



Western Dredging Association

2018 Gulf Coast Chapter Annual Meeting

Bottom-Sealed Filter Barrier
Technology and Its Application
for Controlling Suspended
Sediments,
Turbidity and Other
Contaminants During Dredging,
Construction and Demolition

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MACKWORTH-ENVIRO
Aquatic Barrier & Screening Solutions



WHAT DO YOU DO FOR SEDIMENT CONTROL IF...

You are Designing a Remedial Action for Contaminated Sediment Removal at a Former MGP Site along the shore of a Deepwater Shipping Harbor on the Maine Coast?

And, the contaminated sediment extends to both intertidal and shallow subtidal zones.

Also, By the Way:

- Depth ranges to 35 ft & Tides range to ~14 ft
- The narrow navigation channel is less than 150 ft away and tugs pass and oil tankers pass by regularly
- There is a winter flounder protection season



OR, WHAT IF ...

You are Designing a Tidal Creek Habitat Creation Project through a Fine-Sediment Marsh and Opening into a Canal off of a Marine National Park in southeastern Florida.

And, the National Park doesn't allow any increase in turbidity (e.g., <1 ntu) into the Bay.

Also, by the Way:

- Clay Particles – Extremely Dispersible, Almost Uncannily So
- There will be High Flows – Sudden and Significant when the canal berm is breached after the creeks are constructed
- There will be three creeks! And,
 - There are likely to be crocodiles!



OR, HOW ABOUT IF ...

You are Responsible to Design a Remedial Action to Remove Contaminated Sediment from within a Sheet-Pile Enclosed Large Vessel Dry Dock in a British Columbia Harbor?

And, the Area Outside the SPW has previously been remediated -- so Contaminated Sediment Release is Not an Option

- Existing SPW to Low Tide Height Only
- Design Challenges:
 - Wall-Top Design
 - High Tidal Flows
 - Filtration Effectiveness



AND, FINALLY, HOW ABOUT IF ...

You must design for debris and sediment containment for demolition of large concrete bridge piers in a Southern California major port and maintain the 78 ft channel between two of the piers?

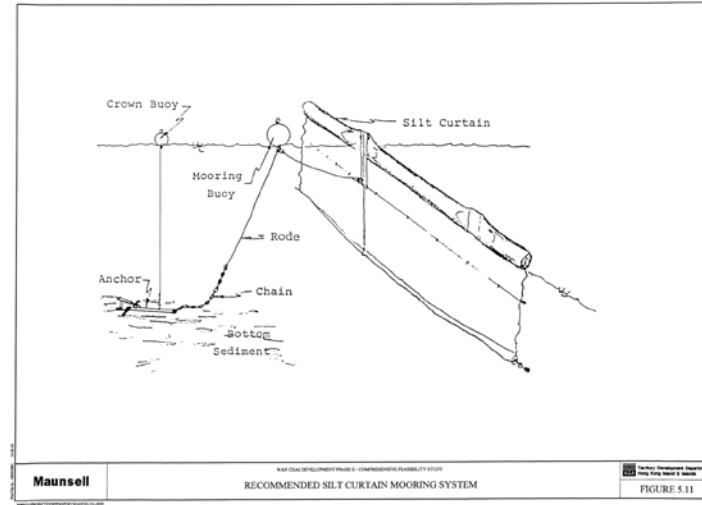
And constraints include:

- Stringent Water Quality Objectives
- Urgency for regulatory approvals and implementation
- No SPWs due to submerged gas line and proximity of RR Bridge



FOR YOUR FOUR PROJECTS, WHAT ARE YOUR CONTAINMENT OPTIONS FOR SUSPENDED SEDIMENT?

- Silt Curtains?
 - Sheet Pile Walls/Cofferdams?
 - "Other"?
- ... Are Bottom-Sealed Filter Barriers an option?



WHAT IS BOTTOM-SEALED FILTER BARRIER TECHNOLOGY?

