E. MARINE RECOVERY

Objective & Strategy

The objective of the marine recovery unit is to recover spilled oil that has been diverted to a designated recovery site accessible only from the water.

Numerous types of recovery systems and temporary oil storage devices are available to recover a variety of oil types. Oil type, local conditions and available vessels will influence or dictate the recovery system. Access to recovery sites is typically restricted to shallow draft vessels due to proximity of the shore and water depths at low tide. The water depth, including area of maneuverability, should be considered in selection of vessels and storage systems. The size of recovery and storage system devices varies and needs to be considered when matching with the deployment vessel. Capability of the vessel to lift and deploy the recovery devices and to handle the storage devices in shallow water and possible fast current should be considered. Recovery system efficiency varies depending on oil type and encounter rates. To minimize excess waste/water content of recovery fluids, oleophillic skimming systems and decanting procedures are recommended.

The general strategy is to:

- Identify the primary recovery site and assess the site conditions.
- Determine the appropriate recovery and storage systems based on oil type, site conditions and deployment vessel capabilities.
- Mobilize and deploy equipment to recover and store the oil from the designated recovery site.

Resources for this module have been defined as a recovery system, a storage device, a deployment vessel along with the associated support equipment and materials. Quantity of units required will be determined by site and resource sets may need to be refined as site specific requirements dictate.

Marine Recovery Unit General Configuration

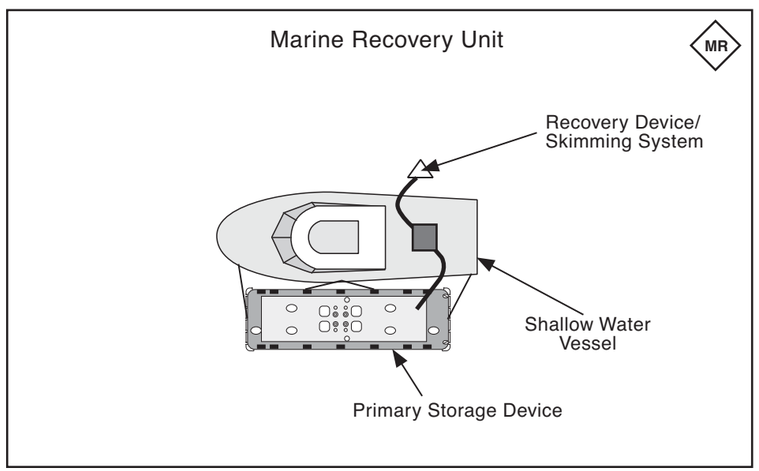

Figure G-2-16. Marine recovery unit.

Marine Recovery Unit Equipment Options

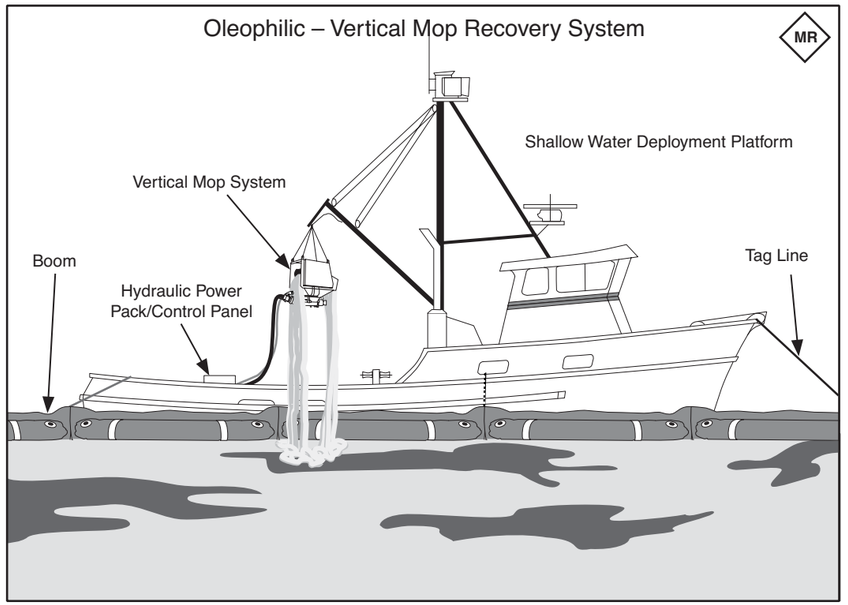

Figure G-2-17. Vertical mop recovery system.

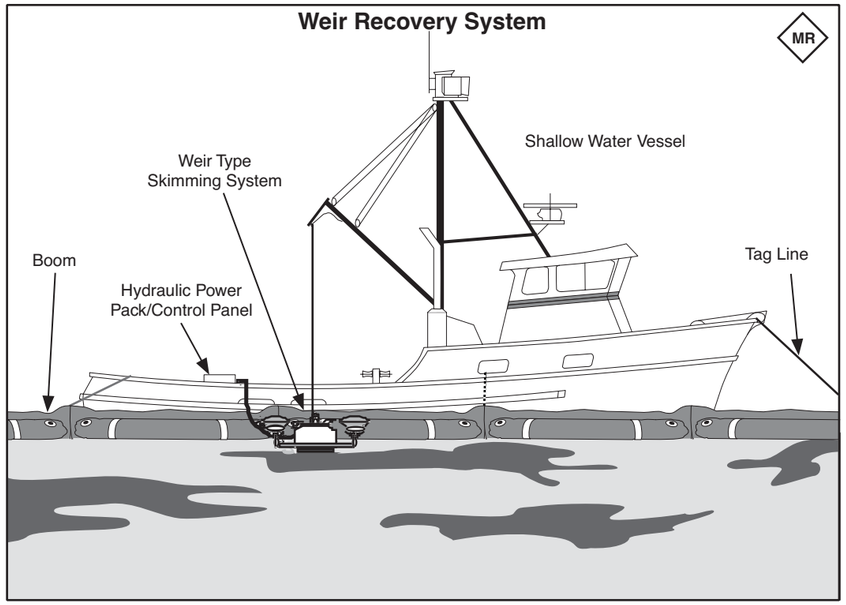

Figure G-2-18. Weir recovery system.

