Sunken Oil Containment/Protection Techniques and Data Gaps

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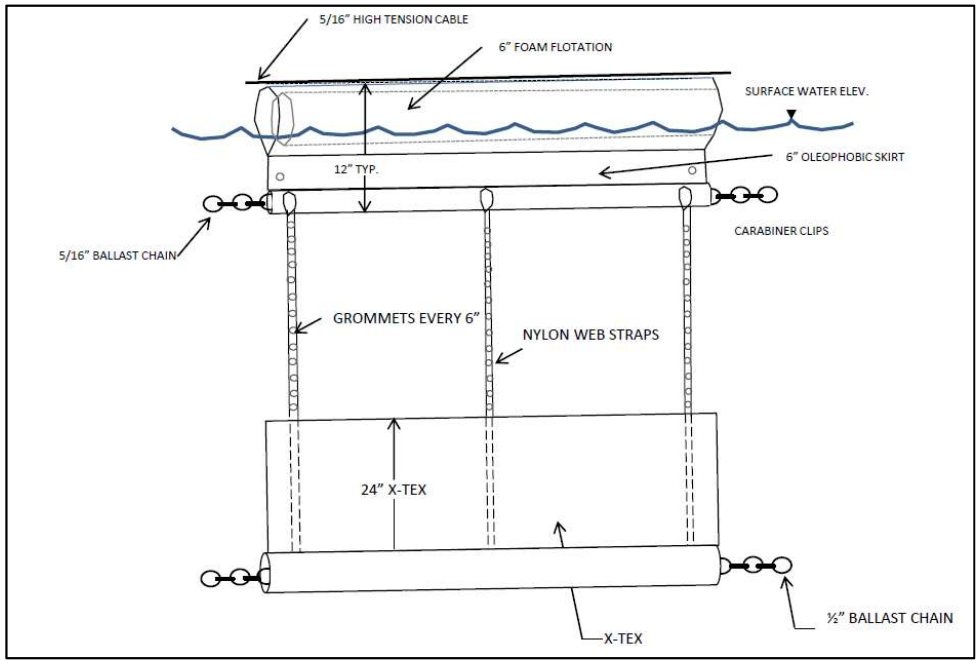
Sunken Oil *Containment*

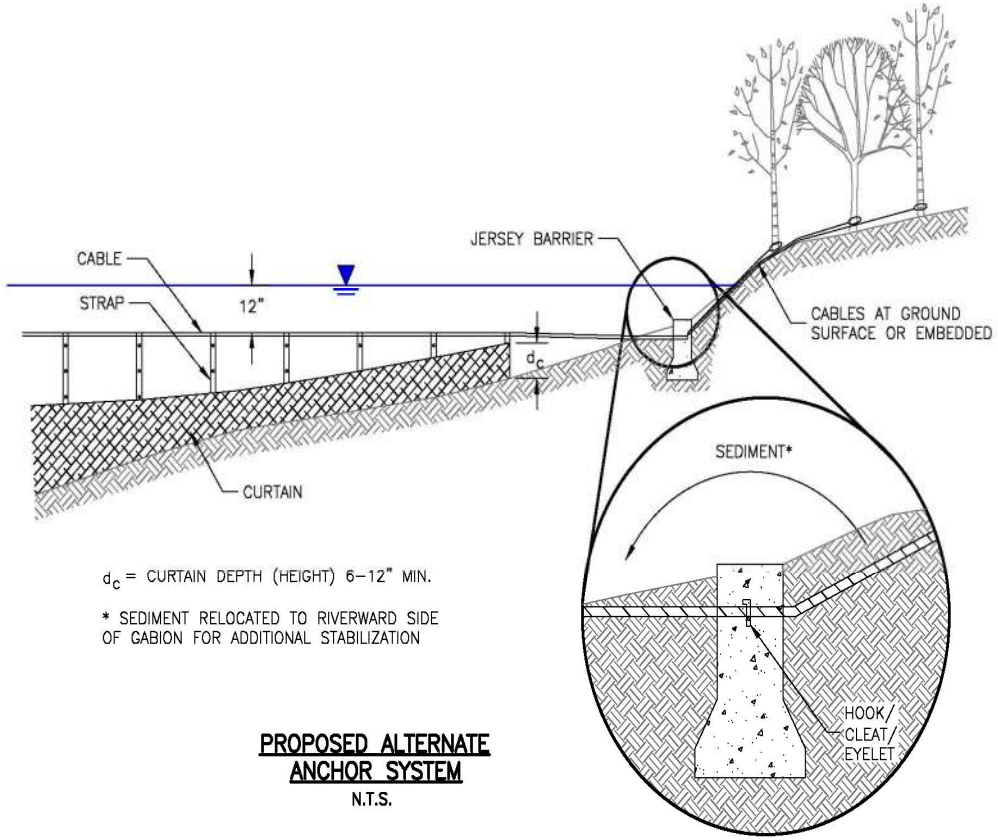
- Bottom half curtain with surface floatation
- Bottom filter fence
- Full-height curtain
- Berm
- Enhance natural collection area
- Trenching to create a depression down current