- Floating filtering curtain that includes seal to the bottom and completely enclosing the area of sediment disturbance
- Have been applied for various purposes since 1
- Recent sediment control applications in diverse circumstances have met challenge
 - High velocity and bi-directional currents
 - Deep water
 - Large tidal ranges
 - Restrictive Water Quality Objectives



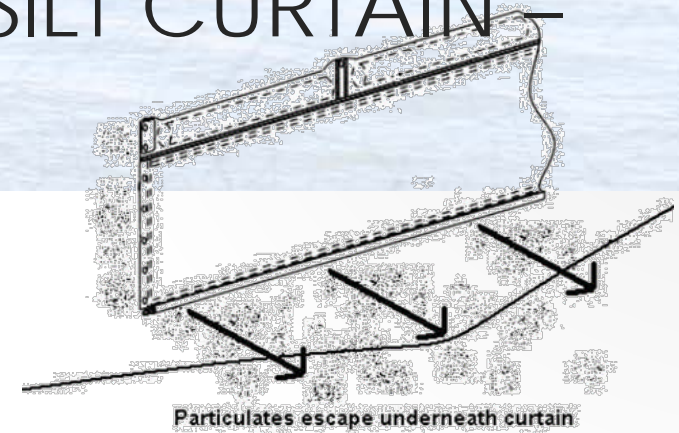
BOTTOM-SEALED FILTER BARRIER VS. SILT CURTAIN – DIFFERENCES

Silt Curtain

Flotation, Curtain, Ballast,
Anchored the surface,
Generally 1+ ft from the
Bottom

Bottom can move with
water flow

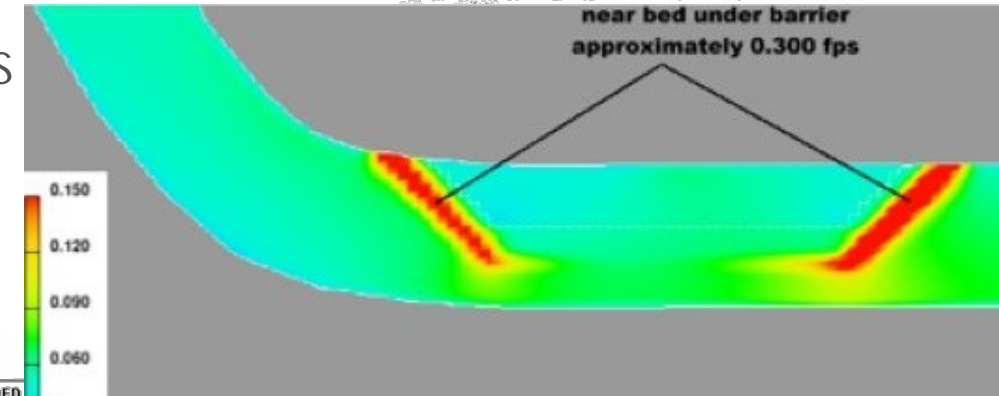
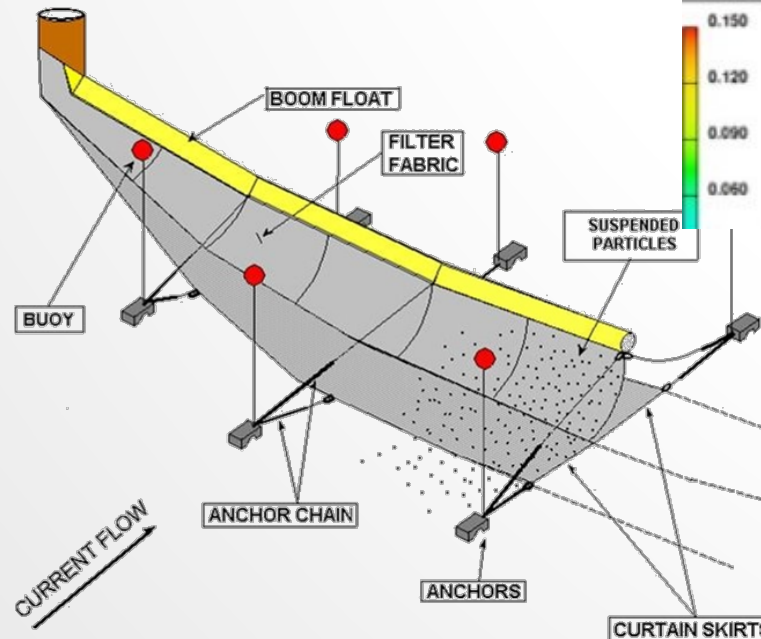
Primary Issue- If water
movement, particulates
pass under the curtain