Resources

Marine Recovery, Exposed Shoreline

MR

Direct Resources

Description	Type	Function	Quantity
Collection System	Situation dependent	Oil recovery	1
Storage Device	Situation dependent	Oil storage	1
Hoses & Fittings	Misc.	System support	
Rigging/Tackle	Misc.	System support	
Deployment Platform	Mini-Barge or Vessel Class 3/4/5/6	System deployment	1

Support Resources*

Description	Type	Function	Quantity
Personnel**	Crew & Tech./Shift		3 to 5

* Support Resources may need to be re-evaluated, and in most cases decreased, when deploying multiple units or tending systems after deployment.

** Personnel includes vessel crew.

Deployment Considerations and Limitations

- Water depth and oil type may influence equipment options.
- Recovery vessel needs to coordinate closely with diversion booming units.
- Monitor and reposition as necessary through tide cycles.
- Constant monitoring of system efficiency is required.
- Procedure to decant should be considered.
- Deployment planning should be based on average high tidal conditions and take into account low tide water depths.
- Vessel master should use extreme caution when manuevering primary storage devices around submerged rocks.

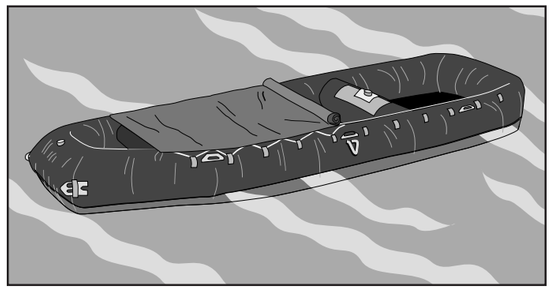

Figure G-2-19. Towable open primary storage device.

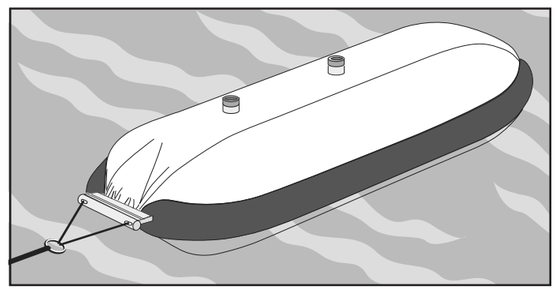

Figure G-2-20. Towable, flexible primary storage device.

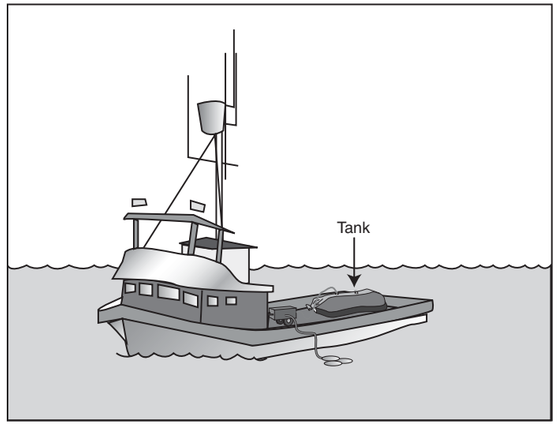

Figure G-2-21. Deck tank primary storage device.

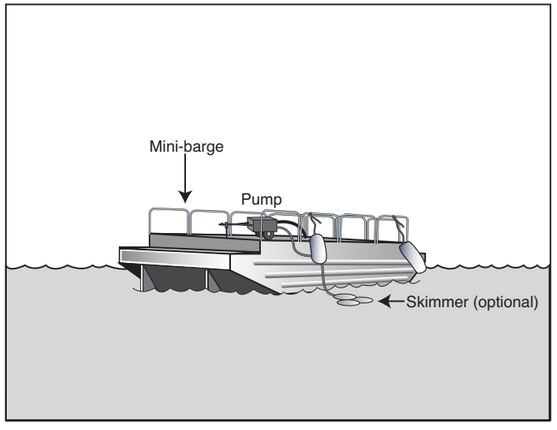

Figure G-2-22. Towable Mini-barge primary storage device.

F. FREE-OIL RECOVERY

Objective & Strategy

The objective of the free-oil recovery is to maximize the containment and recovery of spilled oil on the water in the nearshore environment, thus minimizing impact to sensitive areas. Shallow-water Free-oil recovery strike teams are typically designed to address the fragmented rafts, windrows, slicks and sheens that have escaped the high volume containment and recovery efforts, or are in areas where the high volume containment and recovery systems are unable to operate.

Free-Oil strike teams are comprised of vessels with containment boom for oil containment and concentration, skimming systems for recovery, and primary storage devices for temporary storage before transfer to secondary storage.