Considerations for Effectiveness of Sunken Oil *Containment*

- Effects of water currents on performance
- Presence/absence of natural depositional areas in the spill waterbody
- Timing of deployment relative to timing of sunken oil movement

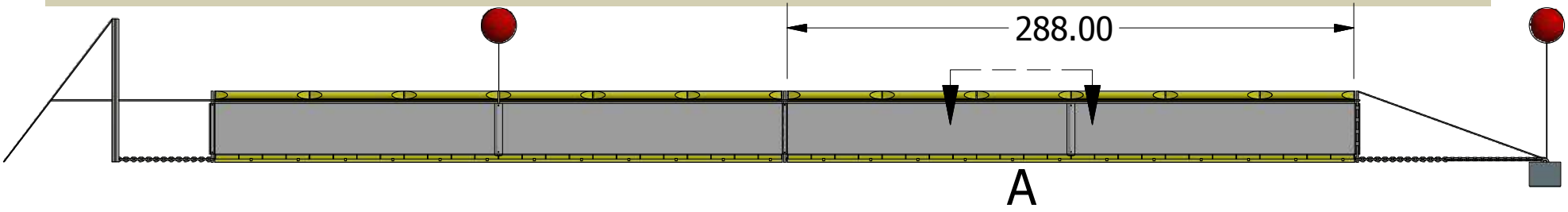
Bottom Half Curtain: River





PROPOSED ALTERNATE ANCHOR SYSTEM
N.T.S.

