Part Two – General Protection/Recovery Tactics

This section contains generalized oil spill response tactics that were used to develop the specific strategies contained in Section 3. Each general tactic description contains objectives, implementation instructions, response resources required, and deployment considerations and limitations. These general tactics are shown as symbols on the GRS maps and the required resources have been adapted to the specific site and listed in the GRS tables in Section 3. Equipment classifications are taken from the World Catalog of Oil Spill Response Products.

VESSEL CLASSIFICATION

The following table contains vessel classifications used in this document.

1	Class 1 vessels are large, deep draft, steel hull vessels generally longer that 150 ft. and over 1,500 HP. These vessels are capable of providing all offshore services required during a responses, i.e.: major skimming systems, berthing, command vessel hauling cargo, etc. They generally have large open rear decks, elevated wheelhouses and are USCG inspected. They can be used in any offshore region of Alaska. These vessels may be able to provide limited support services to other vessels in the fleet, i.e.: berthing, meals, fuel, water, repair, etc. They are not restricted by seasonal or most sea ice constraints.
2	Class 2 vessels are slightly smaller that Class 1 vessels, typically less that 150 ft. in length. All are steel hulled with drafts generally less than 12 ft. They have forward or aft houses, (can include larger LCMs), and have adequate deck space for deployment/operation of VOSS systems, boom deployment/towing, and barge assist. They may have limited accommodation space. These vessels may be able to provide limited support services to other vessels in the fleet, i.e.: fuel, water, repair, etc. They are not restricted by seasonal or most sea ice constraints.
3	Class 3 vessels are the largest of the fishing fleet, including large seiners, long liners, gill net boats and tenders. They may have steel, aluminum or fiberglass hulls. Deck space is adequate for small skimming system deployment/operation. HP is generally over 400, allowing them to tow boom up to ocean size. These vessels have accommodations, but are usually limited to the vessel crew plus 1 or 2. They are not restricted by seasonal use, but will be restricted in sea ice concentration over 7/10 ths.
4	Class 4 vessels are smaller fishing vessels, including seiners, longliners and gill net boats. They have limited deck space and accommodations. They can be used for towing ocean boom in areas of lower current speed, but are well suited for towing protected-water or calm-water boom. These vessels work best in nearshore areas with support from Class 1, 2 or 3 vessels. They are perfect for bays and protected waters. They are shallow draft vessels, made of aluminum or fiberglass and usually have no additional accommodations space. They may be limited by seasonal constraints and are not expected to work in sea ice concentrations over 5/10 ths.
5	Class 5 vessels are small, generally less than 30 ft., with no accommodations. These day-use vessels are used for placing and towing protected-water or calm-water boom in nearshore areas or river mouths. They may be used for scouting, wildlife hazing/capture, and miscellaneous assignments within various on-water task forces. These vessels may be limited by seasonal constraints.
6	Class 6 vessels are work boats or skiffs, open small boat type vessels, generally with outboard motors and no accommodations. Used to handle protected-water or calm-water boom in nearshore areas or river mouths and other miscellaneous assignments within on-water task forces.
7	Class 7 vessels are passenger charter vessels designed and licensed to carry passengers such as supervisors, media, or regulatory agency representatives. They are generally day use and can also be used to support safety staff, wildlife hazing/capture, and logistics support.
8	Class 8 vessels are inspected or un-inspected towing vessels, designed and equipped for towing large or small vessels.
9	Class 9 vessels are dive vessels, designed or equipped to support diving operations.
10	Class 10 vessels are salvage vessels, designed or equipped to support marine salvage operations.
11	Class 11 vessels are tank barges or tank vessels designed and equipped to carry liquid cargoes.

SYMBOLS

The following are the symbols used in the GRS maps to depict a general strategy:

Tactical Information

A. Deflection Booming
- DF — Deflection Booming
- DF-R — Deflection Booming, River Mouth
- DF-L — Deflection Booming, Live

B. Diversion Booming
- DV — Diversion Booming, Fixed

C. Exclusion Booming
- EX — Exclusion Booming

D. Shoreside Recovery
- SR — Shoreside Recovery, Restricted Access
- SR — Shoreside Recovery, No Access Restriction

E. Marine Recovery
- MR — Marine Recovery

F. Nearshore Free-oil Recovery
- FO-S — Free-oil Recovery, Shallow Water
- FO-O — Free-oil Recovery, Open Water

G. Passive Recovery and Debris Removal
- PR — Passive Recovery and Debris Removal, Marine Access
- PR-S — Passive Recovery and Debris Removal, Shoreside Access
- PR-MM — Passive Recovery, Marine Mammal Haulout

H. Cold Water Deluge
- CWD — Cold Water Deluge, Marine Access
- CWD-S — Cold Water Deluge, Shoreside Access

I. Dam
- DAM — Dam
- DAM-U — Underflow Dam

A. DEFLECTION BOOMING

Objective & Strategy

The objective of deflection booming is to direct spilled oil away from one location to another or to simply change the course of the slick. The two alternatives of this technique are Fixed Deflection and Live Deflection.

In fixed deflection, boom is anchored to the shoreline or bottom. This technique consists of oil spill boom placed at an angle to the current and uses the movement of the current to assist in response operations. One basic deployment technique for fixed deflection is to secure/anchor one end of the boom up-current from the selected deflection site. Then place additional anchor systems to the boom to achieve the desired deflection angle with the least amount of entrainment or escapement. Boom arrays may have to be cascaded in short sections to prevent entrainment.

In live deflection, the boom is attached to vessels and held in position by the power of the vessels or one end of the boom is anchored and the other end held in position with a vessel. Live deflection is a very difficult tactic to execute. It should only be utilized where fixed deflection can not be achieved, usually because of deep water precluding anchoring.

Deflection Boom (single boom): Boom is deployed from a site at an optimum angle to the current and anchored to deflect the oil away from a location.

Deflection Boom (cascade): Several booms are deployed in a cascade configuration when a single boom cannot be used because of fast current or because it is necessary to leave openings in the boom for vessel traffic, etc. This configuration can be used in strong currents where it may be impossible to effectively deploy one continuous section of boom. Shorter sections of boom used in a cascade deployment are easier to handle in faster water, thereby increasing efficiency. Additional equipment may be required to set and maintain this system as compared to the single boom configuration.

Resources for this module have been defined as an increment of 200 ft. of boom with associated support equipment. Quantity of units required will be determined by site, and resource sets may need to be refined as site specific requirements dictate.

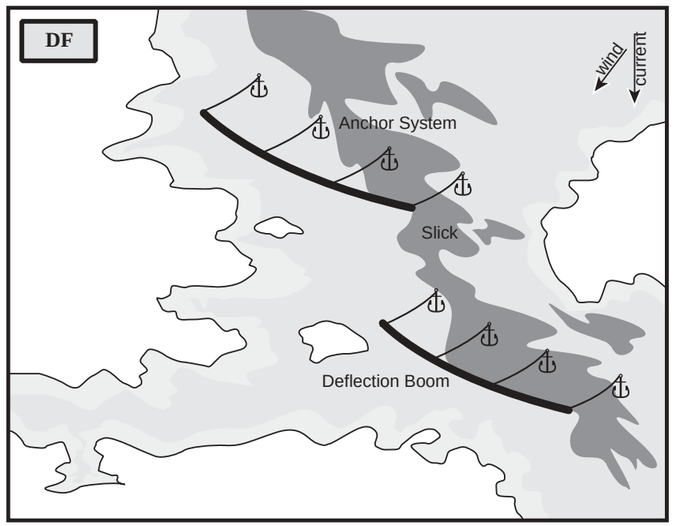


Figure G-2-1. Deflection booming, fixed cascaded array.