There are typically three primary deployment configurations for Nearshore Free-Oil strike teams.

- U - Boom System
- V - Boom System
- J - Boom System

The U-Boom System consists of vessels towing boom in a "U" configuration concentrating spilled oil into the back of the pocket formed by the boom. This technique can also be used solely for oil concentration by leaving an opening secured by chain in the apex of the boom (see figure G-2-27). This is often referred to as a "gated U – Boom". Typically, combinations of these configurations are used to enhance concentration and containment effectiveness. The spilled oil is then collected with a recovery device (skimmer), typically deployed by an additional vessel, and stored in a storage device.

The V-Boom System consists of vessels towing boom and a recovery device (skimmer) in a "V" configuration. The spilled oil is concentrated with the boom toward the back apex where a skimmer is located for oil recovery. Typically, these recovery systems are designed with a limited amount of storage built in and are either offloaded frequently or are augmented with additional storage devices and transfer systems.

The J-Boom System consists of vessels towing boom in a "J" configuration, concentrating the spilled oil for recovery into the back of the pocket formed by the boom. The rear towing vessel is outfitted with a recovery device (skimmer) for deployment along the vessel side where the apex of the boom is formed. The oil is then collected with the skimmer and stored in a primary storage device, such as a mini barge. This system is often utilized in place of the U-Boom system, when the response is limited by the amount of vessels available and when maneuverability is not as critical.

The general strategy is to:

- Identify the trajectory and location of the spilled oil by performing overflight surveillance and vector evaluations.
- Select a deployment configuration that best supports the site conditions and available resources.
- Mobilize and deploy Free-Oil Recovery teams as determined by overflight information and response priority.

Resources for this module have been defined as vessels, boom, skimmers, primary storage devices, and personnel. Configuration type and quantity of strike teams required will be determined by site conditions, spilled oil type and volume, area of coverage, as well as resource availability. Resource sets may need to be refined as site specific requirements dictate. Combinations of free-oil recovery and diversion are often a consideration.

General Configuration

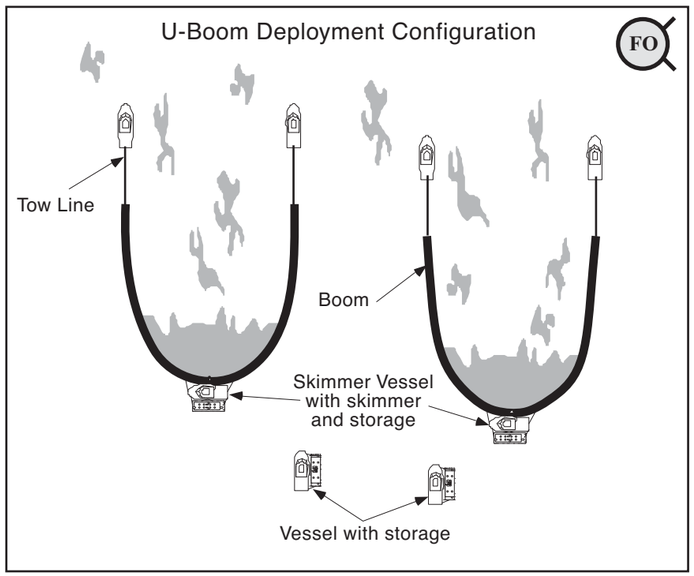

Figure G-2-23. U-boom configuration.

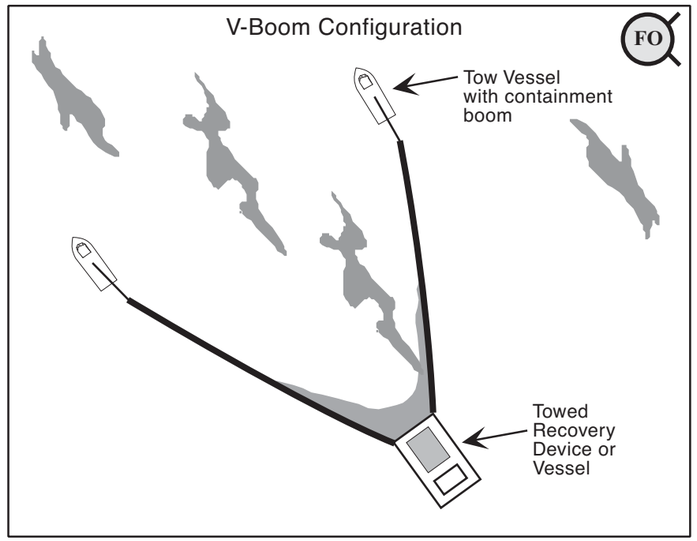

Figure G-2-24. V-boom Configuration.

