

DREDGED MATERIAL MANAGEMENT AREA WEIR DESIGN, THE STATE OF THE ART

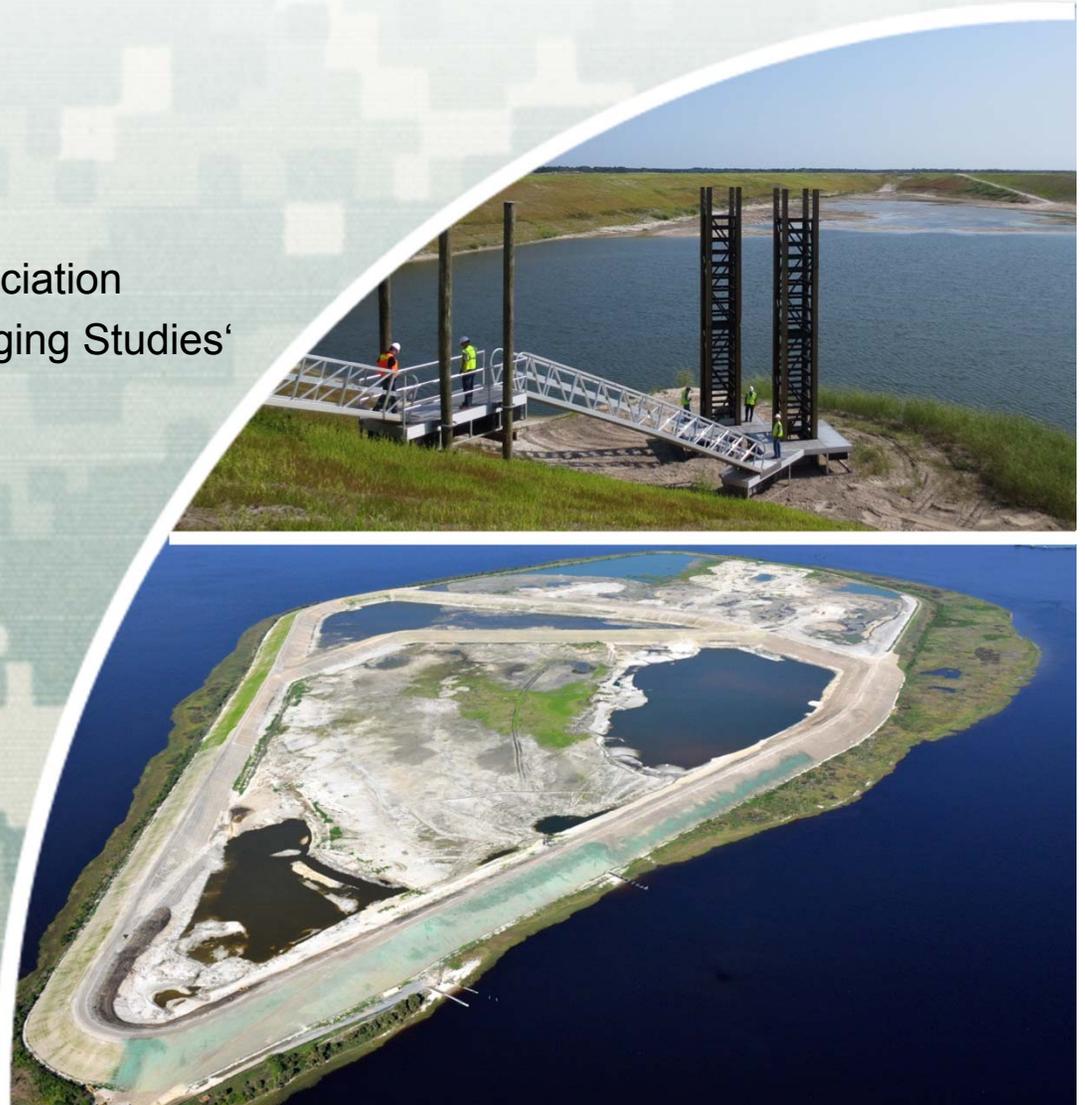
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US Army Corps of Engineers
BUILDING STRONG[®]