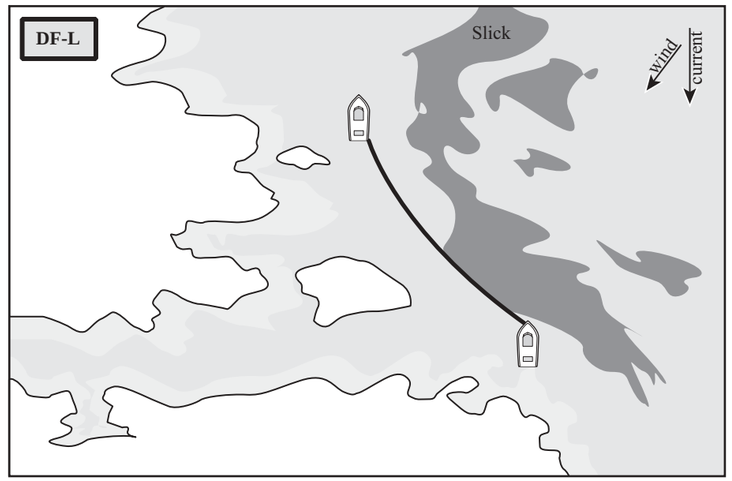
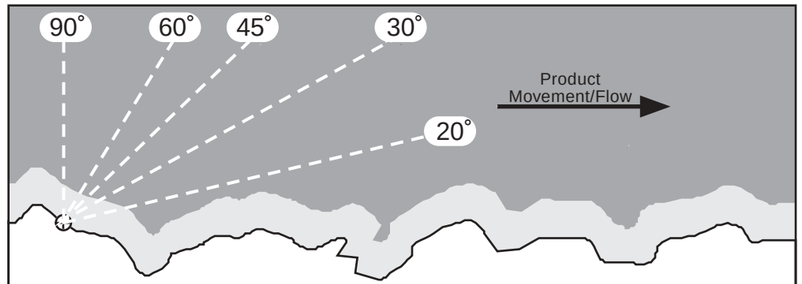


Figure G-2-2. Deflection booming, live.



Boom angle relative to current required to maintain component of current <3/4 knot

CURRENT (Knots)	CURRENT (ft/second)	BOOM (angle)
1.5	2.5	30˚ to 42˚
1.75	2.9	25˚ to 35˚
2.0	3.4	22˚ to 30˚
2.25	3.8	19˚ to 26˚
2.5	4.2	17˚ to 24˚
2.75	4.6	16˚ to 21˚
3.0	5.0	15˚ to 19˚

Difficulty in deployment will increase and effectiveness will decrease as a function of water velocity.

Figure G-2-3. Deflection booming deployment configurations.

Note: Some of the figures in this section were taken from the Alaska Clean Seas Technical Manual with Alaska Clean Seas' permission.

Resources

Deflection Booming, River Mouth **DF-R**

Direct Resources

Description	Type	Function	Quantity
Boom	Calm/Protected water	Deflection booming	200 ft.
Anchor systems	40 lbs.	Securing boom	2
Rigging/Tackle	Misc.		

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 5/6	Booming support	2
Personnel***	Crew & Tech./Shift		3 to 10

Deflection Booming, Exposed Shoreline **DF**

Direct Resources

Description	Type	Function	Quantity
Boom**	Protected water	Deflection booming	200 ft.
Anchor systems	≥ 60 lbs.	Securing boom	2
Rigging/Tackle	Misc.		

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 3/4/6	Booming support	2
Personnel***	Crew & Tech./Shift		3 to 10

Deflection Booming, Live **DF-L**

Direct Resources

Description	Type	Function	Quantity
Boom	Protected water	Deflection booming	200 ft.
Anchor Systems	–	–	–
Rigging/Tackle	Misc.		

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 3/4	Booming support	2
Personnel**	Vessel Crew/Shift		4 to 6

Deployment Considerations and Limitations

- Calm/Protected water boom (6" x 24" / 18" x 42") are most commonly used for this tactic.
- Do not assume 100% efficiency with one boom system.
- Readjust angles and widths between boom sections as necessary to meet changing conditions (tides, currents, and winds).
- Constant monitoring of system efficiency is required.
- Deployment planning should be based on average high tidal conditions.

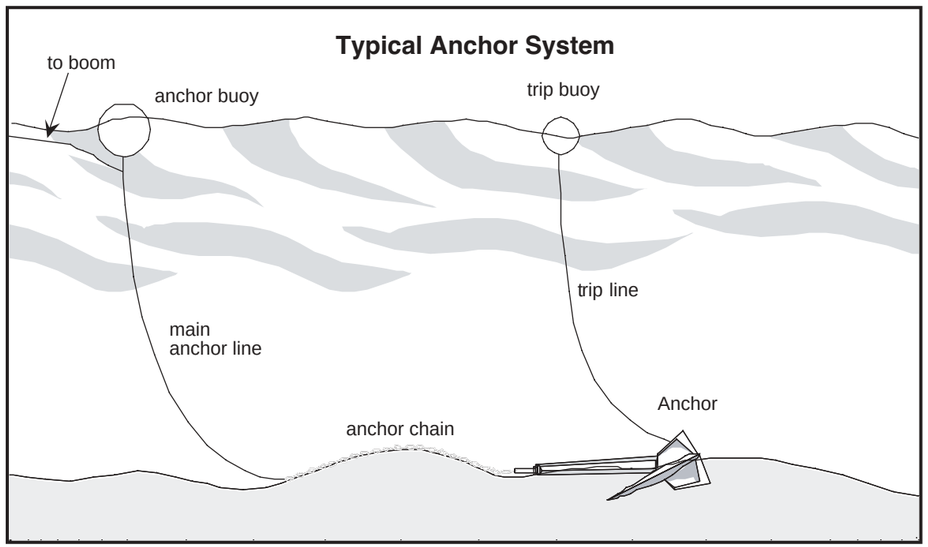


Figure G-2-4. Boom angle relative to current.

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

** Boom types are defined in the World Oil Catalog.

*** Personnel includes vessel crew.

B. DIVERSION BOOMING

Objective & Strategy

The objective of diversion booming is to divert the spilled oil from one location or direction of travel to a specific site for recovery.

This technique consists of boom and anchor systems placed at an optimum angle to the current, using the movement of the current to assist in response operations. One basic deployment technique is to secure/anchor one end of the boom up-current from the selected recovery site. Then secure additional anchor systems to the boom to achieve the desired diversion with the least amount of entrainment or escapement.

Diversion Boom (single boom): Boom is deployed from one bank at an optimum angle to the current and secured/anchored to divert the oil to an eddy, quiet water, or collection beach for recovery.

Diversion Boom (cascade): Several booms are deployed in a cascade configuration when a single boom cannot be used because of fast current or because it is necessary to leave openings in the boom for vessel traffic, etc. This configuration can be used in strong currents where it may be impossible to effectively deploy one continuous section of boom. Shorter sections of boom used in a cascade deployment are easier to handle in faster water, thereby increasing efficiency of oil control. Additional equipment may be required to set and maintain this system as compared to the single boom configuration.

Chevron boom configurations may be used in fast water. Two booms are deployed from an anchor in the middle of the stream/ river and then attached to each bank. A closed chevron configuration is used to divide a slick for diversion to two or more recovery areas. An open chevron can be used where boat traffic must be able to pass. In the open chevron configuration the two booms are anchored separately midstream, with one anchor point up-stream or downstream of the other. An inverted chevron can also be used to funnel the oil slick to a marine recovery unit anchored mid-channel.

Resources for this module have been defined as an increment of 200 ft. of boom with associated support equipment. Quantity of units required will be determined by site and resource sets may need to be refined as site specific requirements dictate.