Bottom Half Curtain



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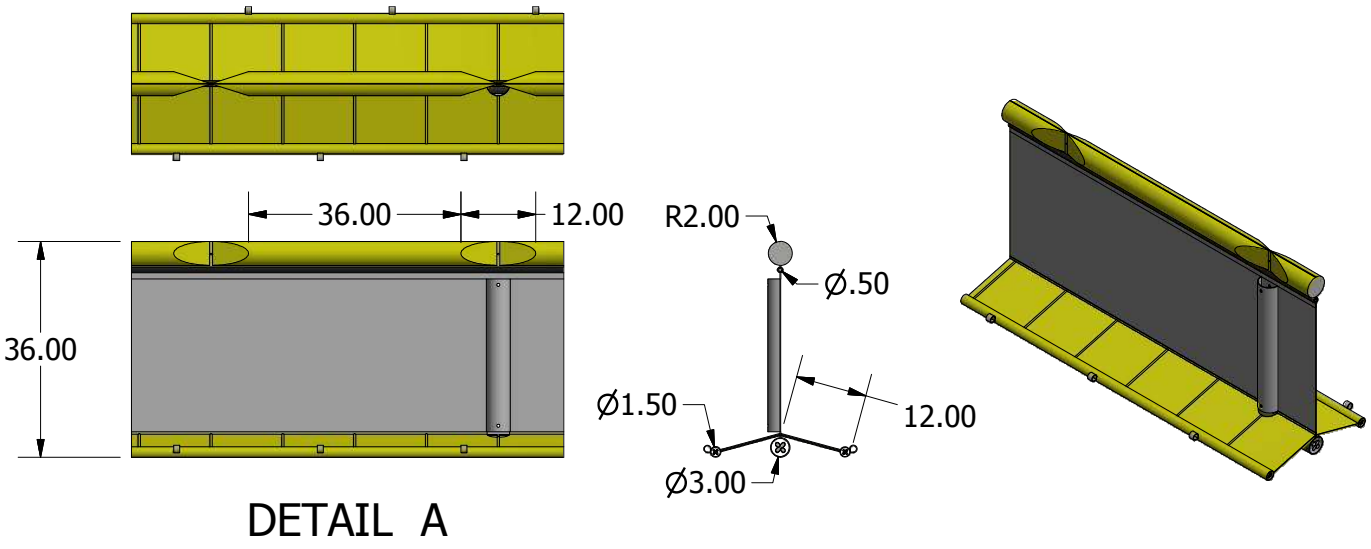
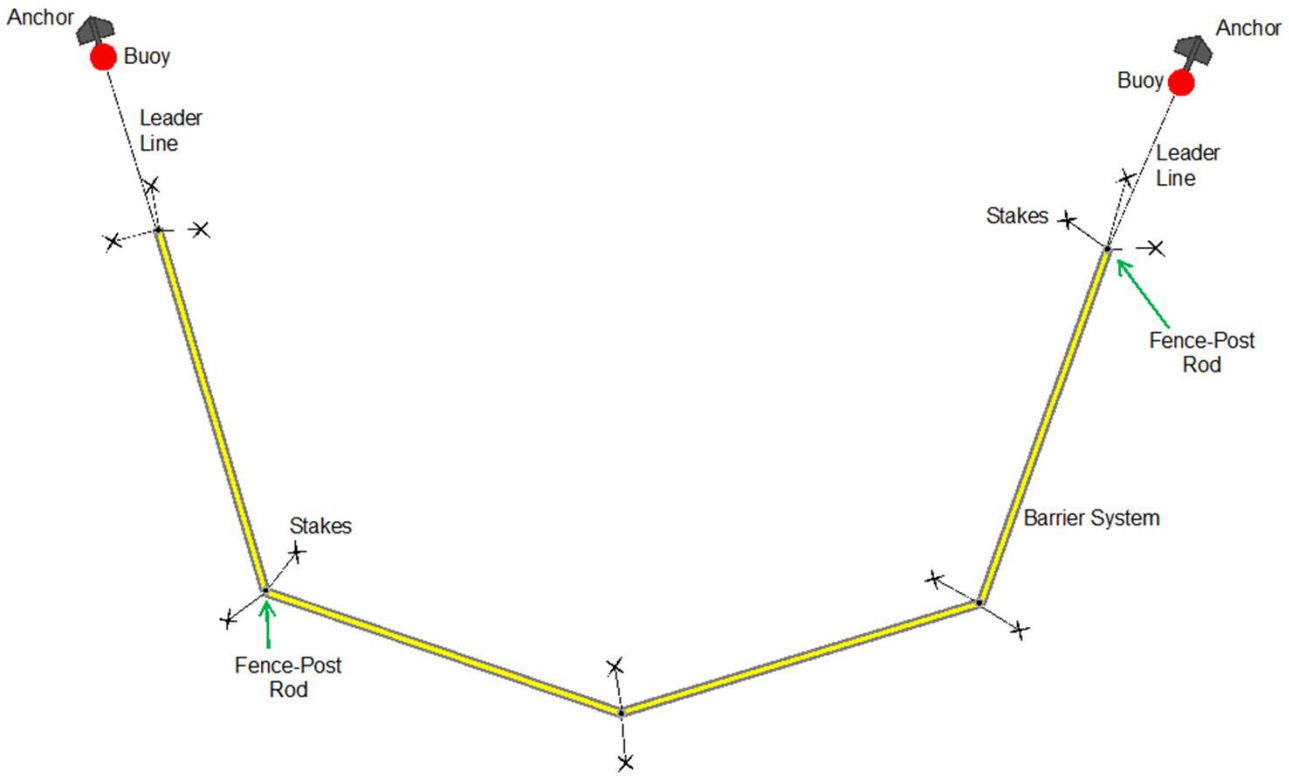