Resources

Free-oil Recovery, Shallow Water FO-S

Direct Resources

Description	Type	Function	Quantity
Containment Boom	Protected water	Containment	up to 600’
Skimming System	Situation dependent	Oil Recovery	1
Primary Storage Device	Situation dependent	Oil Storage	2
Misc. Tow Bridles, Line & Buoys	Situation dependent	System Support	

Support Resources*

Description	Type	Function	Quantity
Personnel	Staff & Tech./Shift	Vessel Crew	10 to 12
Vessel	Class 4/5/6	Boom Operations	2
Vessel	Class 3/4	Recovery	1
Vessel	Class 3/4	Storage/Transport	1

Free-oil Recovery, Open Water FO-O

Direct Resources

Description	Type	Function	Quantity
Containment Boom	Open water	Containment	up to 1800’
Skimming System	Situation dependent	Oil Recovery	1
Primary Storage Device	Situation dependent	Oil Storage	2
Misc. Tow Bridles, Line & Buoys	Situation dependent	System Support	

Support Resources*

Description	Type	Function	Quantity
Personnel	Staff & Tech./Shift	Vessel Crew	7 to 9
Vessel	Class 2/3/4	Boom/Recovery	2
Vessel	Class 3/4	Storage/Transport	1

* Support Resources may need to be re-evaluated, and in most cases decreased, when deploying multiple units or tending systems after deployment.

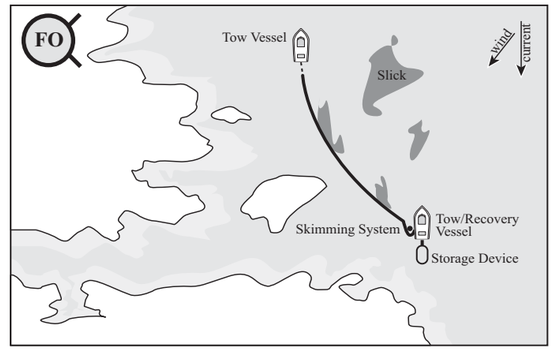

Figure G-2-25. J-boom configuration.

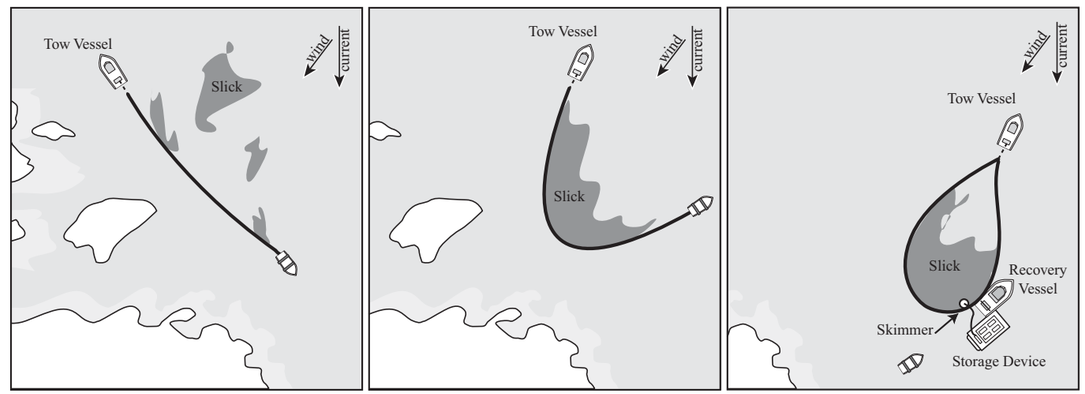

Figure G-2-26. Nearshore trapping, boom towing boats collect oil in boom then tow the trapped oil to deeper water for recovery.

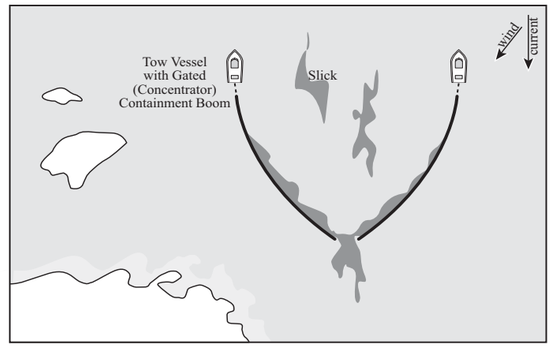

Figure G-2-27. Gated U-boom concentrator boom, towed in front of free-oil recovery.

Deployment Considerations and Limitations

- Site conditions may influence deployment configuration options.
- Combinations of configurations may optimize recovery.
- Procedures for decant and logistics for oil transport and disposal should be considered.
- Daily fair and foul weather evaluations are recommended, and should include distance to safe harbor, transit times and exposure of vessels.

G. PASSIVE RECOVERY AND DEBRIS REMOVAL

Objective & Strategy

The objective of the passive recovery and debris removal unit is to minimize the impact to designated shoreline by reducing the potential oil volume through passive recovery as well as by removing driftwood and other debris that spilled oil may contaminate.

Passive recovery is performed by placing sorbent materials at or near sensitive areas to collect oil and thus minimize impacts. This is usually accomplished by anchoring rows of sorbent boom or snare line[1] (oleophillic pom poms attached to a rope) between the high and low tide zones on the shoreline. Passive recovery for marine mammal haul-outs is accomplished by broadcasting natural sorbent material, such as peat moss or sphagnum moss, on the haulout.

Passive recovery can be deployed along selected shorelines prior to impact to reduce the quantity of oil that might otherwise adhere to the beach. This technique can also be applied to shoreline that has already been oiled to help keep the mobile oil from refloating and migrating to other non-impacted shorelines. In either case, the recovery must be monitored after each tide and recovery materials must be replaced as necessary.

The debris removal component of this tactic is to remove or re-locate excessive concentrations of driftwood and other debris from areas of the shoreline likely to be oiled. The impact area is typically defined as the low to mean high tide zone of the shoreline. The debris removal tactic is normally considered to be an independent unit but, in this case, has been combined with the passive recovery unit to optimize resource utilization.