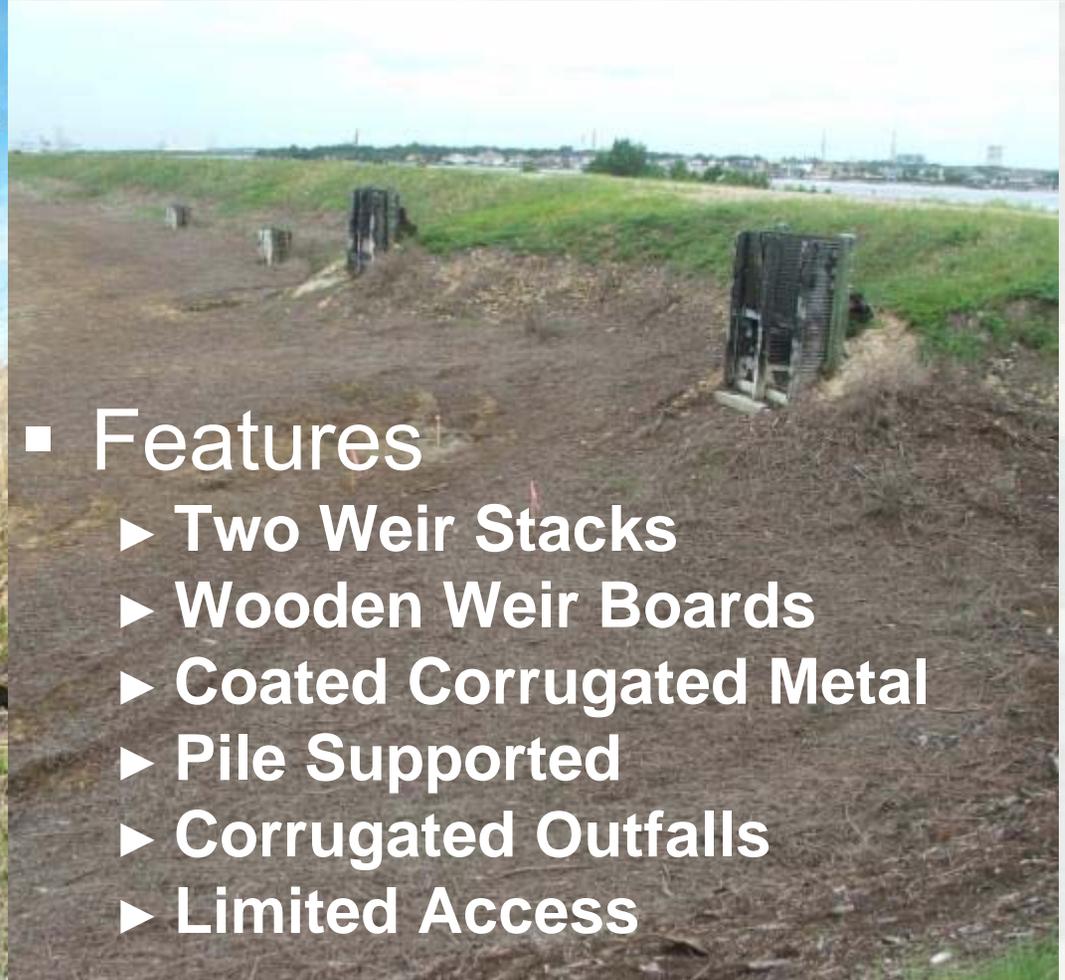


Agenda

- **Background**
- **Box riser weir SAJ experience**
- **Floating weir concept SAM**
- **Complete composite weir system**



Historical Standard



- Features
 - ▶ Two Weir Stacks
 - ▶ Wooden Weir Boards
 - ▶ Coated Corrugated Metal
 - ▶ Pile Supported
 - ▶ Corrugated Outfalls
 - ▶ Limited Access



