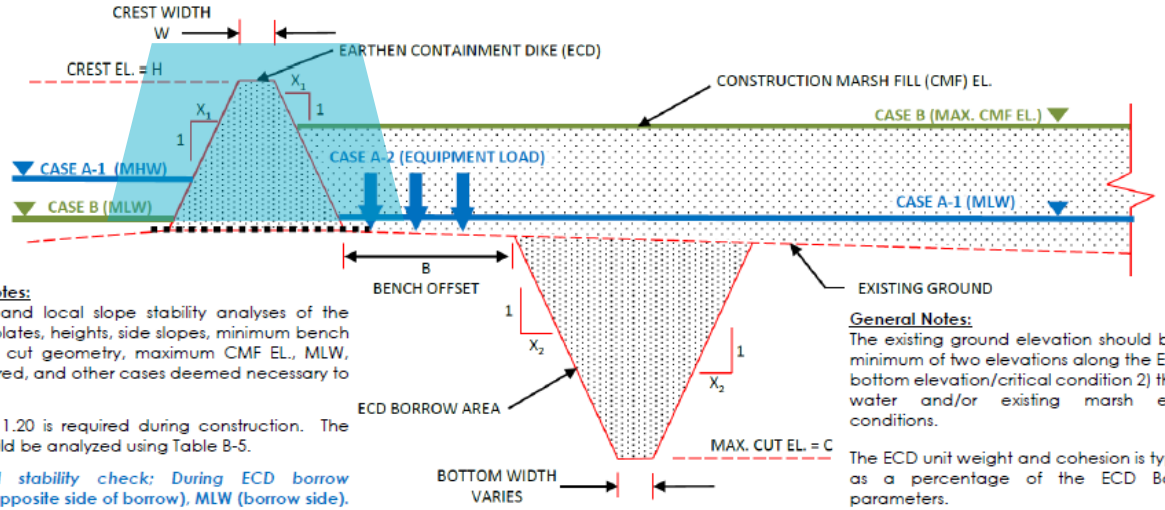


Figure B-5: Typical ECD Template.

Stability Analyses Notes:
Conduct a global and local slope stability analyses of the proposed ECD templates, heights, side slopes, minimum bench offset, borrow area cut geometry, maximum CMF EL., MLW, multi-lift CMF if required, and other cases deemed necessary to ensure ECD stability.

A minimum FOS of 1.20 is required during construction. The following cases should be analyzed using Table B-5.

CASE A-1: Global stability check; During ECD borrow excavation; **MHW (opposite side of borrow), MLW (borrow side).**

CASE A-2: Local stability check; During ECD borrow excavation; Distributed load from excavation equipment, **MLW (borrow side).**

CASE B: Dredged Material placed to CMF EL.; **CMF (max. elevation), MLW (opposite side of borrow).**

General Notes:
The existing ground elevation should be analyzed at a minimum of two elevations along the ECD; 1) the lowest bottom elevation/critical condition 2) the average open water and/or existing marsh elevation/general conditions.

The ECD unit weight and cohesion is typically expressed as a percentage of the ECD Borrow Area soil parameters.

A distributed load of 260 psf is typically used based on large marsh hoe/marsh buggy equipment. The ECD is constructed in several lifts.

A geosynthetic reinforcement fabric may be utilized to achieve the minimum FOS.