DETAIL A

Bottom Half Curtain: Open Water

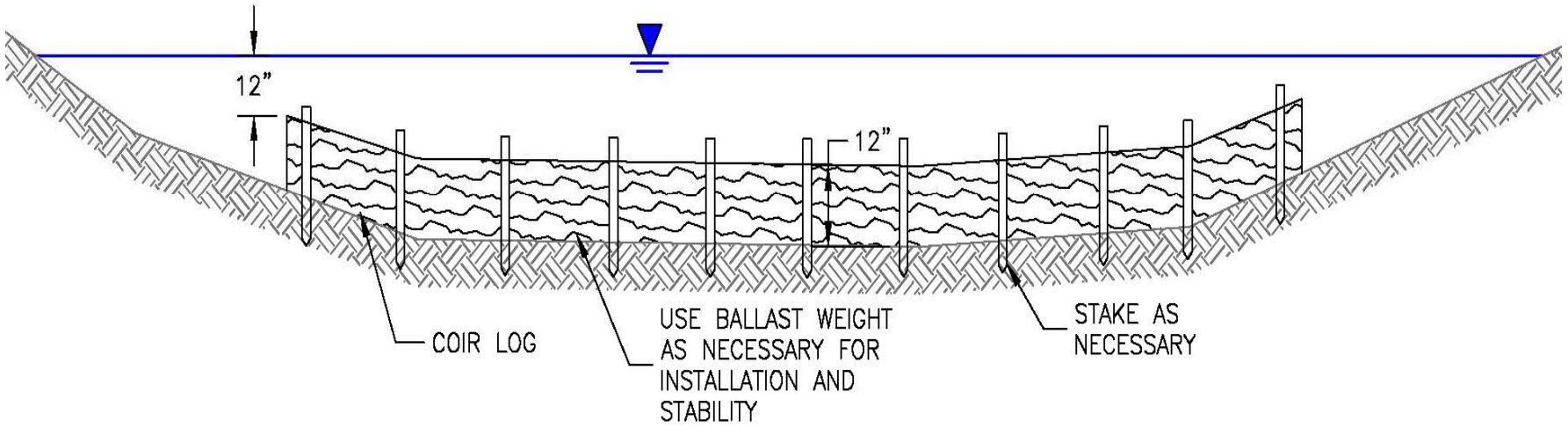


Bottom Half Curtain

Advantages	Considerations
- Partial height curtain limits the environmental loading. - Easy to monitor because of the surface floatation. - The curtain will deflect/contain both surface and sunken oil. Oil in the water column between these levels will escape containment.	- Depth limited because of the surface floatation. - Requires anchorage in all conditions. - May be difficult to install with large variations in bathymetry.

Bottom Filter Fence

Bottom Filter Fence



Bottom Filter Fence

Advantages	Considerations
- Constructed of readily available materials. - Effective at removal of oil droplets in the water column. - Can be deployed at and just below the surface or on the bottom, depending on water depth and where the oil is moving in the water column or along the bottom.	- If currents are >1 knot, there can be scouring of the bottom in front of the baskets and less effective oil deflection/containment. - Not feasible to deploy in high-flow areas. - Can completely fail and be swept downstream if flows suddenly increase. - Not likely effective as a stand-alone barrier for all conditions.

Full-Height Curtain

Full-Height Curtain

Advantages	Considerations
Sediment Curtains	
- Constructed of hydrophilic materials can sorb oil as well as slow the flow and increase sedimentation - Commonly used during dredging operations so readily available - Could deflect/contain oil throughout the water column - Could be deployed around water intakes or sensitive areas	- Full curtains are only effective in low-flow areas, where the curtain can maintain contact with the bottom, where risk of oil mobilization is also low - Requires measurement of current speeds at surface and/or bottom and knowledge of hydraulics for proper design - Can interfere with navigation - Depth limited