Intensive Field Installation



Problems Encountered



Asphaltic
coating and
CMP

Corrosion



Lessons Learned



Lessons Learned



Asphaltic coated
CMP becomes
perforated pipe



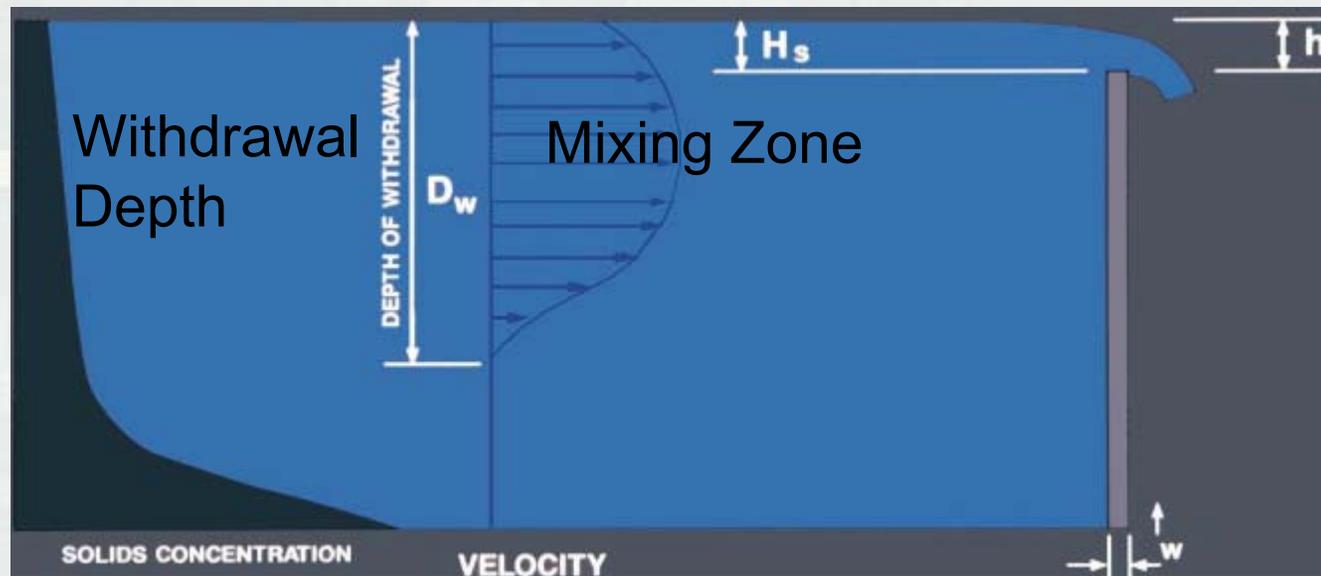
Resulting in
dike toe
failure

Improved Design Criteria SAJ

- **Simplicity**
 - Less structures/pieces
 - Shop Fabrication
 - Easier to install
- **Flexibility**
 - Ability to utilize in various locations
 - Easily extended vertically or horizontally
- **Redundancy**
 - At least two nearly independent systems

Weir Crest Length

- Typical need 24 to 40 feet
- Weir crest length is directly proportional to withdrawal depth which greatly influences turbidity



Improved Design Criteria

- **Require at least 2 Weir Structures**
- **12 to 20 Feet of Crest for Each**
 - Box Weir Design of 3 to 5 feet



Shop Fabricated Box Riser

- Steel frame easily installed



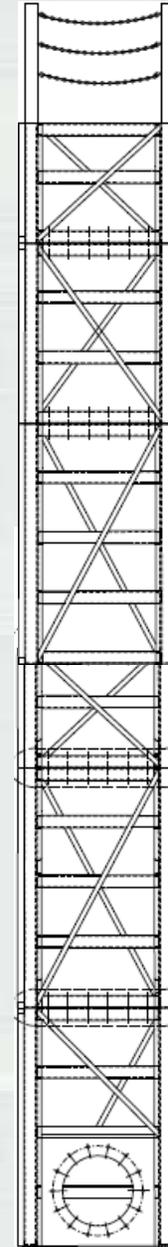
Flexibility

- Spread Foundation
 - ▶ Resist Differential Settlement
 - ▶ Displacement Buoyancy