3.6.3 ECD Design

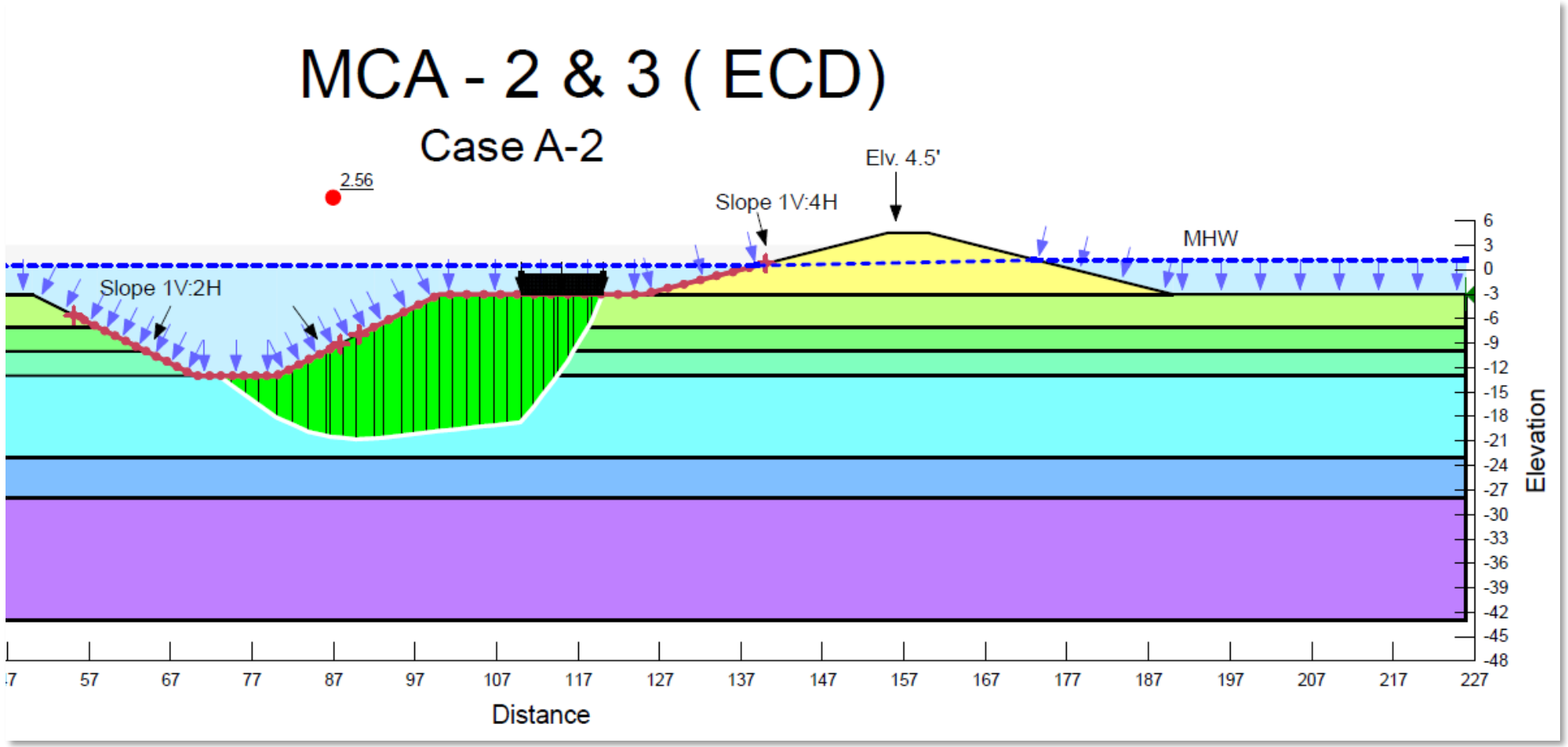
Geotechnical Slope Stability Analyses Requirements

ECD Slope Stability Analyses Requirements, Appendix B-Table B-5:

- Currently provides guidance for the constructability of the ECD.
- Updates to Table B-5 will be developed to evaluate construction overbuild cases during the design process.
  - Enables the Engineer to anticipate potential ECD problems prior to construction.
  - Can be linked to a construction quality assurance program.
  - Provides a consistent analyses requirement.