Diversion Booming Deployment Configurations

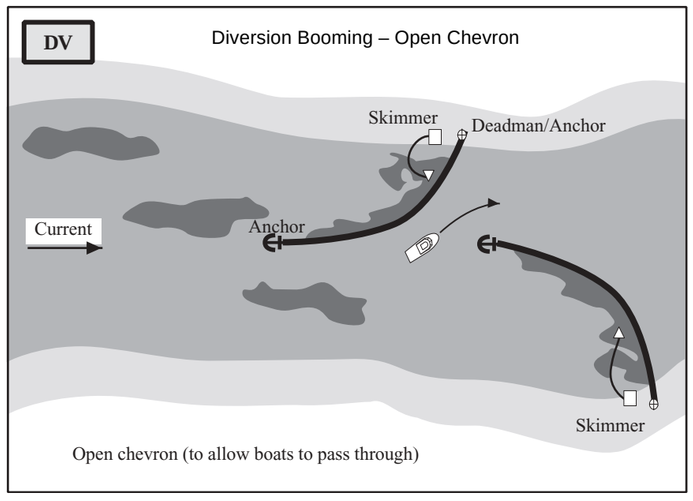


Figure G-2-5. Diversion booming, open chevron.

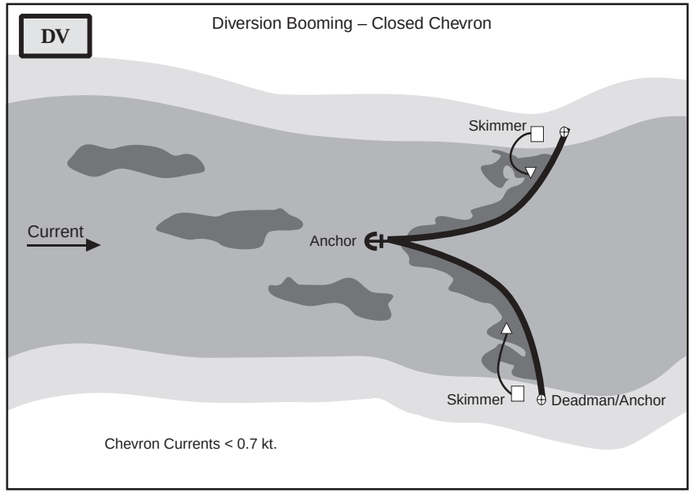


Figure G-2-6. Diversion booming, closed chevron, on-shore skimming.

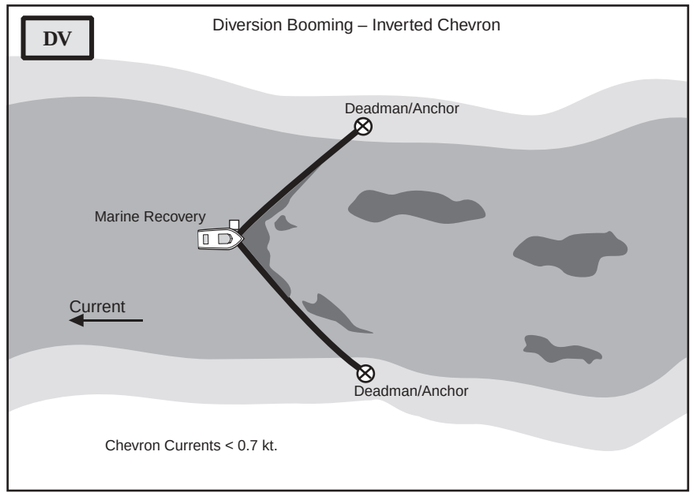


Figure G-2-7. Diversion booming, inverted chevron, marine skimming.

Resources

Diversion Booming, Fixed DV

Direct Resources

Description	Type	Function	Quantity
Boom	Calm/Protected water	Diversion booming	200 ft.
Anchor systems	40 lbs.	Securing boom	2
Rigging/Tackle	Misc.		

Support Resources*

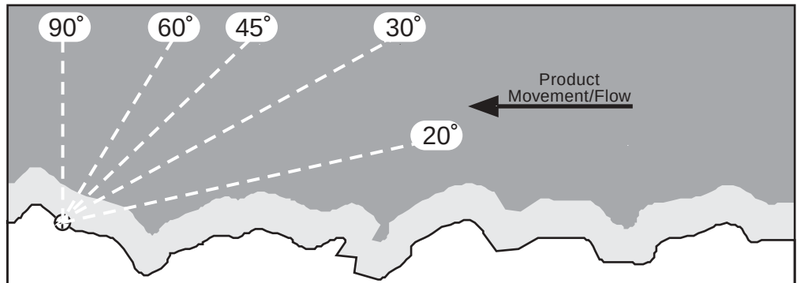
Description	Type	Function	Quantity
Vessels	Vessel Class 3/4/5/6	Booming support	2
Personnel**	Crew & Tech./Shift		3 to 10

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

** Personnel includes vessel crew.

Deployment Considerations and Limitations

- Calm/Protected water boom are most commonly used for this tactic.
- Do not assume 100% efficiency with one boom system.
- Readjust angles and widths between boom sections as necessary to meet changing conditions.
- Constant monitoring of system efficiency is required.
- Deployment planning should be based on average high tidal conditions.
- See Figure G-2-8 for anchor system components.
- Title 16 permit required to work inside an anadromous stream. Due to the possibility of contaminating spawning habitat, avoid diverting and/or collecting oil inside a stream mouth if possible.
- See Figure G-2-15 for methods to keep oil from contaminating beaches at collection points.



Boom angle relative to current required to maintain component of current <3/4 knot

CURRENT (Knots)	CURRENT (ft/second)	BOOM (Knots)
1.5	2.5	30˚ to 42˚
1.75	2.9	25˚ to 35˚
2.0	3.4	22˚ to 30˚
2.25	3.8	19˚ to 26˚
2.5	4.2	17˚ to 24˚
2.75	4.6	16˚ to 21˚
3.0	5.0	15˚ to 19˚

Difficulty in deployment will increase and effectiveness will decrease as a function of water velocity.

Figure G-2-8. Boom angle relative to current.

C. EXCLUSION BOOMING

Objective & Strategy

The objective of exclusion booming is to exclude any oil slick from entering a sensitive area.

This technique requires the area to be completely boomed off, essentially forming a barrier to protect the location. Conventional containment boom, tidal-seal boom, or a combination of each can be used to exclude spilled oil from a sensitive area. Typically, tidal-seal boom is deployed at the shoreline/water interface on both shores and is secured/anchored into position. Conventional containment boom is then connected to the tidal-seal boom and is secured with additional anchor systems to form a barrier and to maintain shape.

This technique is most efficient in low current areas. Freshwater outflow may assist in maintaining boom configuration and pushing oil away from the area inside the boom.

Resources for this module have been defined as an increment of 200 ft. of containment boom with at least 50 ft. of tidal-seal boom on each shoreward end and associated support equipment. Quantity of units required will be determined by site, and resource sets may need to be refined as site specific requirements dictate.

Exclusion Booming Deployment Configurations

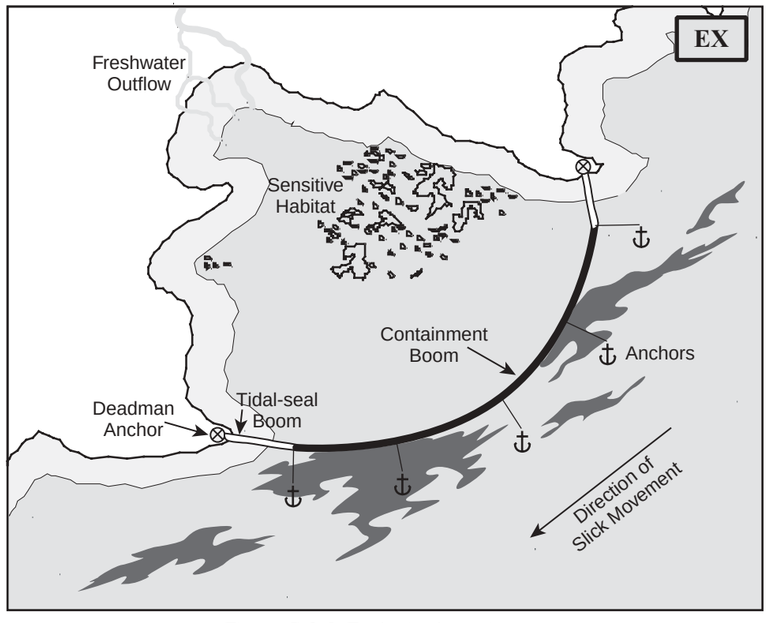


Figure G-2-9. Exclusion booming.