Bottom-Sealed Filter Barrier

Sealed – Bottom, Top and
Sides
Anchored – Top and
Bottom

Durable, Able to
Handle Loads



Curtain Geotextile Options

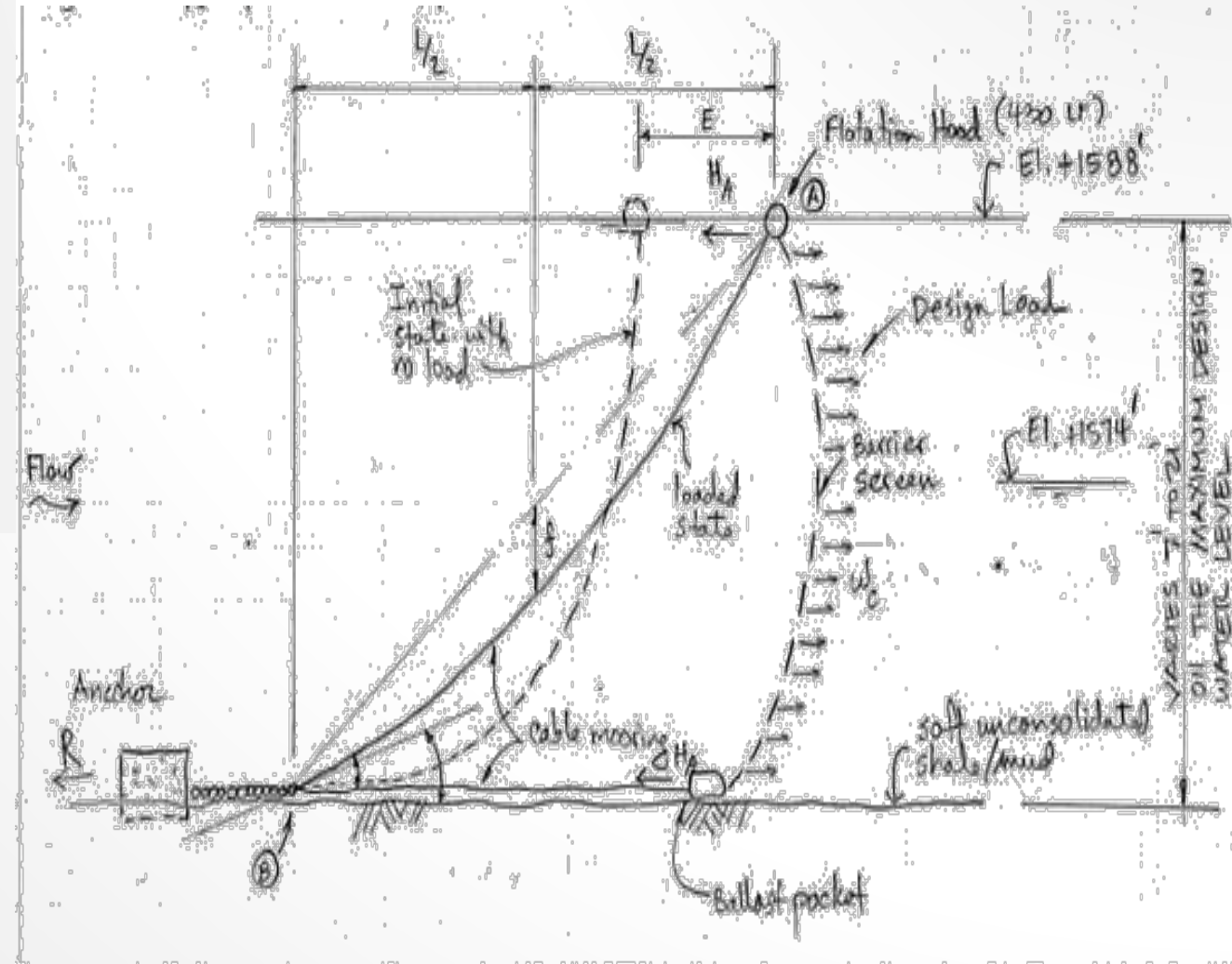
- Permeable or Impermeable
- Single- or Multi- Layered
- Selected for Environment and Specific Control