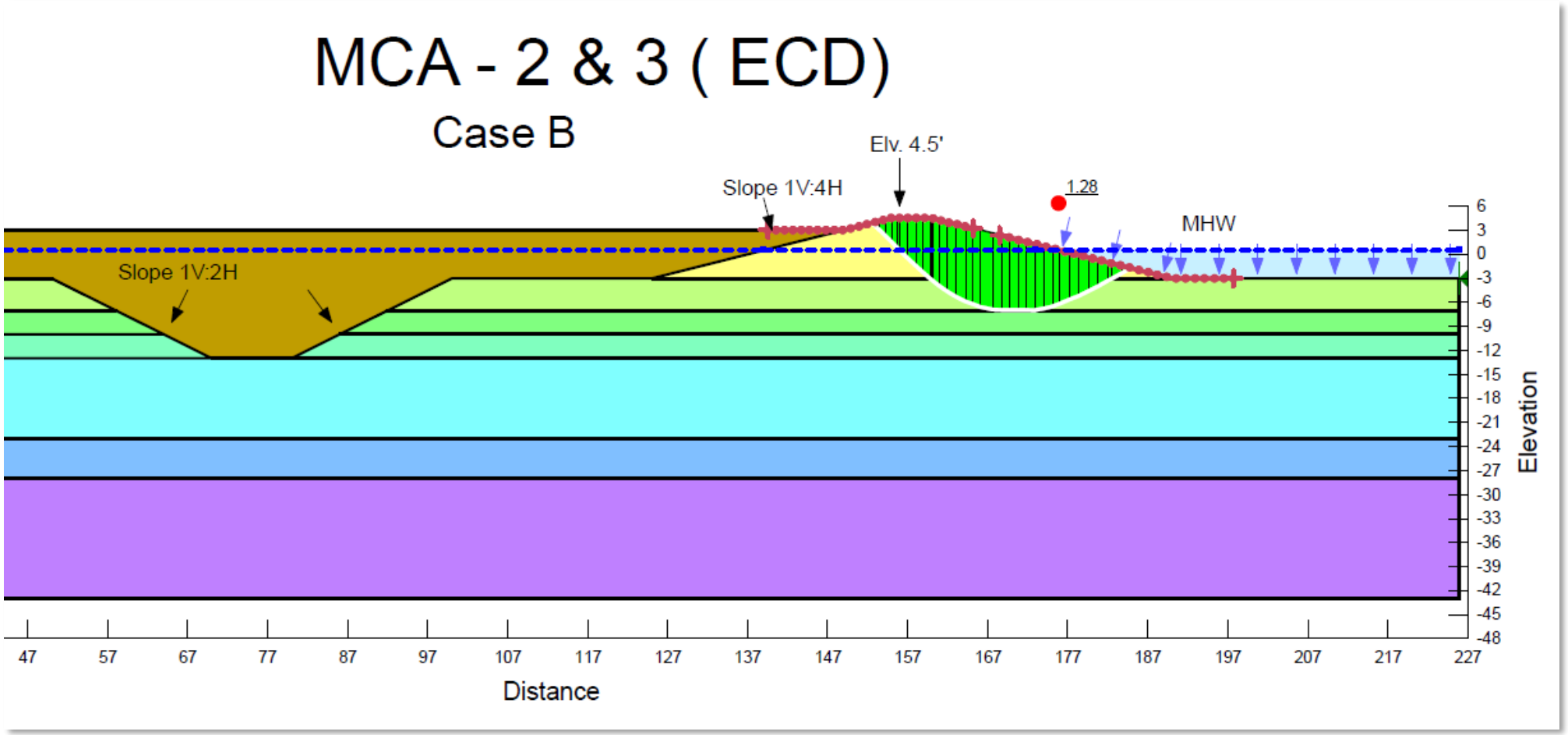
3.6.3 ECD Design

Geotechnical Slope Stability Analyses Example



3.6.3 ECD Design

Geotechnical Slope Stability Analyses Example



3.6.3 ECD Design

Geotechnical Slope Stability Analyses Results Table Example

TABLE 7.0 ECD Slope Stability Analysis Results

MCA #	Mud Elevation (ft.)	ECD CMF Elevation (feet)	Factor of Safety		
			Case A-1	Case A-2	Case B
1	-1.5	+4.25	1.27	2.22	1.27
2	-3.0	+4.50	1.28	2.56	1.28
3	-3.0	+4.50	1.28	2.56	1.28
4	-2.0	+4.25	1.40	1.77	1.39