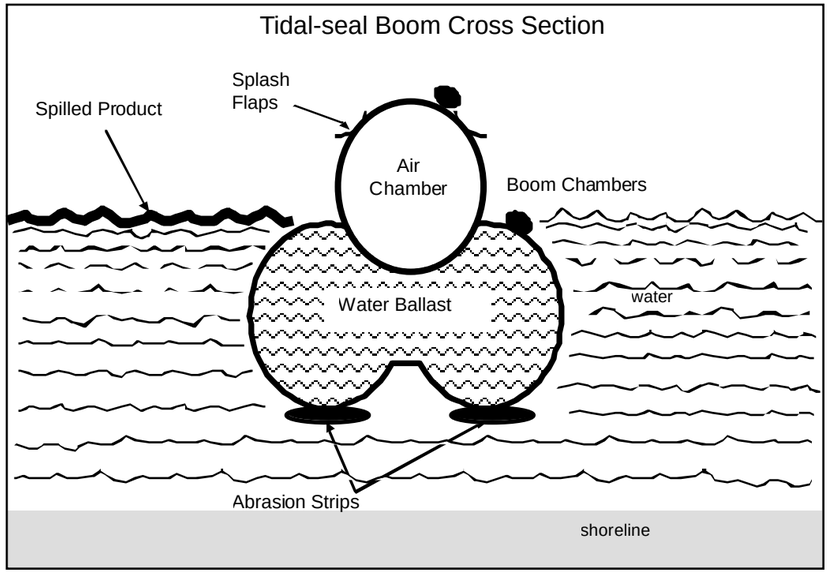


Figure G-2-10. Tidal-seal boom cross section.

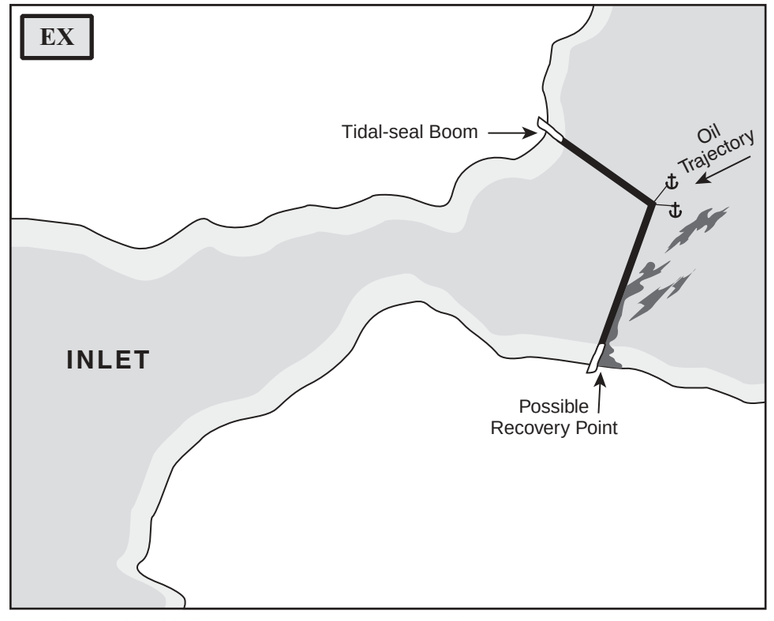


Figure G-2-11. Exclusion booming with apex for exposed shores or currents.

Resources

Exclusion Booming EX

Direct Resources

Description	Type	Function	Quantity
Boom	Calm or Protected water	Exclusion booming	200 ft.
Boom	Tidal-seal	Exclusion booming	100 ft
Anchor systems	40 lbs. or 60 lbs.	Securing boom	4
Inflator & Pump	Leaf blower & 2" pump with jumpers	Filling tidal-seal boom	
Rigging/Tackle	Misc.		

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 3/4/5/6	Booming support	2
Personnel**	Crew & Tech./Shift		3 to 10

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

** Personnel includes vessel crew.

Deployment Considerations and Limitations

- Calm/Protected water boom, and tidal-seal boom are most commonly used for this tactic.
- Do not assume 100% efficiency with one boom system.
- Readjust anchors to maintain shape through tide cycles.
- Constant monitoring of system efficiency is required.
- Deployment planning should be based on average high tidal conditions.
- Technique may be ineffective in currents over 3/4 of a knot.
- See figure G-2-3 for boom angle relative to current.
- See Figure G-2-4 for anchor system components.
- A gate may be installed to allow vessels to pass inside the boom.

D. SHORESIDE RECOVERY

Objective & Strategy

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

Numerous types of recovery systems (skimmers) are available to recover many types of oil. Recovery systems vary in size and support requirements. There is also a wide range of options for temporary oil storage. Access to the recovery site and the oil type may influence/dictate the options of equipment to be used. If access is restricted to four wheel ATVs, then the systems chosen need to be light enough to be transported by ATV and capable of being setup/deployed by a minimal number of personnel. If access is not restricted, larger systems can be used and deployed by heavy lifting equipment. If the site is accessible by road, vacuum trucks may be used for oil recovery, storage and transport. In all cases, every effort should be made to protect the collection beach. See figure G-2-13.

The general strategy is to:

- Identify the primary recovery site and access capabilities.
- Determine the appropriate recovery and storage systems based on oil, access, and deployment restrictions.
- Mobilize and deploy equipment to recover and temporarily store the oil from the recovery site.

Resources for this module vary and have been divided into two categories: Restricted Access and No Restrictions. Each unit is defined to contain a recovery device, a storage device and the associated direct and 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.

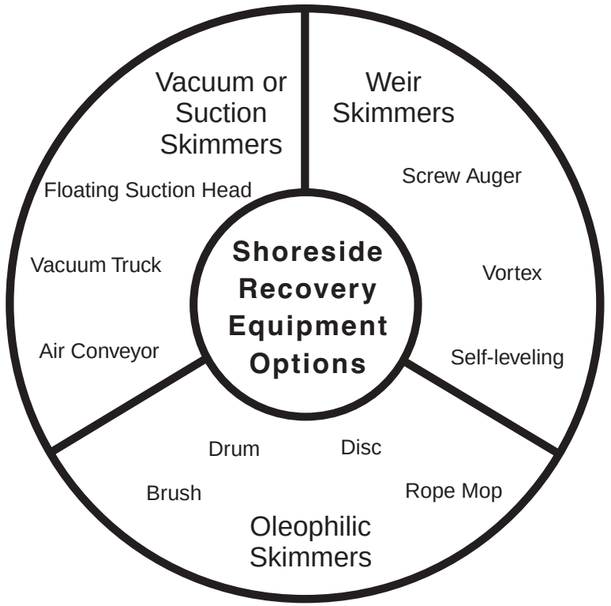


Figure G-2-13. Shoreside recovery unit equipment options.

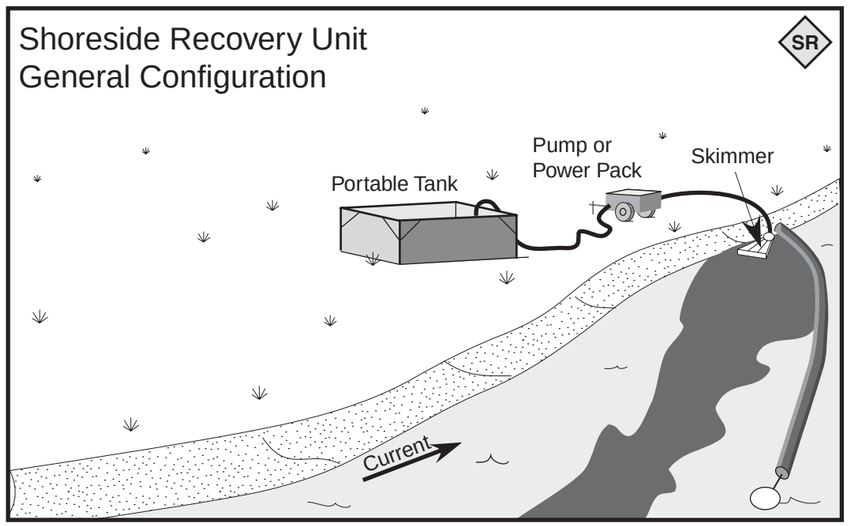


Figure G-2-12. Shoreside recovery unit general configuration.