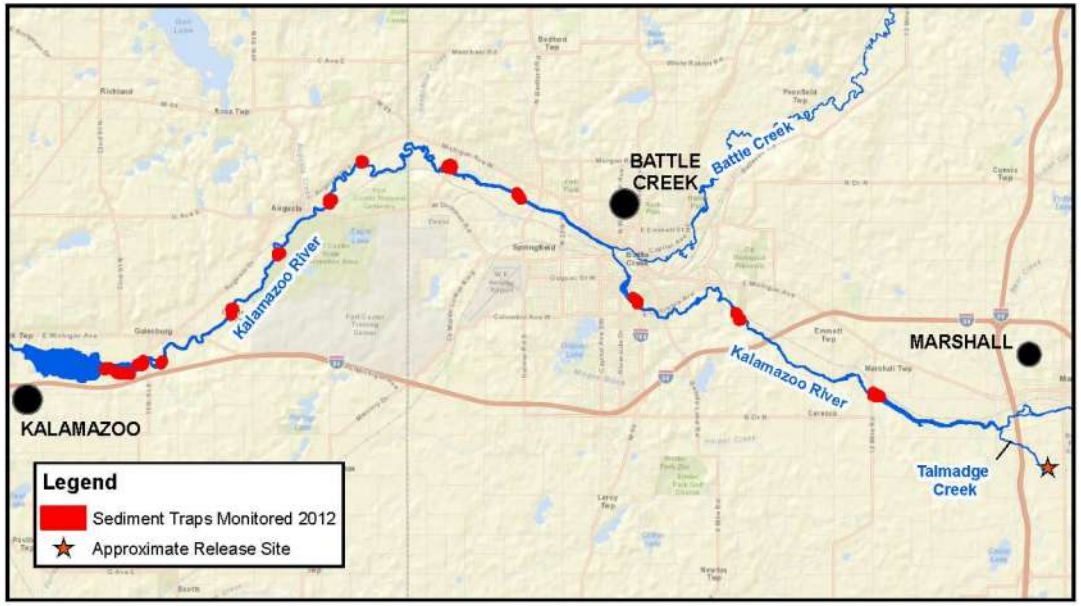
Berm

Advantages	Considerations
- A berm can be formed by non-erodible material or a sediment filled geofabric bag. - May allow for the passage of watercraft.	- Requires suitable material at the spill site. - Requires a hydraulic pump to fill a fabric tube or an excavator or dredge pump to create a sediment berm. - Permits may be needed for excavation and sediment disposal.

Trenching a Downstream Depression

Advantages	Considerations
- Could be method to contain oil entering a small impoundment from river/stream. - Most likely used in combination with a bottom barrier to create a collection area or improve the effectiveness of a natural collection area.	- Only feasible in soft sediments (sand and mud). - Will disturb benthic habitats in excavated footprint. - Excavated sediments may need to be dewatered and disposed of, or in some cases, could be released to the water column down current. - Permits may be needed for excavation and sediment disposal.