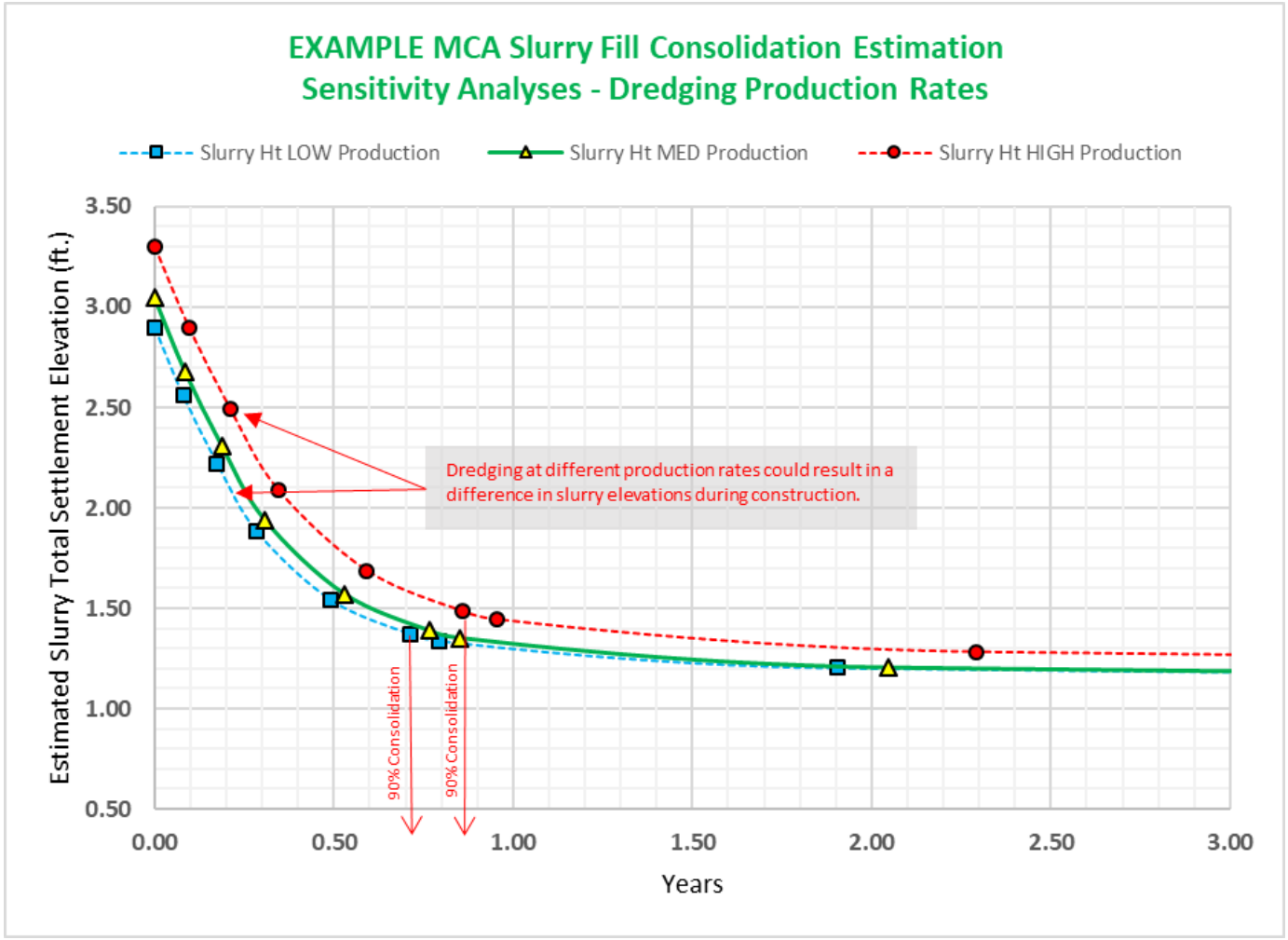
3.6.4 Marsh Creation Area Design

Marsh Fill – Sensitivity Analyses

- Benefits:
  - *Enables the Engineer of Record to evaluate dredging "what if" scenarios during the design phase for project optimization.*
  - *Provides improved confidence in the proposed design and consolidation settlement benefits curve.*
  - *Can provide insight needed for a construction quality assurance plan.*