IMPORTANT PARAMETERS FOR DESIGN

- Water Current: Velocity Magnitude, Direction, Variability
- Bottom Type and Anchoring
- Particle Size or Volume of Suspended Sediments
- Presence of Petroleum Hydrocarbons or Other Chemicals of Concern

ALSO

- Level of Performance Required
- Duration of Operations
- Concern for the Presence of Important Fish, Invertebrate or Marine Mammal Species



SO, WHAT WAS SELECTED FOR THESE FOUR PROJECTS AND HOW SUCCESSFUL WAS THE SELECTED TECHNOLOGY

1. CONTAMINATED SEDIMENT REMOVAL – ONSHORE AND NEAR-SHORE SUBTIDAL

AMEC FW SELECTED BOTTOM SEALED BARRIER

2. TURBIDITY CONTROL SYSTEM TO ACHIEVE 0 NTU INCREASE INTO ADJACENT WATERS

AECOM RECOMMENDED BOTTOM-SEALED FILTER BARRIER

3. SPW-MOUNTED (BOTTOM-SEALED) FB

ANCHOR QEA RECOMMENDED BOTTOM-SEALED FILTER BARRIER

4. BRIDGE PIER DEMOLITION AND SEDIMENT REMOVAL

CALTRANS RECOMMENDED BOTTOM-SEALED FILTER BARRIER

CONTAMINATED SEDIMENT REMOVAL ONSHORE AND NEAR-SHORE SUBTIDAL

Voluntary Coal Tar Remediation - Site of Former MGP – Intertidal Excavation

- Substantial Savings to Costs and Schedule Over Cofferdam
- Silt Curtain was not an option due to
 - large amount of water exchange
 - strong tidal currents and vessel wave impacts
 - need for protection of spawning winter flounder
- Design Elements Included:
 - 3 Layers for Strength/Filtration, Plus Sorbent
 - Helical and Rock Anchors Secured



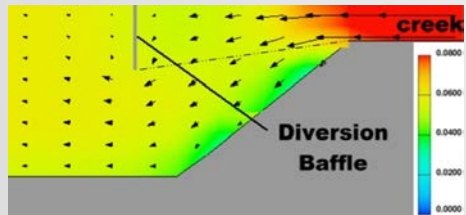
TIDAL CREEK CONSTRUCTION TO ACHIEVE 0 NTU INCREASE INTO ADJACENT WATERS

Design:

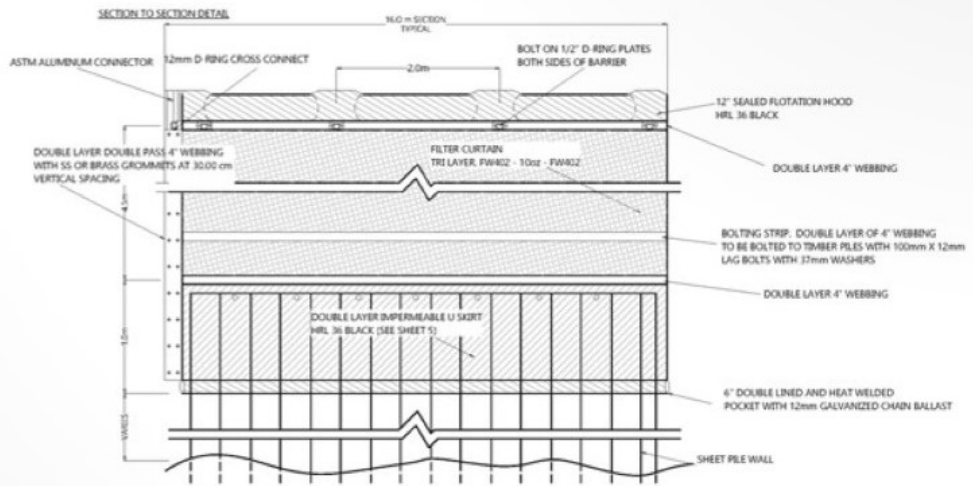
Process included CFD Modeling, Bench Testing