Although this tactic can produce a significant solid waste stream requiring logistical support, it can be very effective due to the ability to rapidly deploy. Once deployed, the snare line needs to be monitored and periodically replaced to avoid diminished effectiveness due to saturation.

Access to selected shoreline may be accomplished from the water using shallow water platforms such as landing craft, or from on-land, using ATV's or other four-wheel drive vehicles.

The general strategy is to:

- Identify the trajectory of the spilled oil and select shoreline to be protected, as well as identify natural recovery sites where debris may concentrate.
- Evaluate access restrictions and select appropriate marine deployment platforms or on-land vehicles.
- Mobilize and deploy personnel with tools and materials to selected shorelines.

Resources for this module have been defined as personnel with tools and sorbent materials. Quantity of units required will be determined by site and resource sets may need to be refined as site-specific requirements dictate.

Passive Recovery Unit General Configuration

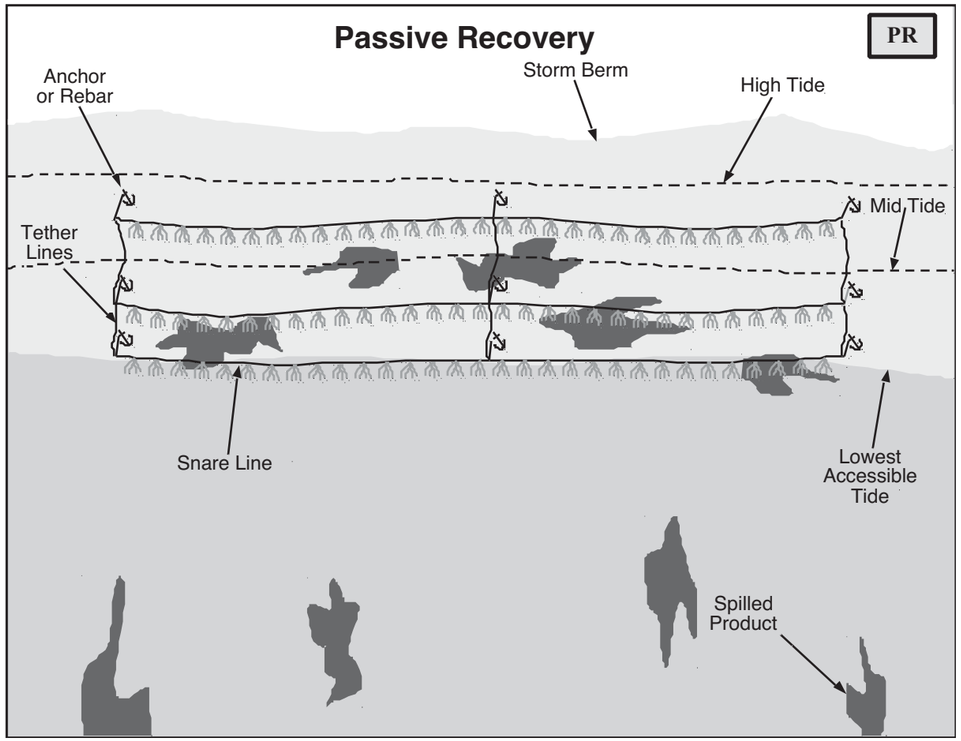

Figure G-2-28. Aerial view of a passive recovery configuration.

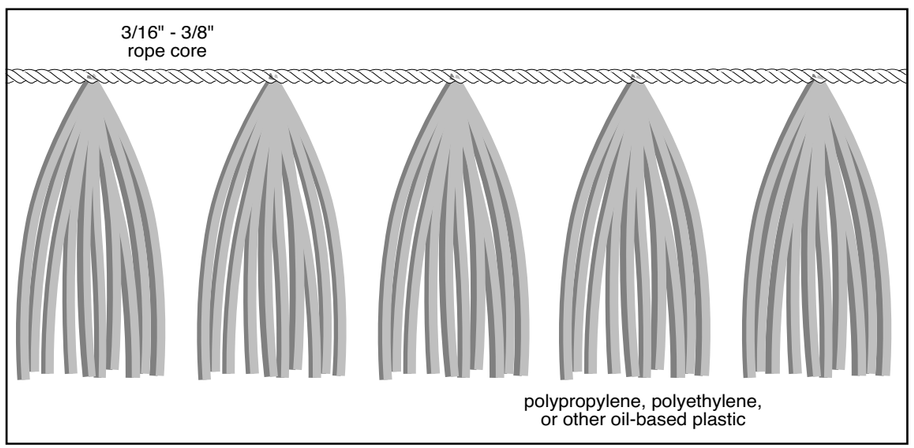

Figure G-2-29. Snare line.

[1] Snare line is also sold as Viscous Sweep and Snare-On-A-Rope. The primary difference is the distance between the pompoms.