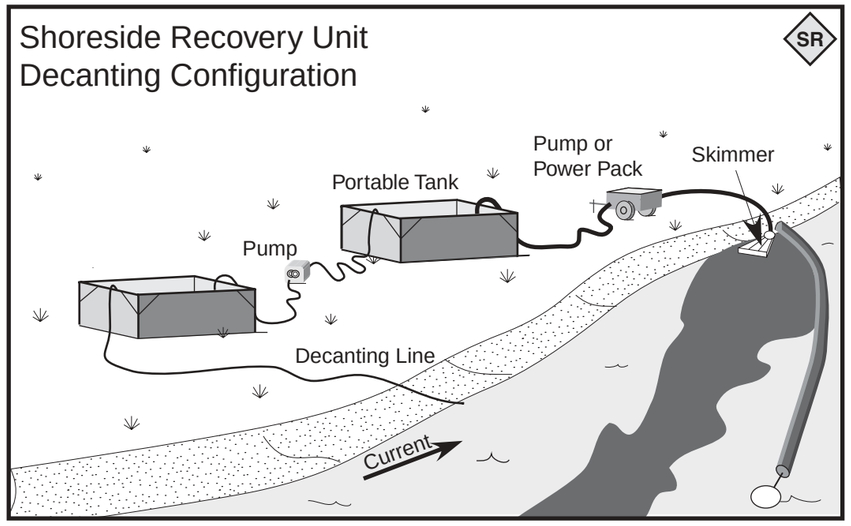


Figure G-2-14. Shoreside recovery unit decant illustration.

Resources

Shoreside Recovery, Restricted Access

Direct Resources

Description	Type	Function	Quantity
Collection System	Calm/Protected water skimmer	Oil recovery	1
Storage Device	Portable/Easy Setup	Oil storage	1
Hoses & Fittings	Misc.	System support	
Rigging/Tackle	Misc.	System support	

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 3/4/5/6	Booming support	2
Personnel**	Response Tech./Shift		3

Shoreside Recovery, No Access Restrictions

Direct Resources

Description	Type	Function	Quantity
Collection System	Calm/Protected water skimmer	Oil recovery	1
Storage Device	Collapsible Tank	Intermediate storage	1
Storage Device	Vacuum Truck	Storage/Transport	1
Hoses & Fittings	Misc.	System support	
Rigging/Tackle	Misc.	System support	

Support Resources*

Description	Type	Function	Quantity
Vessels	Vessel Class 3/4/5/6	Booming support	2
Personnel**	Response Tech./Shift		3
Trucks & Trailers		Equipment & personnel transport	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 vessel crews.

Deployment Considerations and Limitations

- Access 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.
- Where access is restricted, system efficiency should be increased to minimize excess waste/water, and decant options should be reviewed.
- Deployment planning should be based on average high tidal conditions.
- A pump may be required to move oil from storage to vacuum truck or other mobile storage.
- May need to request a permit from ADEC to decant free water from storage back into recovery area.
- Use one of the methods shown in Figure G-2-15 to protect the collection site from contamination.

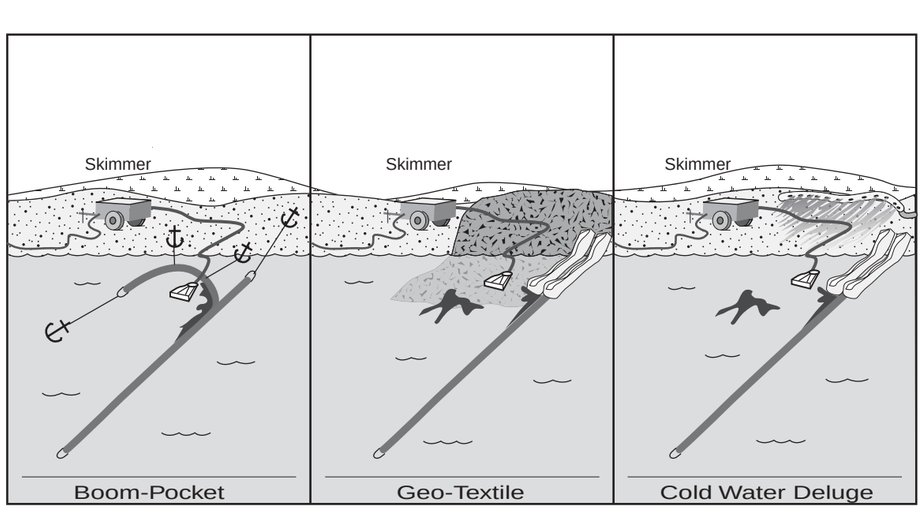


Figure G-2-15. Methods to keep oil from contaminating collection beaches.

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 and 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

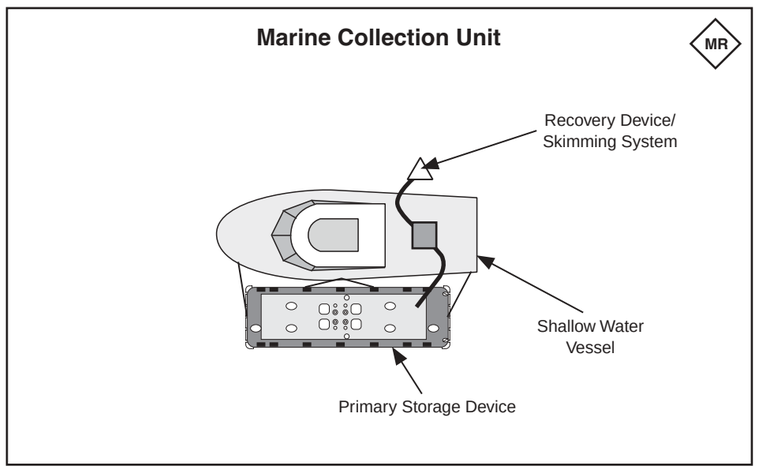


Figure G-2-16. Marine recovery unit.

Marine Recovery Unit Equipment Options

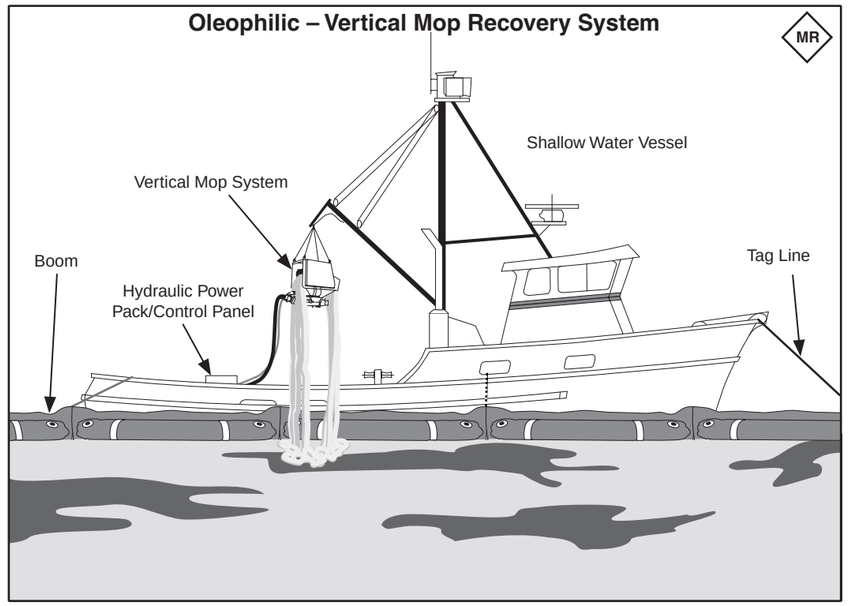


Figure G-2-17. Vertical mop recovery system.