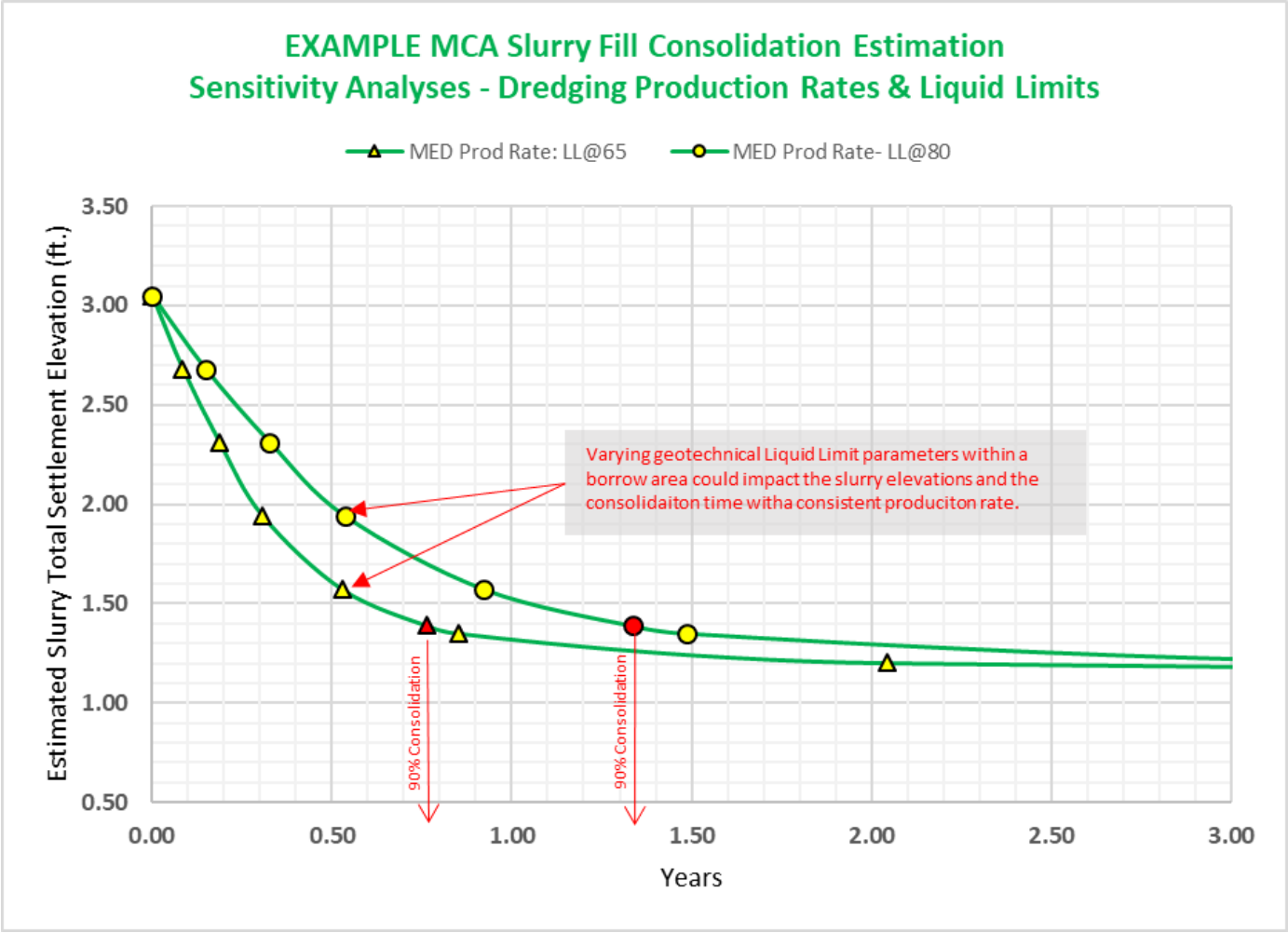
3.6.4 Marsh Creation Area Design

Marsh Fill – Sensitivity Analyses Example



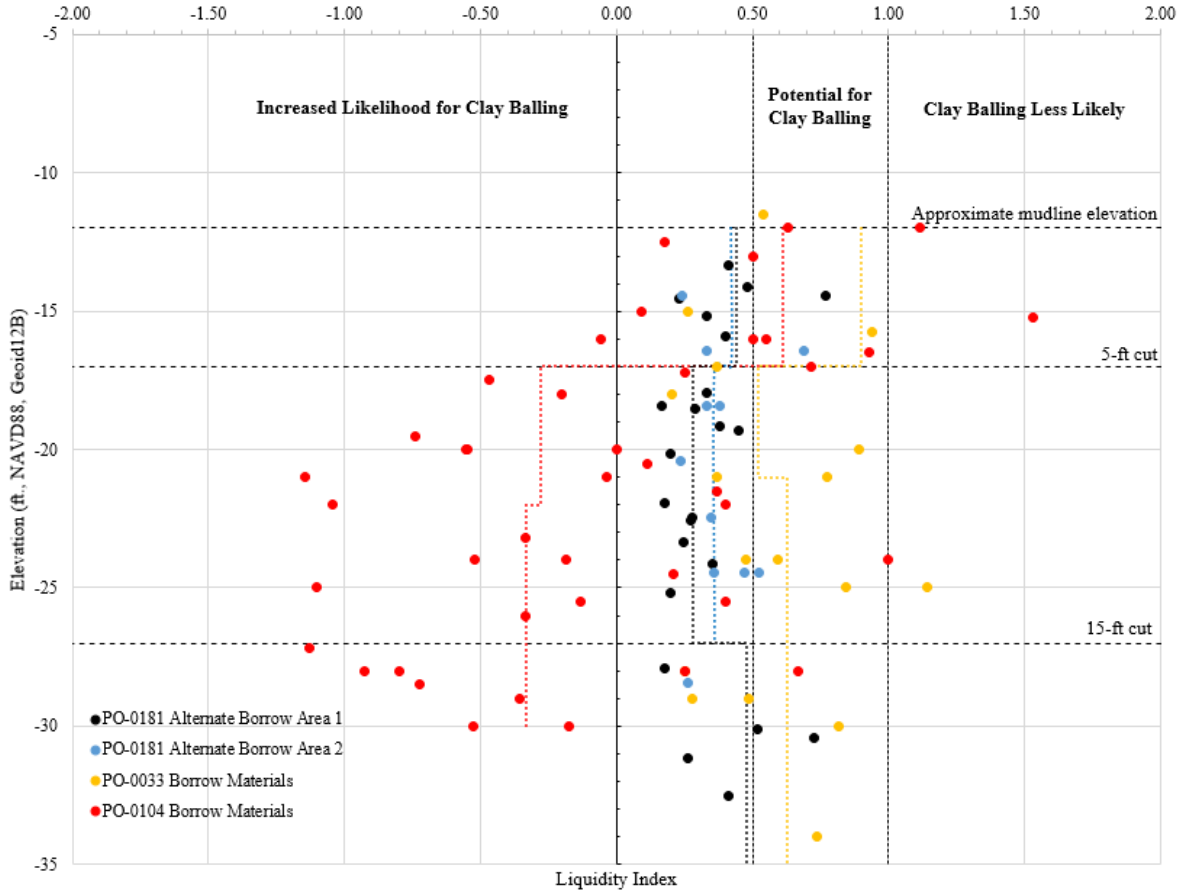
3.6.4 Marsh Creation Area Design

Marsh Fill – Sensitivity Analyses Example

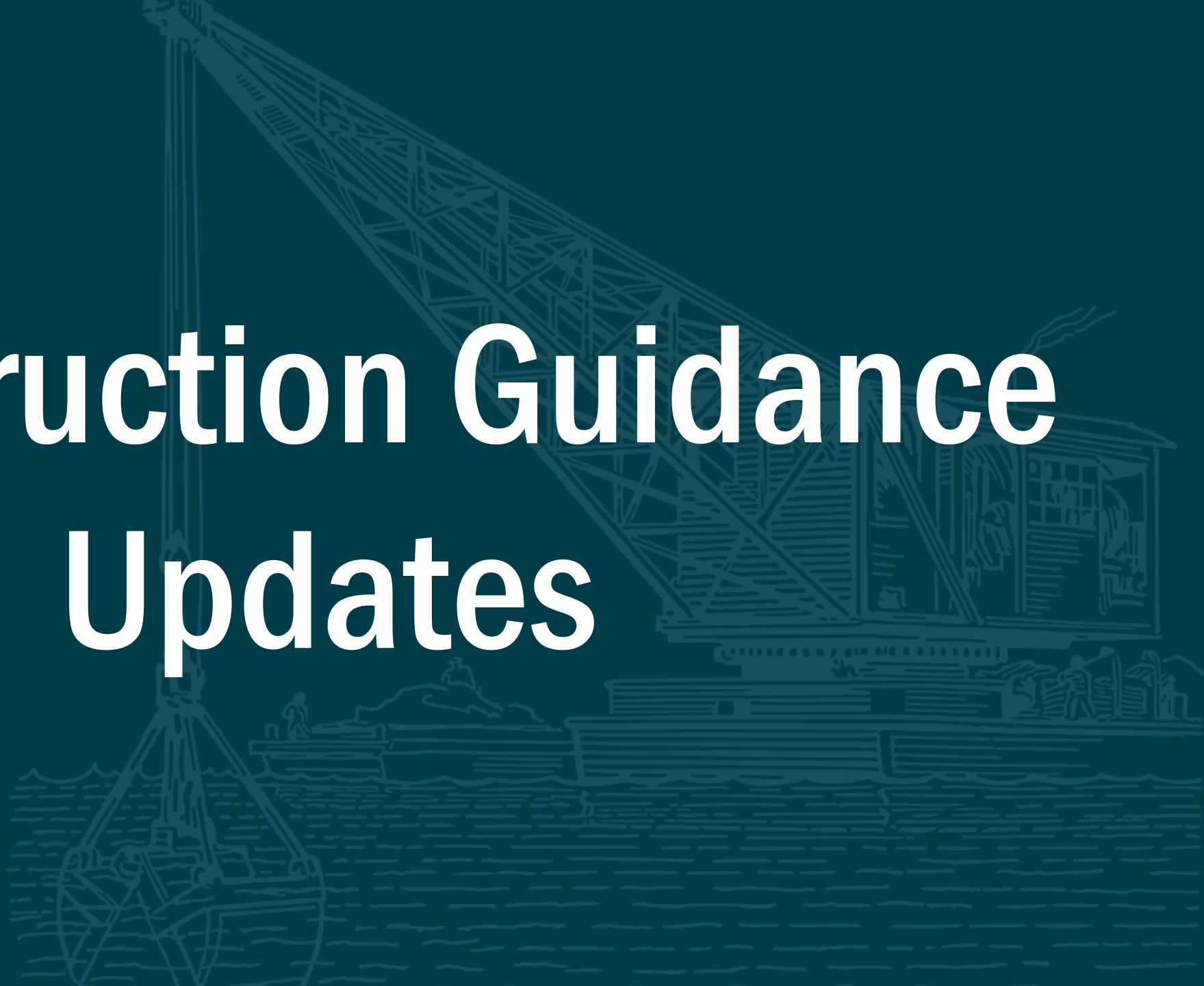


3.7.2.1 Borrow Area Evaluation

Liquidity Index Soil Properties Evaluation



Construction Guidance Updates



Earthen Containment Dike Construction

FIRST AND SECOND LIFTS

GRADING AND SHAPING

FINAL PRODUCT

Marsh Creation Construction

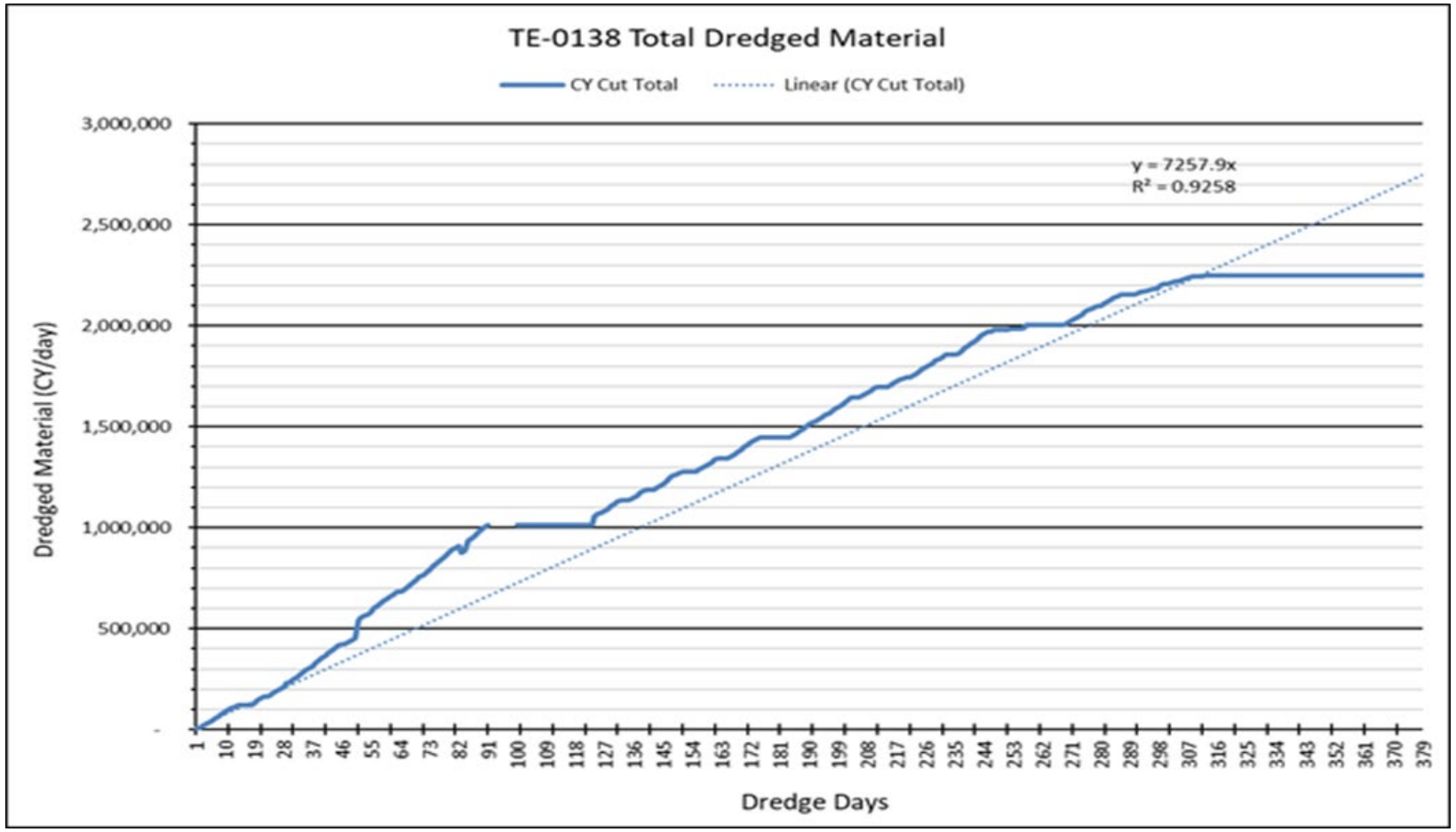
DURING CONSTRUCTION

CONSTRUCTION COMPLETE

1-3 YEARS LATER

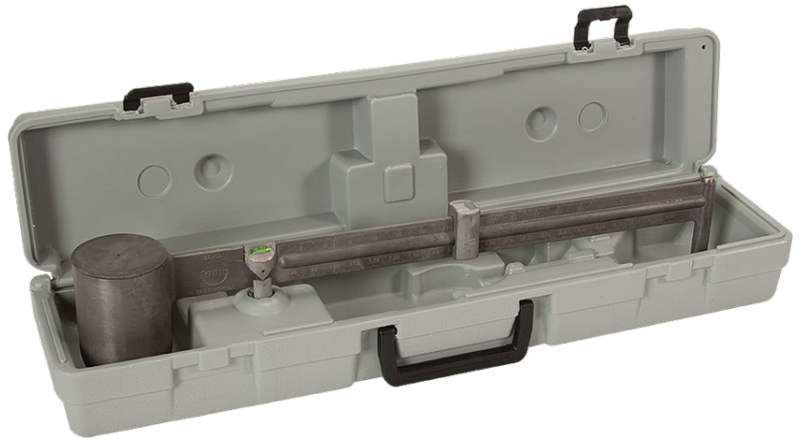
3.10 Construction

Utilize Past Project Data: Dredging Production and Duration



3.10 Construction

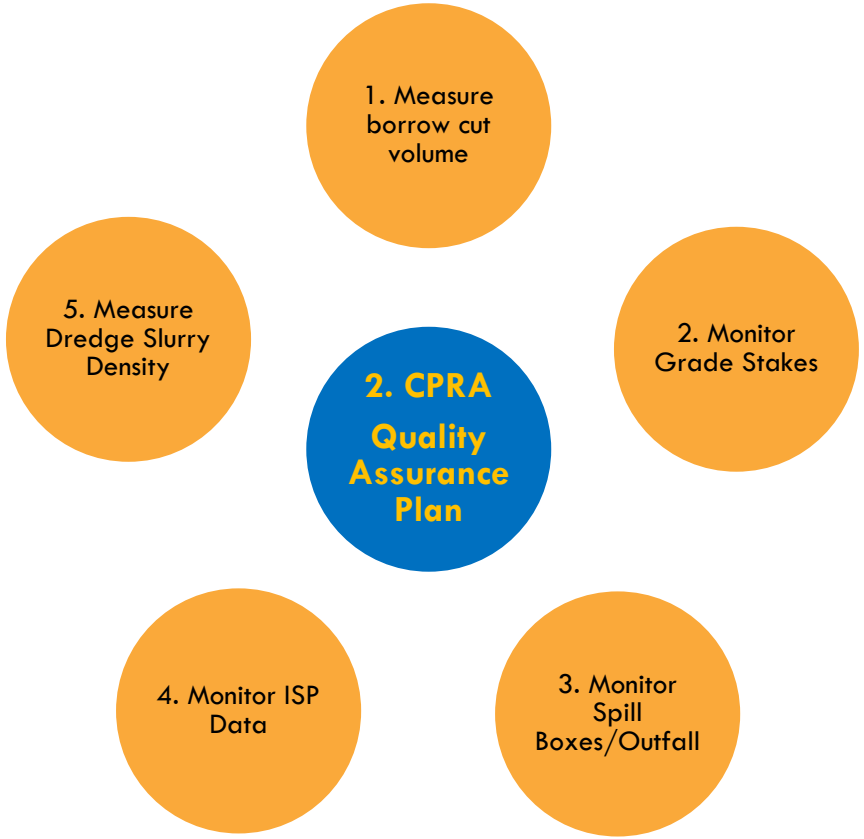
Utilize Construction Project Observation Data: Marsh Slurry Instrumentation



3.10 Construction

Quality Assurance Plan Example

- Benefits:
  - Ensures that the design template/volume has been achieved as per the plans.
  - Ensures that the required volume of solids have been met to achieve the long term marsh platform goals of the project.
  - Develops consistent construction protocol.



Summary & Challenges

Summary