Resources

Passive Recovery and Debris Removal, Marine Access **PR**

Direct Resources

Description	Type	Function	Quantity
Snare Boom	Optional	Oil recovery	3,600'
Rebar Stakes/Small Anchor Materials	Optional	Snare Boom Placement	
Hand Tools and Line	Misc.	System support	
Chainsaw	Optional	Debris Removal	2
Bags/Super Sacks	Optional	Solid Waste Collection	

Support Resources*

Description	Type	Function	Quantity
Personnel**	Crew & Tech./Shift		8
ATV's		Material Transport	2
Landing Craft	Shallow Draft	Access/Deployment	1

Passive Recovery and Debris Removal, Shoreside Access **PR-S**

Direct Resources

Description	Type	Function	Quantity
Snare Boom	Optional	Oil recovery	3,600'
Rebar Stakes/Small Anchor Materials	Optional	Snare Boom Placement	
Hand Tools and Line	Misc.	System support	
Chainsaw	Optional	Debris Removal	2
Bags/Super Sacks	Optional	Solid Waste Collection	

Support Resources*

Description	Type	Function	Quantity
Personnel	Crew & Tech./Shift		6
ATV's		Material Transport	2
Trucks with ATV Trailers	Shallow Draft	Mobilization Support	2

Passive Recovery – Marine Mammal Haulout*** **PR-MM**

Direct Resources

Description	Type	Function	Quantity
Natural Sorbent	Peat Moss Sphagnum Moss	Oil recovery	1/2 #/sq. ft.
Broadcast System	Blower Hydro-seeder	Deploy Sorbent	1

Support Resources*

Description	Type	Function	Quantity
Personnel	Crew & Tech./Shift	Vessel Crew	4 to 6
Vessel	Class 2/3/4	Transport & Broadcast	1
Vessel	Class 5	Hand Broadcast	1

* Support resources may need to be re-evaluated, and in most cases decreased, when deploying multiple units or tending systems after deployment.

** Personnel does not include Landing Craft crew.

*** Passive recovery for marine mammal haulouts should only be attempted after consultation with the National Marine Fisheries Service.

Deployment Considerations and Limitations

- Shoreline access may influence deployment platform options.
- Passive recovery materials need tending and periodic replacement.
- Logistics for solid waste transport and disposal need to be considered.
- Contact NMFS before disturbance of marine mammals.

H. COLD WATER DELUGE

Objective & Strategy

Cold water deluge is typically a protective counter measure with the objective of minimizing the impact to designated shoreline areas. This is achieved by creating a flood of water that forms a hydraulic head in the beach substrate above the sea water level. The flood raises the normal water table, producing free flowing water down the beach surface which prevents the oil from adhering to the shoreline and penetrating the substrate. This strategy can also be used to enhance shoreside recovery.

Deluge is performed by placing perforated hose along the high tide area of the shoreline, connecting it to a high volume (typically six inch) pump. Suction hose is connected to the pump from the source of water, and when started, the water is pumped through the perforated hose to create a flood. This technique can be deployed along selected shoreline prior to impact to reduce the quantity of oil that might otherwise adhere to the beach. This technique can also be applied to assist in treating shoreline that has already been impacted. One of the most common applications is deployment of this technique in unison with Diversion and Marine Recovery units where spilled oil is entrapped or intentionally grounded. Access to selected shoreline may be accomplished from the water using shallow water platforms such as landing craft or, from on-land using ATVs or other four-wheel drive vehicles.

The general strategy is to:

- Identify the trajectory of the spilled oil and select shoreline to be protected, as well as identify natural recovery sites that may be intentionally used for entrapment.
- Evaluate access restrictions and select appropriate marine deployment platform, or on-land vehicles.
- Mobilize and deploy personnel and equipment to selected shoreline sites.

Resources for this module have been defined as personnel with pumps and hoses. Quantity of units required will be determined by site, and resource sets may need to be refined as site specific requirements dictate.

Deluge Unit General Configuration

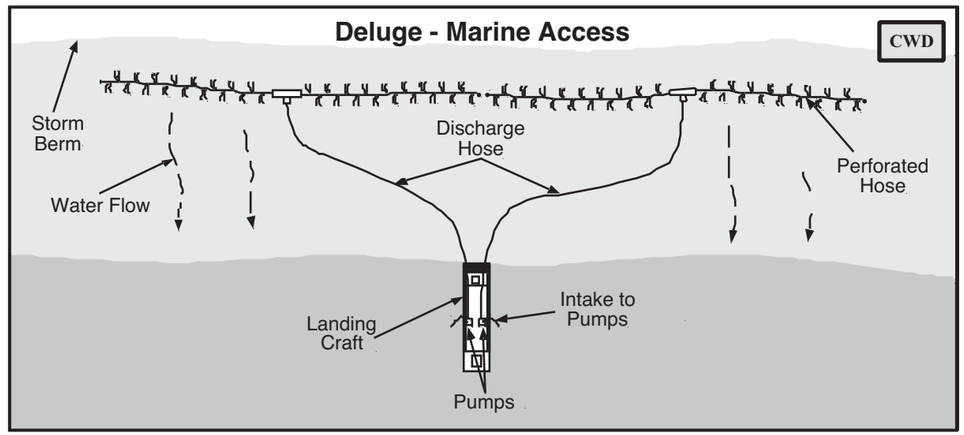

Figure G-2-30. Aerial view of a deluge configuration marine access.