- 8 Feet Tall
5'x5' Box
Riser

- 38 Feet Tall
4'x4' Box
Riser
- 20 Feet Tall
4'x4' Box
Riser



Flexibility

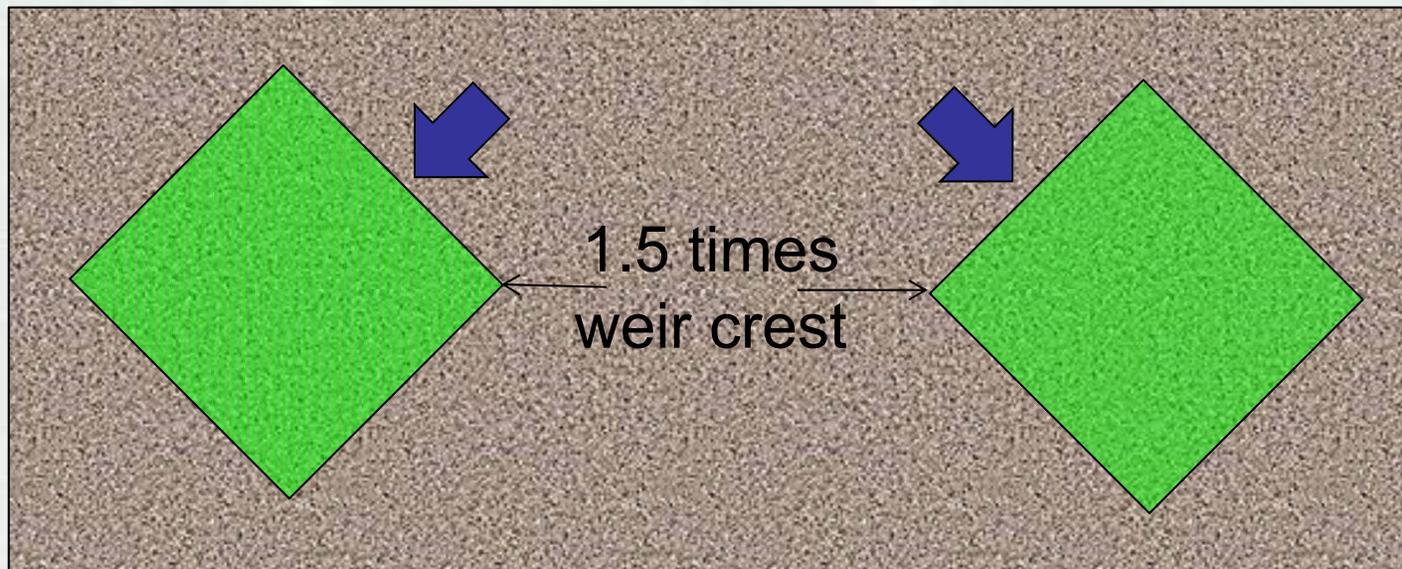


- Twin 38' Tall 4'x4' Box Riser



Foundation

- Single Concrete Foundation
- Crest Elevation Identical



- Reduce Slab Footprint

Access

Very limited
dangerous



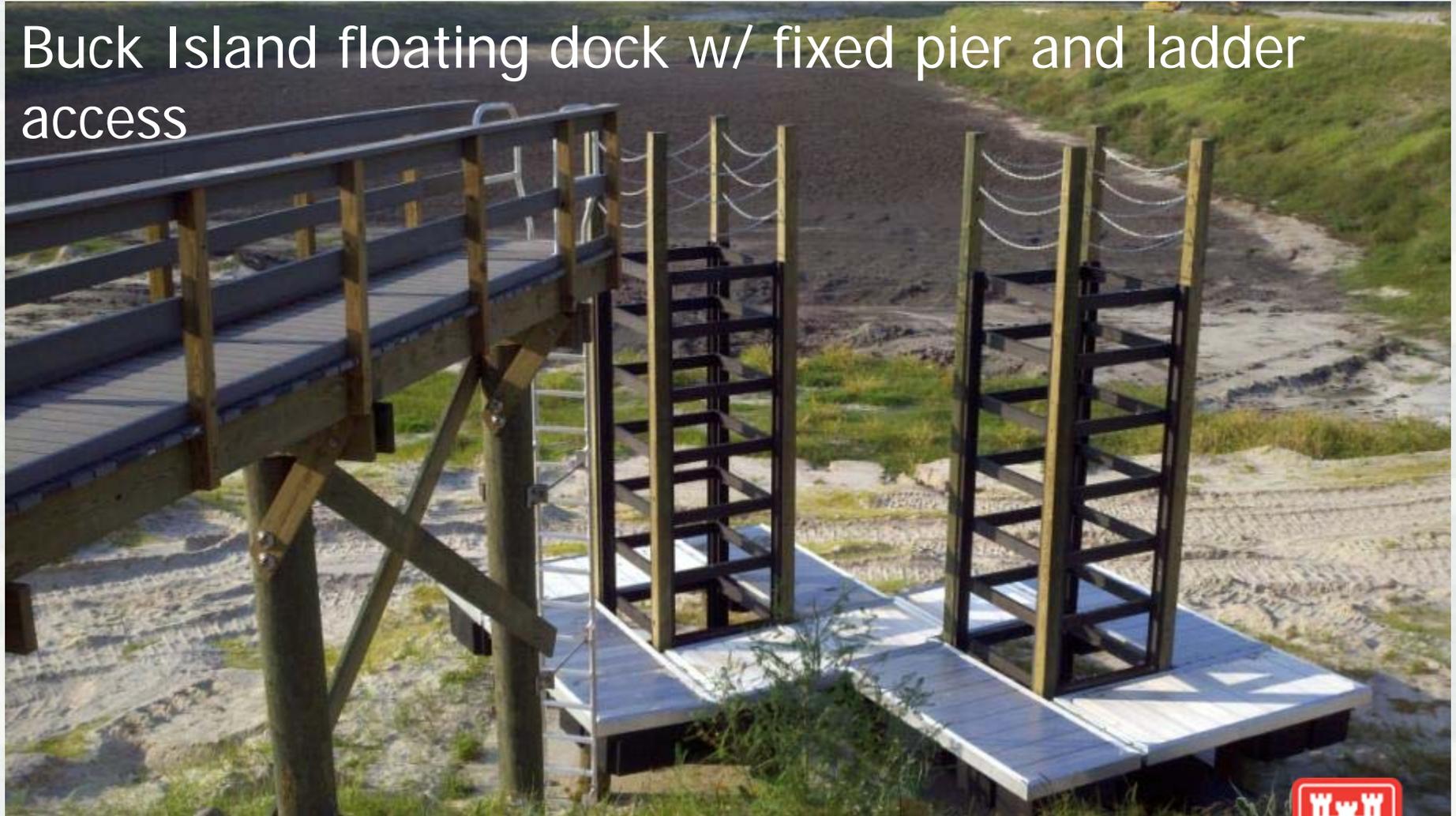
Access



Delray Beach MSA-641a fixed top access
and 4 sided ladder access

Access

Buck Island floating dock w/ fixed pier and ladder access



Access



Bartram Island Cell F
floating dock w/ gangway
access



Access



Two segment gangway
w/ intermediate floating
dock, 30 vertical feet



Permanent Installation



HDPE Outfall Pipes
Composite cradles



Permanent Installation

HDPE Outfall Pipes
Composite cradles

Limited impact that
permanently span
existing wetlands



Environmental Safety

Emergency