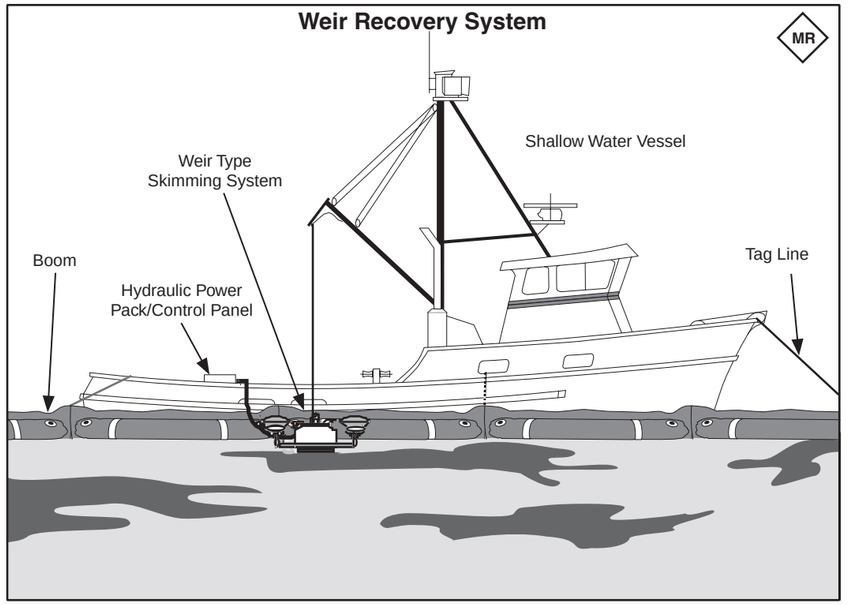


Figure G-2-18. Weir recovery system.

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.

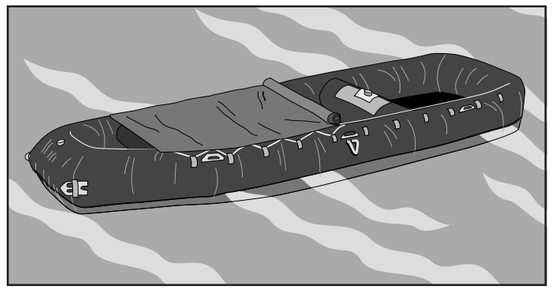


Figure G-2-19. Towable open primary storage device.

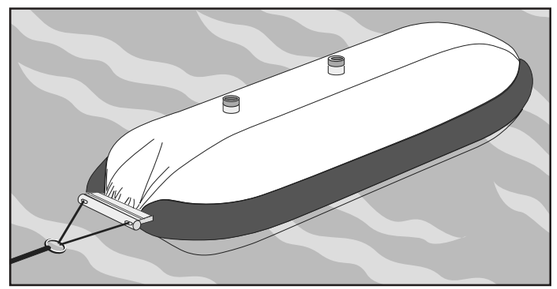


Figure G-2-20. Towable, flexible primary storage device.

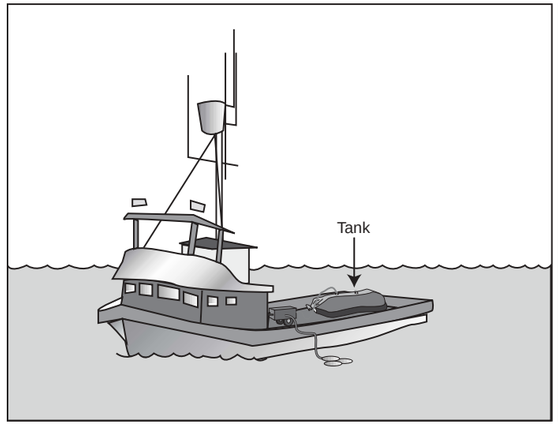


Figure G-2-21. Deck tank primary storage device.

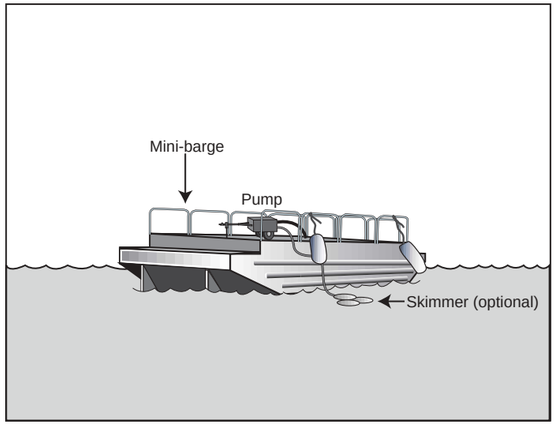


Figure G-2-22. Towable Mini-barge primary storage device.

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 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 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 for recovery 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 vessels 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

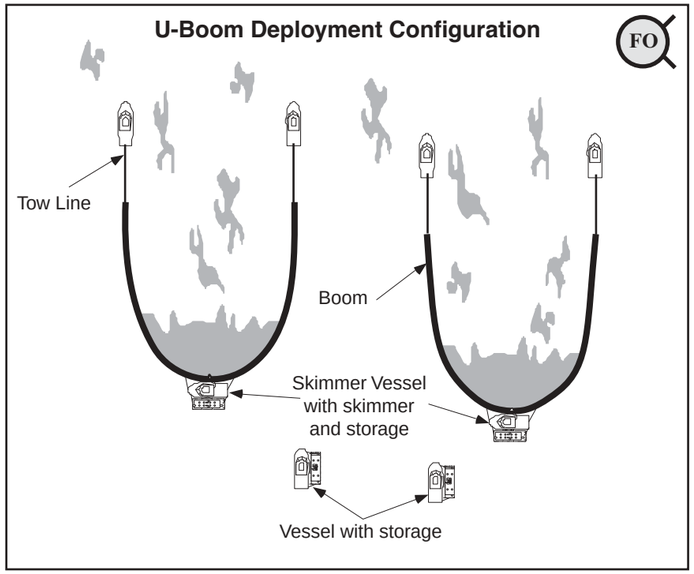


Figure G-2-23. U-boom configuration.

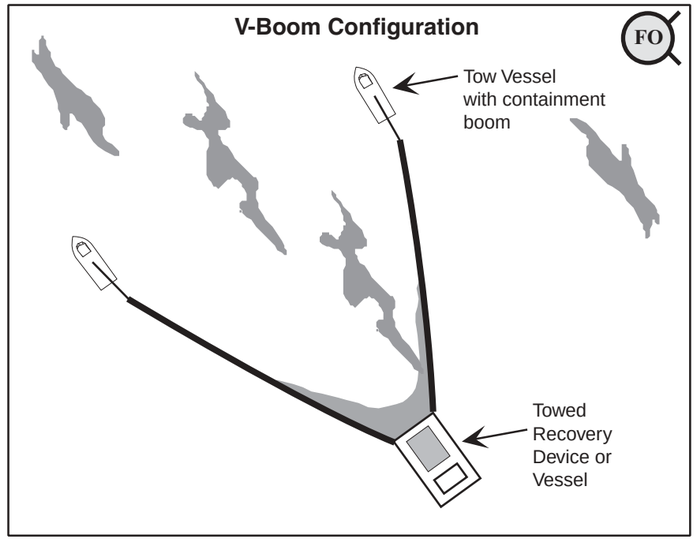


Figure G-2-24. V-boom Configuration.