Enhance Natural Collection Areas



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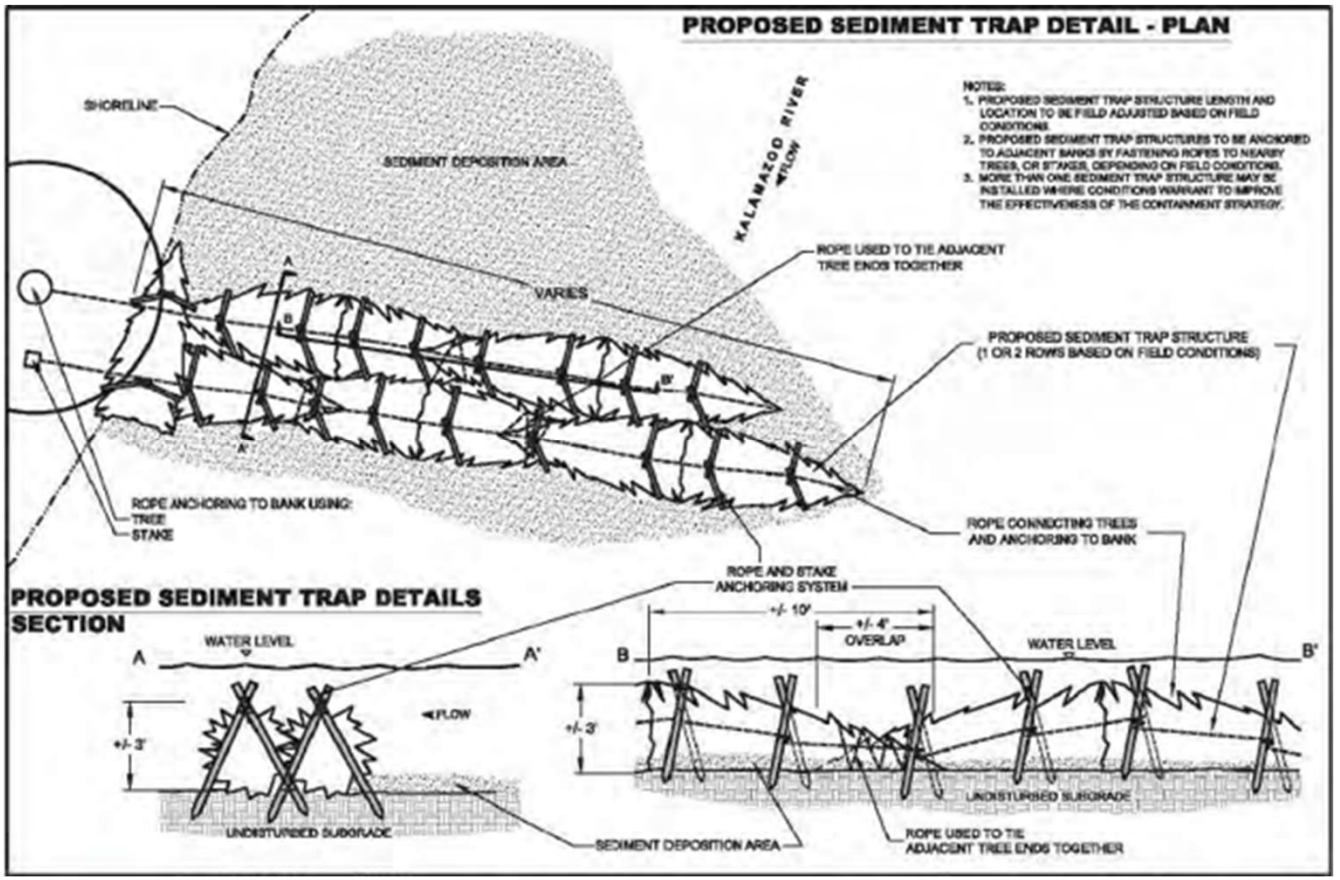

Enhance Natural Collection Areas

Advantages	Considerations
Enhance Natural Collection Areas	
— Builds on natural processes and uses natural materials that can be left in place — Oil that refloats can be recovered by standard response techniques — Does not interfere with navigation if placed below the water surface	— Restricted to areas of natural accumulation, which can be sensitive or high-public use areas — Mixes oil with co-accumulated clean sediment — Could require dredging to remove the accumulated oil and sediment, which disturbs benthic habitats and can affect water quality — Need a good understanding of seasonal flow patterns so sudden floods do not flush out oiled sediments

Trenching to Create a Depression Down Current

Advantages	Considerations
Excavate/Dredge Depression	
— Takes advantage of natural processes for oil deposition — Might be effective in combination with top or bottom curtains that direct oil to low-flow areas	— Requires removal and storage/disposal of potentially large amounts of clean sediment to create a depression — Requires periodic dredging or excavation of accumulated oiled sediments — Mixes oil with co-accumulated clean sediment — Disturbs benthic habitat and could affect water quality during dredging or excavation — Need a good understanding of sediment transport along the bottom under different current and wind conditions

Sunken Oil Containment/Protection Data Gaps

- No off-the-shelf systems available
- Complex bathymetry will require custom designs
- Difficult to determine conditions under which sunken oil is mobilizes and how far off the bottom it moves
- Loads on containment system difficult to predict during mobilization events; thus difficult to predict failure conditions
- RPI is working with a team under contract with USCG RDC on prototypes to be field tested for:
  - Inland rivers/streams
  - Offshore open water and large lakes