Flap Gates



ERDC
Engineer Research and
Development Center

Dredging Summit & Expo 2014

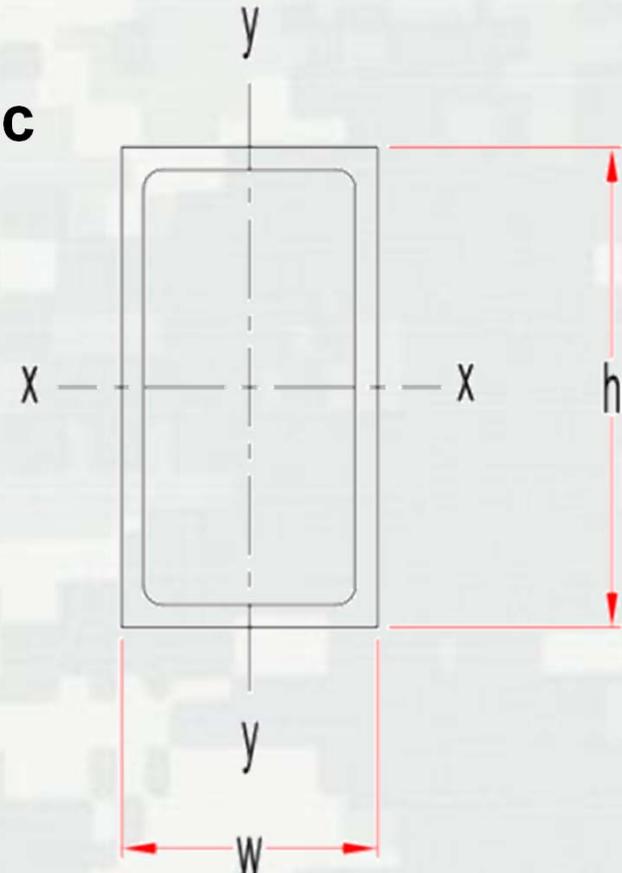
BUILDING STRONG®

Weir Boards



Composite Weir Boards

- **Fiberglass Reinforced Plastic**
- Stronger
- Hollow Core
- Lighter = Safer
- Better fit = less turbidity
- 1.8 times denser than water



Value Engineering Study

- Assumptions
 - 2 Half-Pipe Riser Projects – Historic Style
 - 10 yr life
 - ~ \$715,000
 - 3 Box Riser Projects – Coal Tar Epoxy Steel
 - 25 yr life
 - ~ \$514,000
 - Overall Life Cycle of 50 years
 - Includes \$100K Misc. Design Cost
 - Federal Discount Rate 4.125%



Life Cycle Cost Comparison

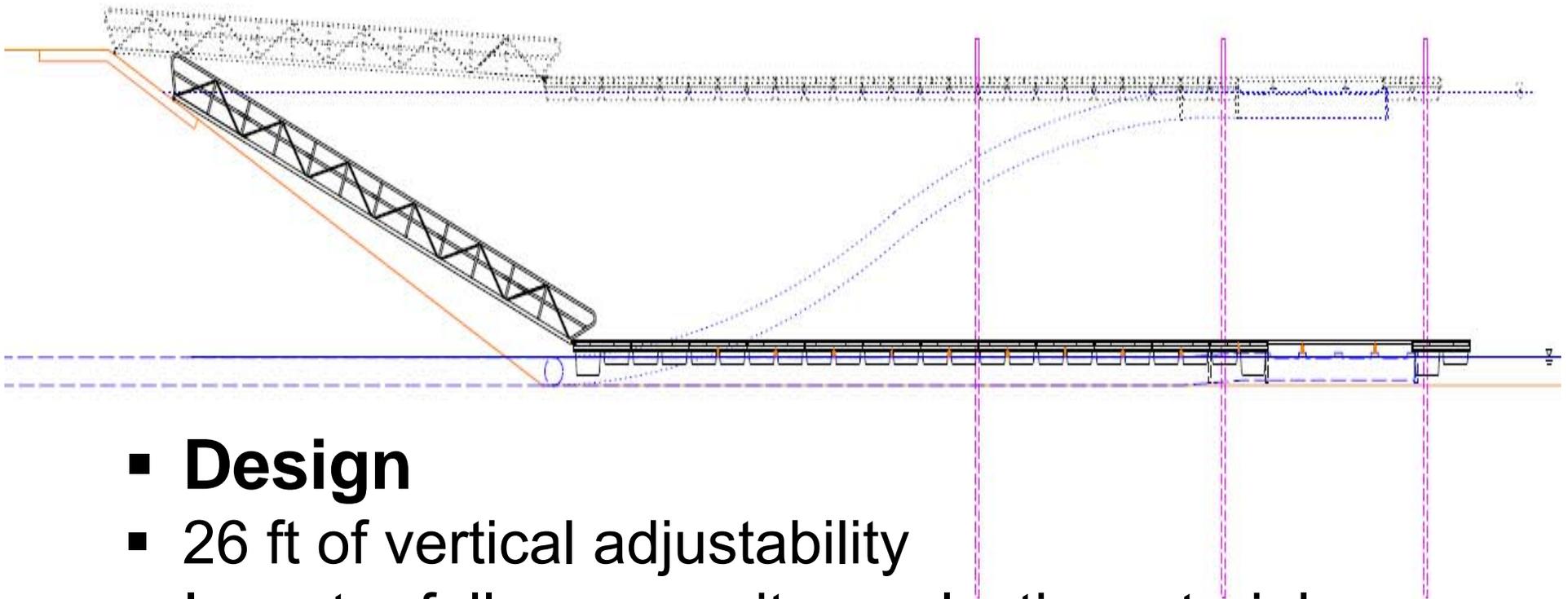
- Costs – Half-pipe vs. box riser coated
 - Initial Cost Savings
 - ~\$201,000 = 28%
 - Life cycle Savings
 - ~\$1,216,000
 - **Total Initial and Life Cycle Savings**
 - ~\$1,417,000