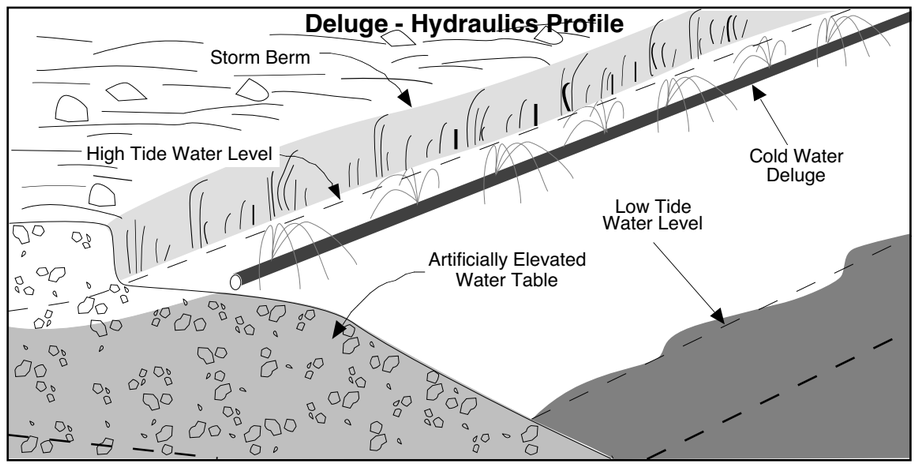

Figure G-2-31. Deluge hydraulic shoreline cross-section profile.

Resources

Cold Water Deluge, Marine Access CWD

Direct Resources

Description	Type	Function	Quantity
Pump	6" Diesel - Trash	Water Flood	2
Perforated Hose	6" Lay Flat – Discharge w/Holes	Deluge Header	400'
Discharge Hose	6" Lay Flat	Header Supply	400'
Suction Hose	6" Suction	Pump Supply	2 x 20'
Kamlock Fittings, Pipe Fittings & Basket Strainers	6" Assorted	Hose Connections	

Support Resources*

Description	Type	Function	Quantity
Personnel**	Crew & Tech./Shift		8
Landing Craft	Shallow Draft	Access/Deployment	1

Cold Water Deluge, Shoreside Access CWD-S

Direct Resources

Description	Type	Function	Quantity
Pump	6" Diesel - Trash	Water Flood	2
Perforated Hose	6" Lay Flat – Discharge w/Holes	Deluge Header	400'
Discharge Hose	6" Lay Flat	Header Supply	400'
Suction Hose	6" Suction	Pump Supply	2 x 20'
Kamlock Fittings, Pipe Fittings & Basket Strainers	6" Assorted	Hose Connections	

Support Resources*

Description	Type	Function	Quantity
Personnel	Crew & Tech./Shift		6
ATV's		Material Transport	2
Trucks with ATV Trailers		Mobilization Support	2

* Support Resources may need to be re-evaluated, and in most cases decreased, when deploying multiple units or tending systems after deployment.

** Personnel does not include Landing Craft crew.

Deployment Considerations and Limitations

- Shoreline access may influence deployment platform options.
- Deluge pressure needs to be regulated to avoid beach erosion.
- Kamlock fittings should be secured with wire or wire ties after lockdown.
- The marine access unit does not specify an ATV. If available, an ATV could support hose & fittings transport from the vessel up the beach.

I. UNDERFLOW DAM, MARINE SPILL

Objective & Strategy

The objective of the underflow dam is to temporarily block the mouth of a stream, slough, or inlet to prevent oil from entering during a flood tide. The underflow is used to allow outflowing fresh water to escape the dam or incoming unpolluted ocean water to enter the estuary. This is accomplished by building a dam using local earth and gravel. If the local material is porous or insufficient, sandbags and polyethylene liners (Visqueen) should be used on the face of the dam to stop leakage.

Underflow dams use inclined culverts to allow water moving downstream to escape while keeping the spill contained on the marine side of the dam. The capacity of the culvert(s) should exceed the stream flow rate. A less preferred alternative is to use pumps to remove water from the inside of the dam. Underflow culverts should be placed through the dam at an incline, with the lower end of the pipe on the marine side of the dam.

The general strategy is to:

- Identify the trajectory of the spilled oil and only install a dam if the inlet is threatened.
- Evaluate access restrictions and select appropriate marine deployment platforms or on-land vehicles.
- Construct the dam with as little damage to the beach and storm-berm as possible.
- Mobilize and deploy personnel with tools and materials to selected shorelines.
- Remove the dam as soon as the site is no longer threatened by a spill.

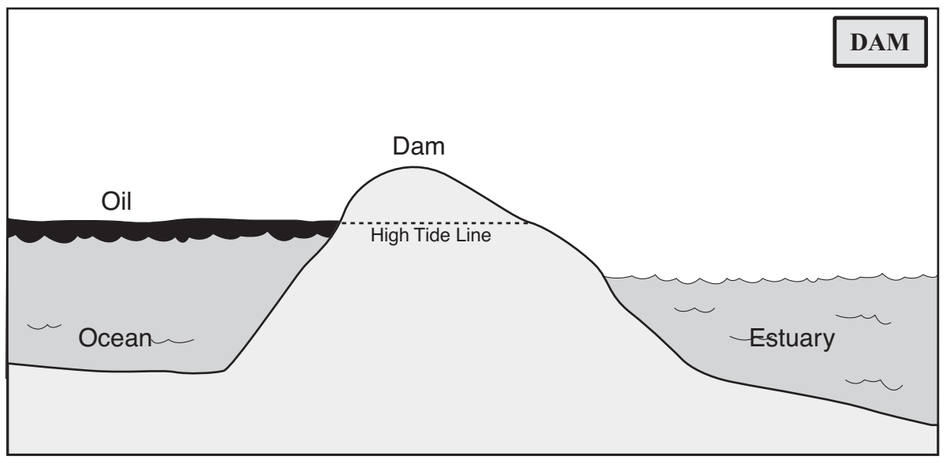

Figure G-2-32. Dam cross-section profile.