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.

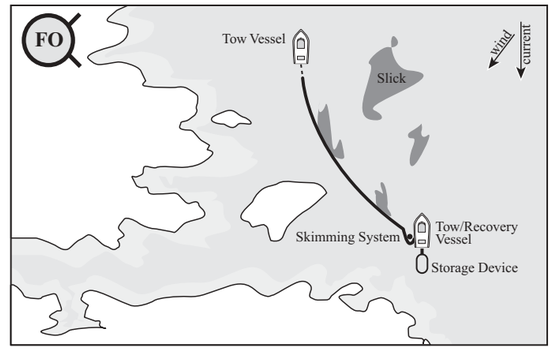


Figure G-2-25. J-boom configuration.

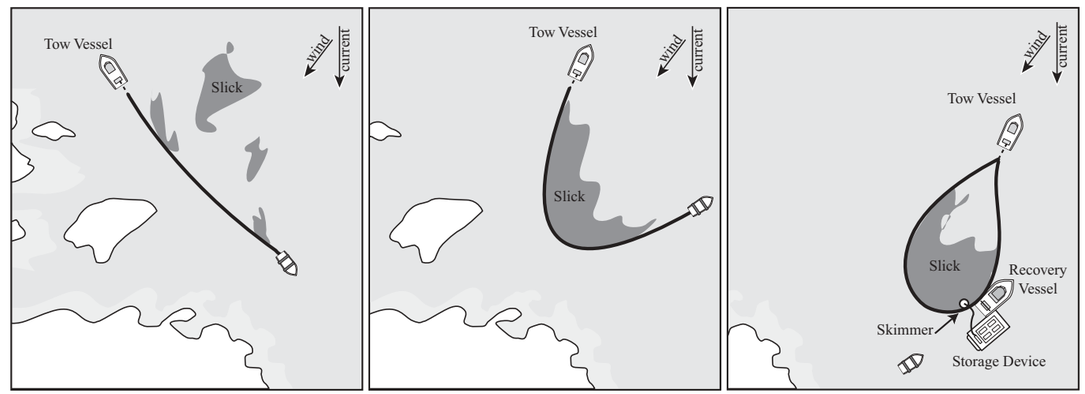


Figure G-2-26. Nearshore trapping, boom towing boats collect oil in boom then tow the trapped oil to deeper water for recovery.

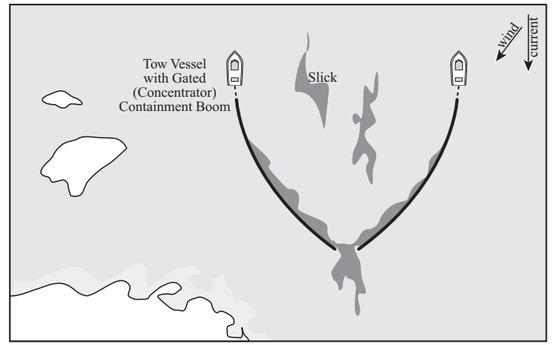


Figure G-2-27. Gated U-boom concentrator boom, towed in front of free-oil recovery.

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

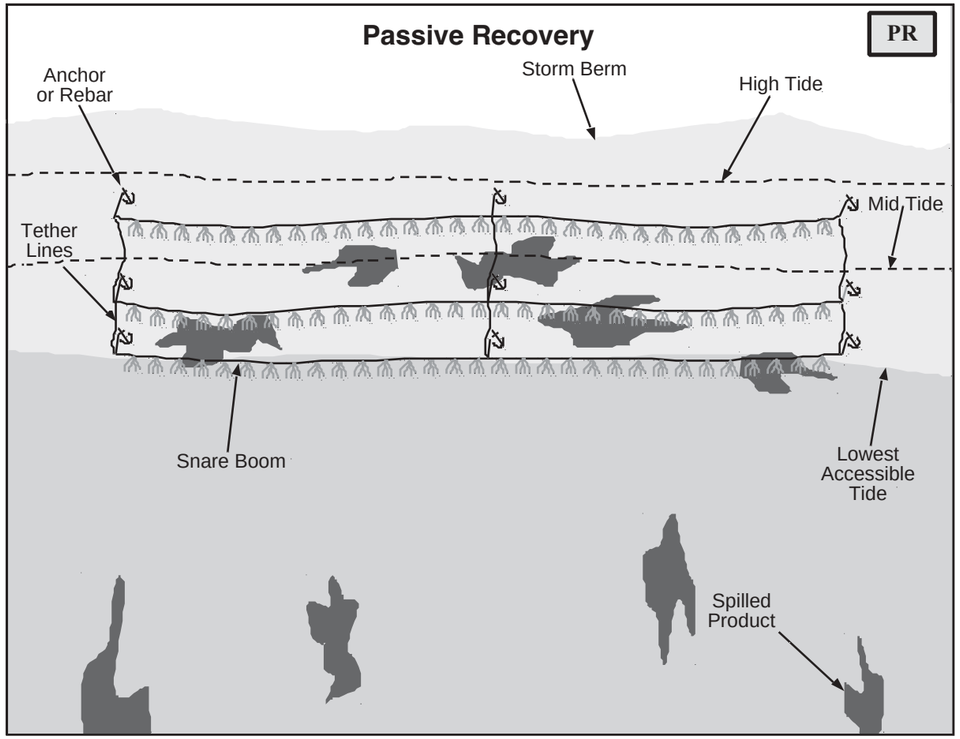


Figure G-2-28. Aerial view of a passive recovery configuration.

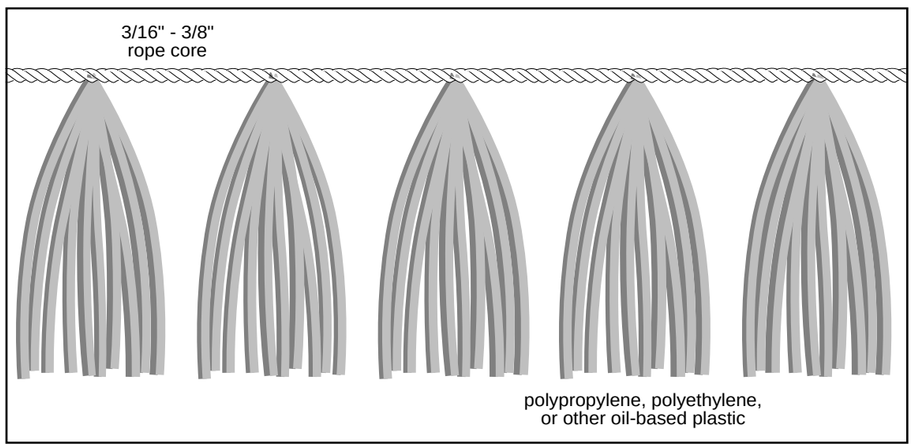


Figure G-2-29. Snare line.

[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 which produced free flowing water down the beach surface that prevent 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 and connecting to a high volume pump (typically six inch). 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 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 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

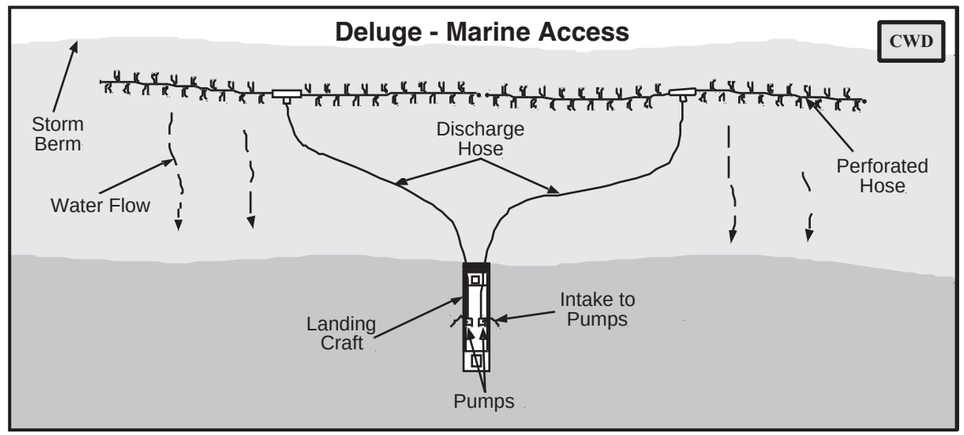


Figure G-2-30. Aerial view of a deluge configuration marine access.