SAJ Weir System Design

- SAJ system met the intent of the improved design criteria
 - Dual Box Risers on Slab
- Further Improvements
 - Floating Docks Access
 - HDPE Outfall Pipes
 - Emergency Shutoff Flap Gates
 - Composite Weir Boards
 - Increased Life-cycle
 - Lower Initial Cost
 - Safety
- Drawbacks – coated steel and concrete



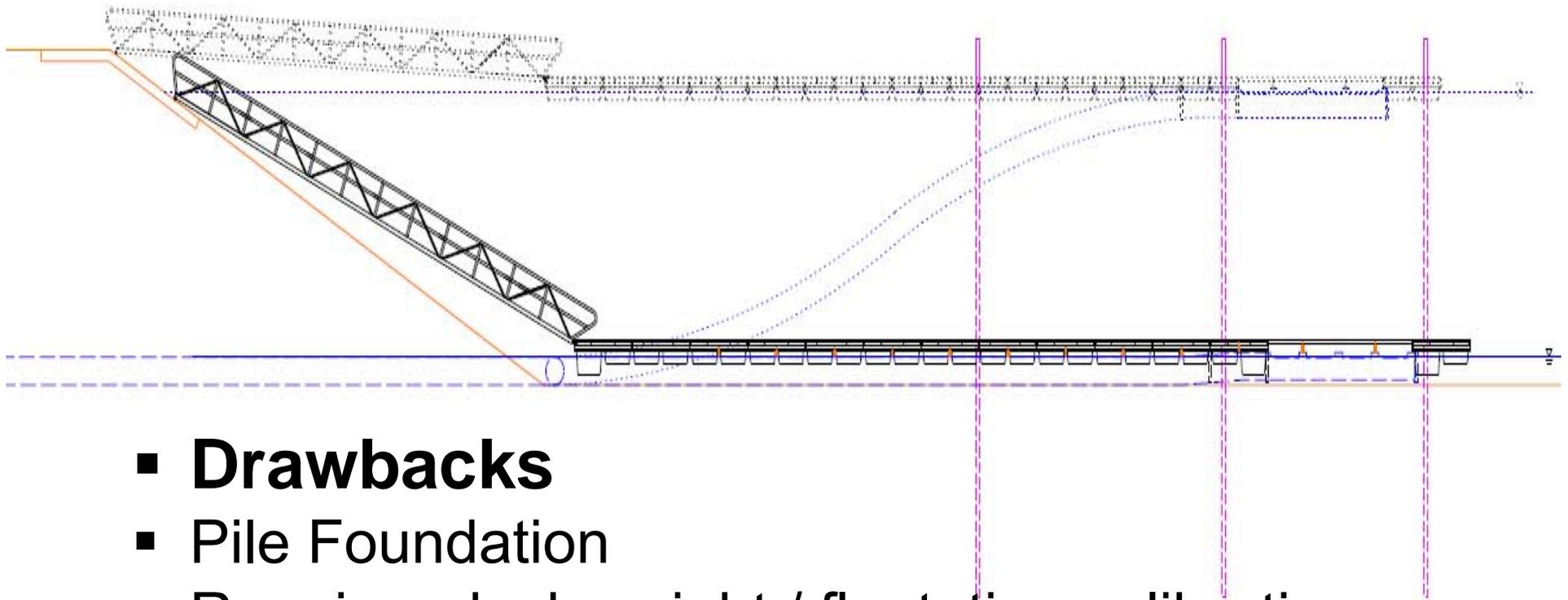
Floating Weir System Concept SAM



- **Design**
- 26 ft of vertical adjustability
- In-water fully composite or plastic materials
- All components off the shelf
- Withdrawal depths constant more efficient operation able to meet tight WQ regs