- 3.0 Marsh Creation Design Criteria
  - *3.5.1 Survey Data Acquisition:* optimizes data efforts and deliverables
  - *3.5.3 Geotechnical Subsurface Investigation:* optimizes data efforts and deliverables
- 3.6 Marsh Creation Area Design
  - 3.6.2 Marsh Fill Elevation: optimizes design
  - 3.6.3 ECD Design: optimizes design
  - 3.6.4 MCA Sensitivity Analyses
- 3.7 Marsh Creation Borrow Area Design
  - 3.7.2.1 Borrow Area Evaluation: evaluates potential constructability problems
- 3.10 Construction
  - 3.10.7 Quality Assurance Protocol: Under Further Development

Challenges – Unknown Pipeline Operators

- The project magnetometer survey is evaluated by both the PLS and the EOR during the design phase to delineate existing oil/gas infrastructure, as per ASCE/CI 38-02 recommendations to reduce risk.
- Existing unknown flow-lines could impact proposed project features, may require additional surveys/additional costs, could impact construction equipment access, and reduce construction safety.

Challenges - Changing Landscape

- The project survey data acquisition is typically completed during the 30% design phase of the project.
- An increase in time, 2 to 3 years, between the 30% design survey and the pre-construction survey data collection efforts, could impact ECD constructability, MCA volumes, and marsh creation project construction costs.

Challenges - Construction Costs

- Public Works agencies and CPRA have seen an increase in construction costs since 2022.
  - Supply chain issues
  - Spike in fuel prices
  - Volatility in construction material prices
  - Labor shortages
  - Construction equipment parts

CPRA Actions

- Continue to Utilize ASCE/CI 38-02 to help identify and delineate existing oil/gas operators to promote construction and Operator safety.
- Value engineering efforts are conducted post-construction project authorization to minimize constructability issues due to site changes, and optimize proposed project features and benefits.
- Construction costs from recently bid marsh creation projects and market fuel costs are evaluated to estimate construction costs.
- Updating the MCDG1.0 based on applied data and experience will provide an updated methodology for marsh creation project design and construction optimization, and ensure efficient project implementation.
- Construction quality assurance protocol for ECD and MCA construction provides inspection consistency's and reduces construction delays.

Why Utilize Standards ?

- Reduces Risk for the Owner, Contractor, and the Engineer of Record.
- Serves as the minimum design standard consistent with sound engineering practices for those engaged in designing and constructing marsh creation projects within the Louisiana Coastal Zone.
- Provides consistent design protocol enabling the optimization of design efforts needed to efficiently implement marsh creation projects.
- Aids in the development of delivering “due diligence” for project implementation.
- It’s the right thing to do!

Discussion

Upcoming Webinars

Coastal Industry Week: Webinar Series

Tuesday, March 19

12:00 p.m. – Chandeleur Islands Engineering and Design Update

Presented by Todd Baker

Coastal Industry Week: Webinar Series

Wednesday, March 20

12:00 p.m. – Sediment Management for a Sustainable Ecosystem

Presented by Syed Khalil

Coastal Industry Week: Webinar Series

Thursday, March 21

12:00 p.m. – Illustrating Coastal Change Using High Tide Flooding and Historic Storms

Presented by Stuart Brown

Coastal Industry Week: Webinar Series

Friday, March 22

12:00 p.m. – Designing for the Birds: Considering Avian Habitat Needs in Coastal Restoration Projects

Presented by Katie Freer

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