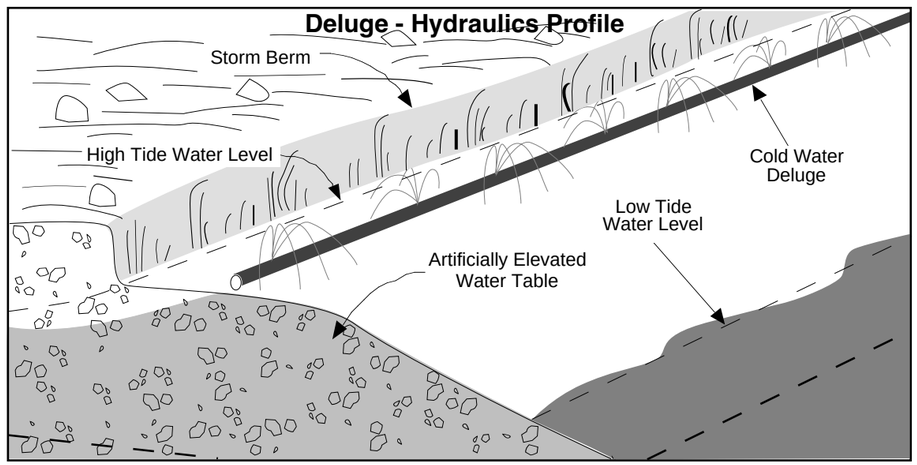


Figure G-2-31. Deluge hydraulic shoreline cross-section profile.

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 ft
Discharge Hose	6" Lay Flat	Header Supply	400 ft
Suction Hose	6" Suction	Pump Supply	2 x 20 ft
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 ft
Discharge Hose	6" Lay Flat	Header Supply	400 ft
Suction Hose	6" Suction	Pump Supply	2 x 20 ft
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 should 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 dam inclined 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.

Underflow Dam General Configuration

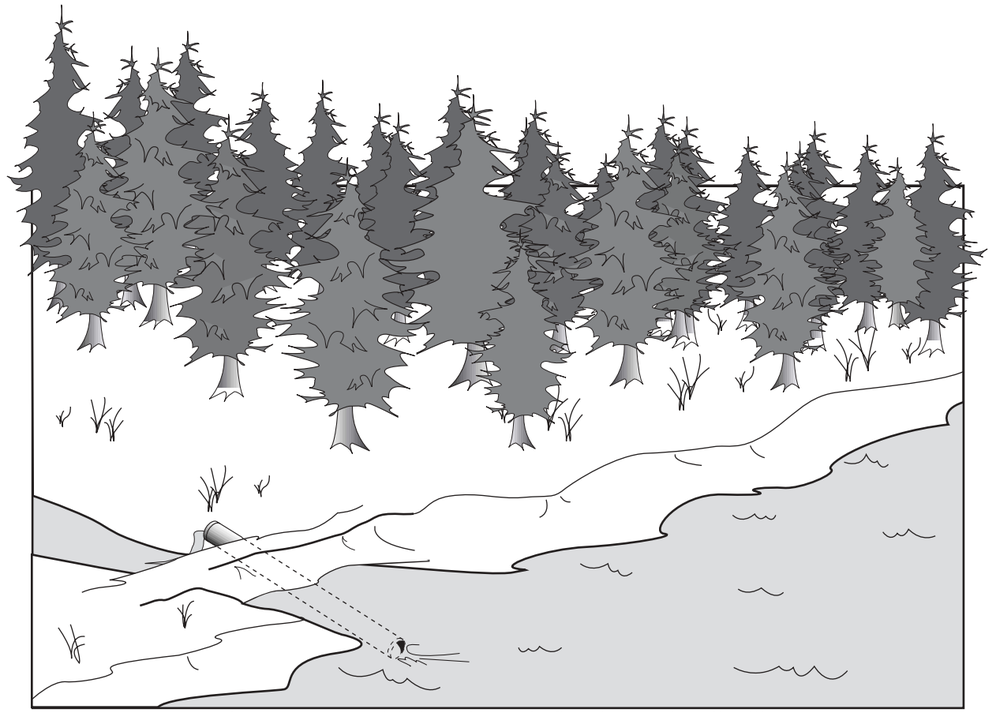


Figure G-2-33. Aerial view of an underflow dam marine oil spill.

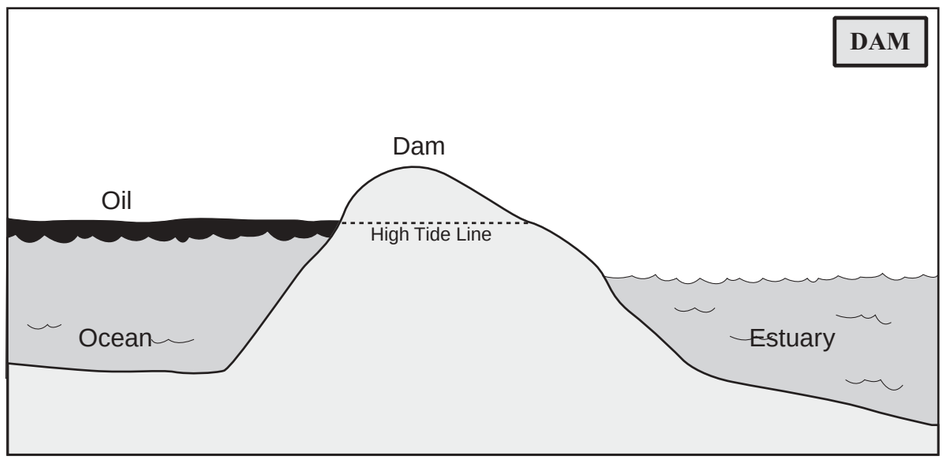


Figure G-2-32. Dam cross-section profile.

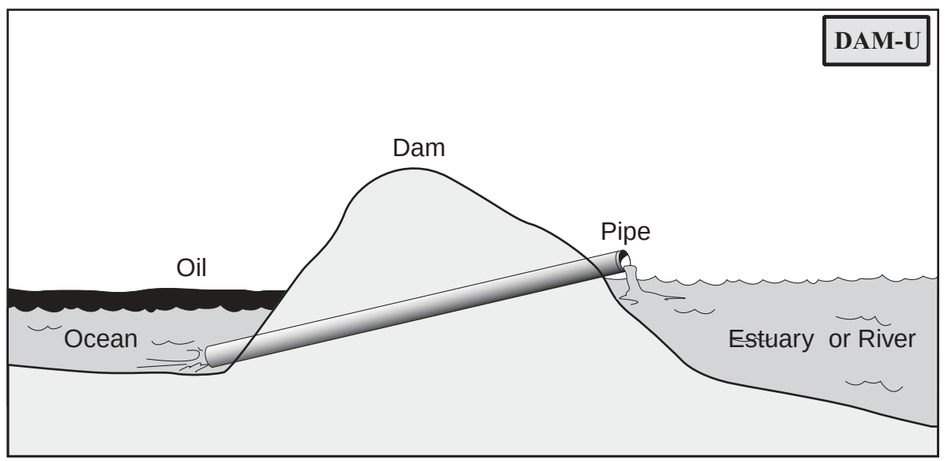


Figure G-2-34. Underflow dam cross-section profile.

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, replace eroded materials, and 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 stream mouth may block fish passage. The dam must be removed inmmediately when it is no longer needed.

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