Floating Weir System Concept SAM

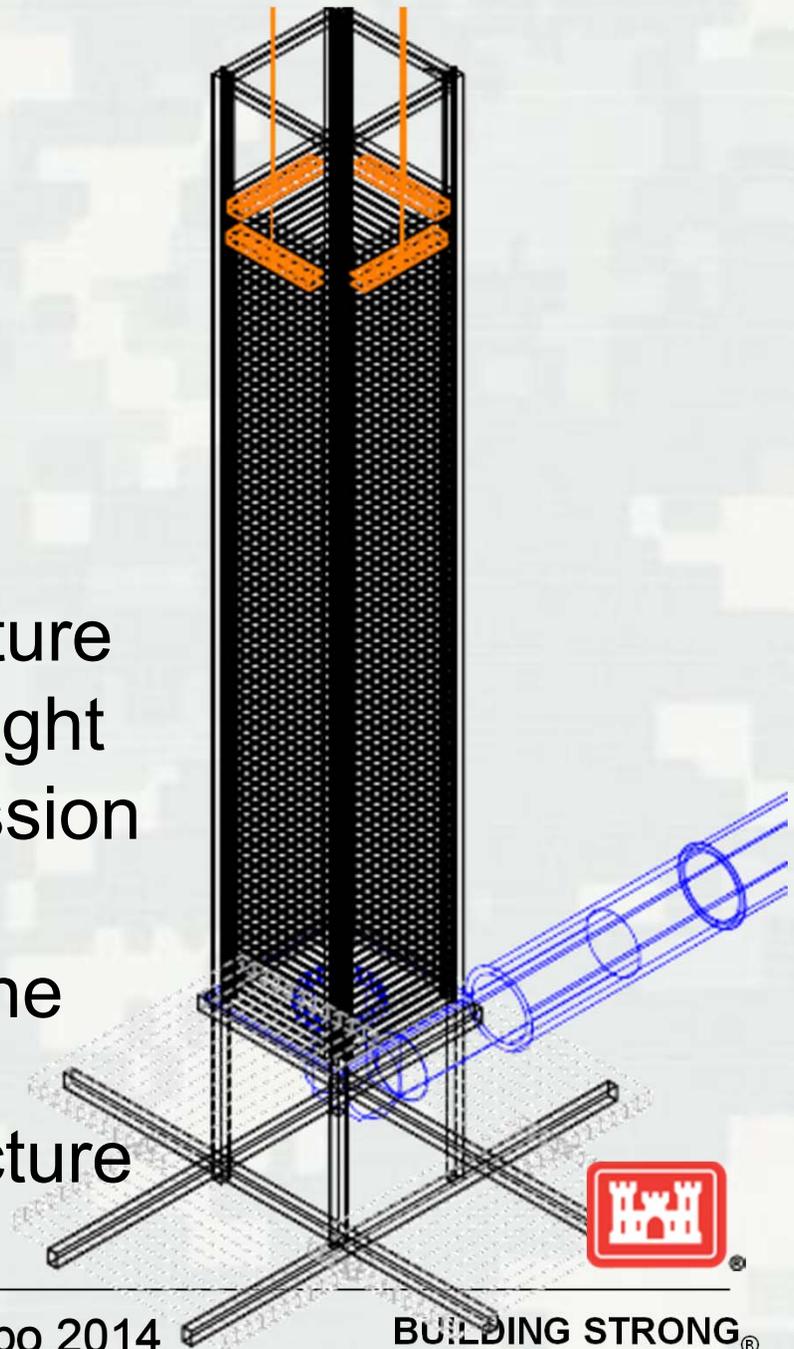


- **Drawbacks**
- Pile Foundation
- Requires dock weight / floatation calibration
- Est. material cost \$135k, not including installation and pile design