3 BARRIERS: Diversion, Filter and Silt

Ability to Reef, Move and Re-use



SPW-MOUNTED (BOTTOM-SEALED) FILTER BARRIER



1. SECTION SHOWN IS FOR FINAL FABRICATION. VERIFY ALL DIMENSIONS WITH THE MANUFACTURER.
2. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
3. SECTION TO BE BUILT TO MATCH WITH JOHN'S 10mm DIMENSIONS WITH 10mm TOLERANCE INCLUDING REVISIONS.
4. SEALING STRIPS TO BE CONNECTED TO SPW WITH 1mm DIMENSIONS AT ALL JOINTS AND AT PILING. DIMENSIONS TO BE GIVEN IN SHEET 5. VERIFY WITH THE MANUFACTURER.
5. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
6. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
7. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
8. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
9. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.
10. BARRIER TO BE BUILT TO MATCH WITH ORIGINAL SITE DRAWINGS INCLUDING REVISIONS.

<p>MACKWORTH-ENVIRO Aquatic Barrier & Screening Solutions</p>	<p>TYPICAL ELEVATION SPW - TRB</p>	
	<p>PROJECT: [REDACTED]</p> <p>CLIENT: [REDACTED]</p> <p>DATE: [REDACTED]</p>	<p>DESIGNED BY: [REDACTED]</p> <p>CHECKED BY: [REDACTED]</p> <p>SCALE: [REDACTED]</p>



Big Challenge!

Success!



BRIDGE PIER DEMOLITION AND SEDIMENT REMOVAL

Full-Depth Filter Barriers Installed Where SPW Infeasible and Silt Curtains Inadequate

- Urgency- Award to Initial Installation ~3-4 mos
- Design Process Included CFD Modeling
- Diver-Installed Reinforcements To Address Damage from Demolition Debris and Chafing
- Meeting Stringent WQ Objectives for Project



APPLICATION EVALUATION: BOTTOM-SEALED FILTER BARRIER VS. SILT CURTAIN

Conditions where project costs can go up without bottom sealing and anchoring, and where FBs may be more advantageous include:

- Dynamic Water Conditions –
SCs can require excess hours for maintenance, restoration of position or replacement due to damage
- Water Quality Performance Requirements –
Sediment releases that exceed water quality performance criteria and cause operations to be suspended creates additional costs, or compromises continuity of operations, with associated issues of potential permit violations



APPLICATION EVALUATION: BOTTOM-SEALED FILTER BARRIER VS. SHEET PILE WALL



- SPW cofferdams utilized for contaminated sediment removal can provide very effective containment
- There may be a concern about releases from SPW removal
 - This may be addressable by locating the SPW away from the contaminants or sometimes addressed with Silt Curtains
- There may be too much area to contain, or the water is too deep or other factors impede the use of SPWs.

SHEET PILE WALL APPLICATION ASPECTS

- Used at many environmental dredging sites where the superior containment of SPWs relative to silt curtains has justified the substantially higher cost
- Most significant consideration is cost
- Secondary considerations
 - Impact to project schedule
 - Potential contaminant release issues during removal
- Other unforeseen issues, such as having to cut at mudline if cannot remove



BOTTOM-SEALED FILTER BARRIERS WHERE SPW INFEASIBLE OR NON-ECONOMIC

Where feasible in a location, a Bottom-Sealed FB can provide control for a project for less time and cost than a SPW.

Key Questions:

- Will the FB be adequately effective as an alternative?
- Will the FB cause any scouring or other adverse impacts that may not result from use of a SPW?

There are few situations where a SPW could be deployed for containment that a bottom-sealed barrier cannot

- Excessive currents, e.g. > 3 fps
- Very toxic contaminants requiring a de-watered SPW



CONCLUSIONS

	Silt Curtains	Sheet Pile Walls	Filter Barriers
COST	Lowest	Very High	Moderate
TIME TO IMPLEMENT	Short	Very Long	Short
EFFECTIVENESS	Acceptable	Excellent	Excellent
↓ <i>Depending on currents and water quality goals</i>			

- Silt curtains are effective for turbidity control and containment in limited situations
- A primary consideration with SPWs is the cost and impact to project schedules.
- Bottom-sealed FB systems can, in many circumstances, achieve the objectives of SPWs and their cost can be 70% less.



QUESTIONS?

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