Underflow Dam General Configuration

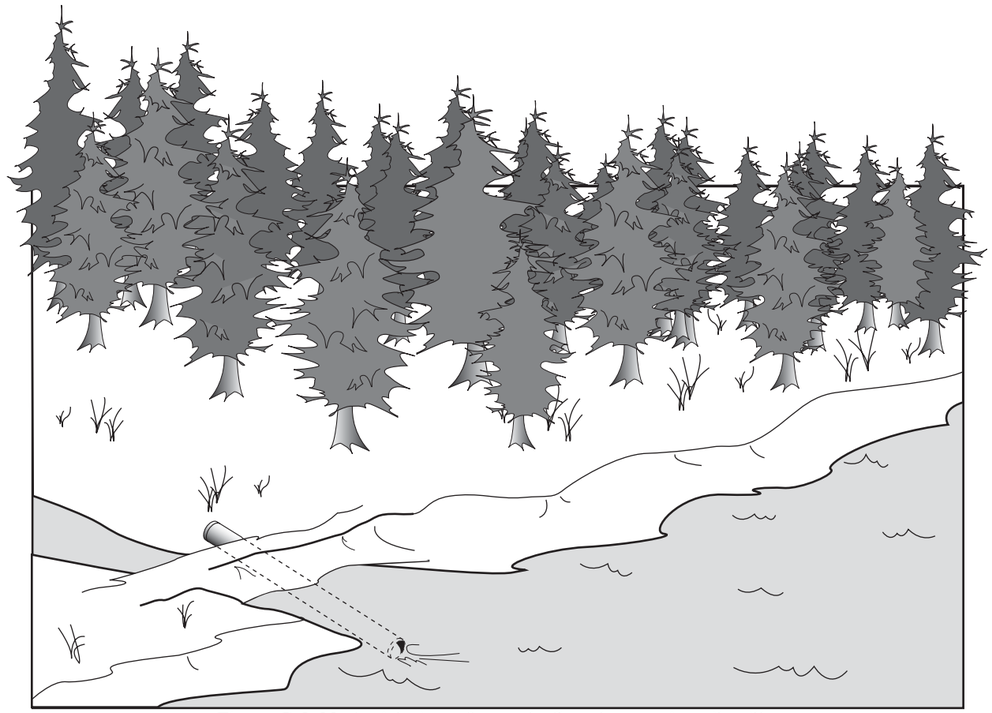

Figure G-2-33. Aerial view of an underflow dam marine oil spill.

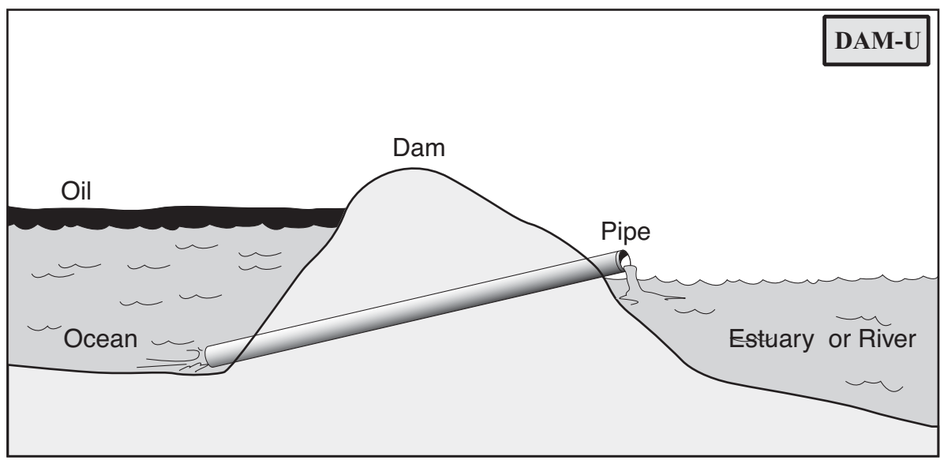

Figure G-2-34. Underflow dam cross-section profile.

Resources

Underflow Dam DAM-U

Direct Resources

Description	Type	Function	Quantity
Loader, Bulldozer, or Backhoe	Various	Dam Construction	1
Visqueen	6 mil.	Optional Dam Liner	1 roll
Culvert	Sized to exceed stream outflow	Dam	1

Support Resources*

Description	Type	Function	Quantity
Personnel	Crew & Tech./Shift		2

Dam, Shoreside Access DAM

Direct Resources

Description	Type	Function	Quantity
Loader, Bulldozer, or Backhoe	Various	Dam Construction	1
Visqueen	6 mil.	Optional Dam Liner	1 roll

Support Resources*

Description	Type	Function	Quantity
Personnel	Crew & Tech./Shift		2

* Support Resources may need to be re-evaluated, and in most cases decreased, when deploying multiple units or tending systems after deployment.

Deployment Considerations and Limitations

- Army Corps of Engineer permit is necessary to utilize this strategy.
- If shoreside access is not available, equipment will have to be transported by landing craft.
- Dams must be checked periodically for leakage and integrity, to replace eroded materials, and to continually monitor the water/oil interface. Valved pipes, pumps, or number of siphons may require periodic adjustment to compensate for minor changes in stream flow.
- Damming of a stream mouth may block fish passage. The dam must be removed inmmediately when it is no longer needed.

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