Complete Composite Weir System

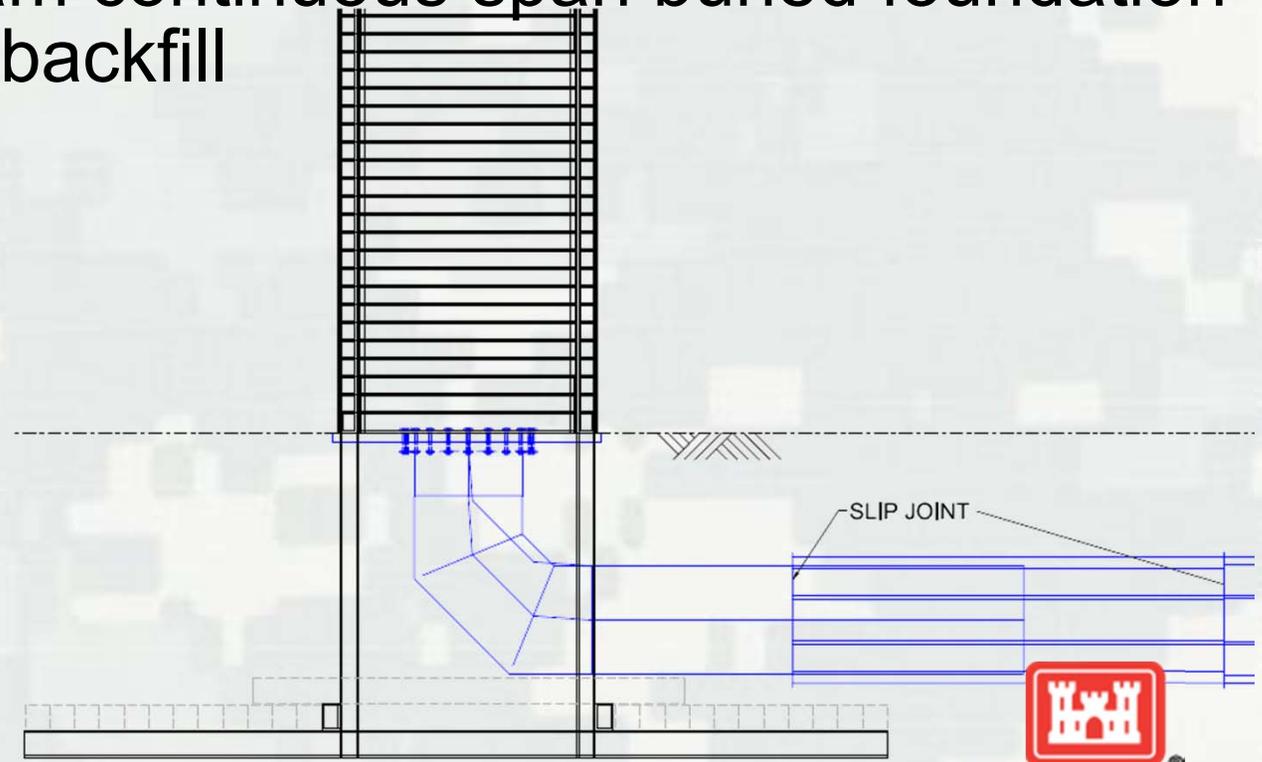
Patent Pending

- 26 ft of vertical adjustability
- 4ft by 4ft (16 feet of crest)
- Fully composite superstructure
- Pre-fabricated and light weight
- Weir boards resist compression
- HDPE floor and outfall
- Nearly all components off the shelf
- Adjustable from top of structure



Complete Composite Weir System

- Outfall slip joint to ensure dike settlement not transferred
- No pile or concrete foundation
- Composite beam continuous span buried foundation using granular backfill
 - ▶ Excavatable
 - ▶ Moveable
 - ▶ Re-usable



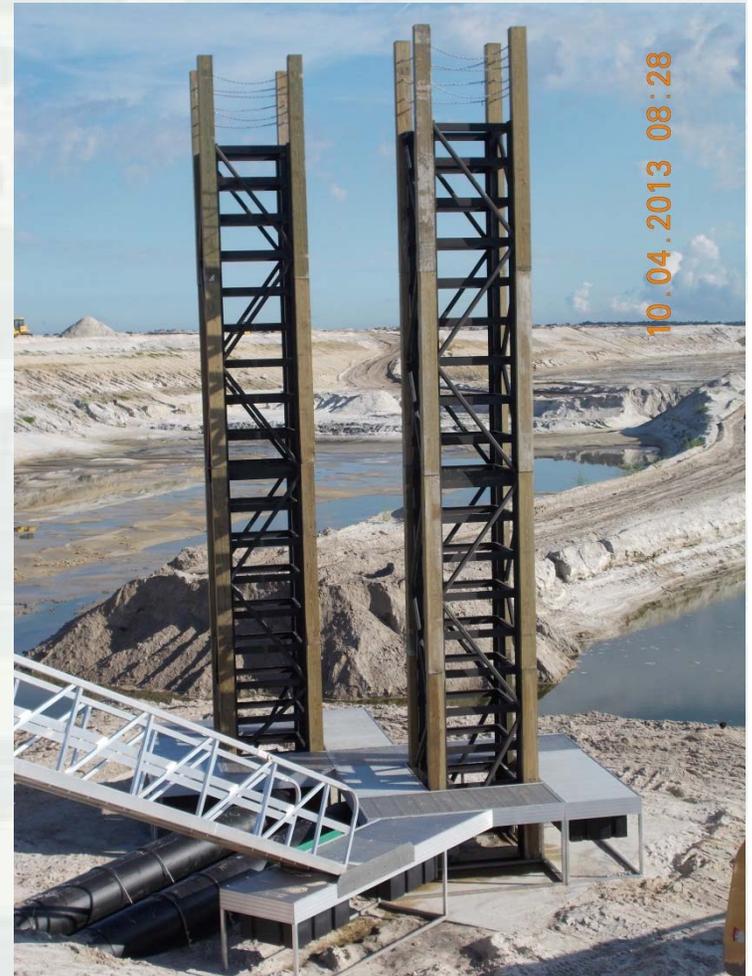
Complete Composite Weir System

- **Cost**
- Est. material cost \$66k per box riser, not including installation
- **Drawbacks**
- 60-90 day manufacturer lead-time
- 20 year composite material warranty
- Composite materials do not yet have standard design guidance
- Materials and manufacturing methods are closely guarded trade secrets



Summary

- **Box riser weir SAJ**
 - Less costly system
 - Longer life cycle
 - Safer
 - Environmental precautions
- **Floating weir concept SAM**
 - Optimized withdrawal
- **Complete composite weir**
 - Always ready non-corrosive
- **These systems can benefit the USACE, Ports, Industry and A&E**



Thank You! Questions?



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