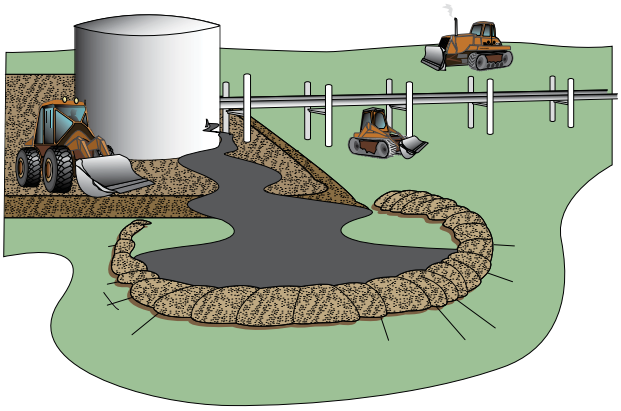
DIKES, BERMS, AND DAMS

OBJECTIVE & STRATEGY

DBD

Dikes, Berms, and Dams are land-based tactics, with the objective of containing spilled oil and limiting spreading of oil slicks, thus minimizing impacts to the environment. Dikes, berms and dams are embankment structures built-up from the existing terrain, placed to contain and accumulate oil for recovery. These barriers can serve to:



- Contain and stabilize a contaminated area.
- Contain or divert oil on water or oil that has potential to migrate.
- Create cells for recovery.
- Use natural depressions to act as containment areas for recovery.

The tactic may be deployed in association with a recovery tactic, such as Shoreside Recovery or On-land Recovery. Dikes, berms, and dams are most effective when placed before oil arrives. Dikes, berms, and dams can also be used to exclude oil from a sensitive area, which is covered in the Beach Berms and Exclusion Dams tactic. The tactic can also be used in conjunction with an excavation tactic to enhance containment volumes (see Pits, Trenches, and Slots).

The general strategy is to:

1. Identify the location and trajectory of the spill or potential spill.
2. Plan a deployment configuration that best supports the operating environment and available resources.
3. Mobilize to the location and deploy response resources.
4. Construct the containment structure and ensure it does not leak.
5. Consider the need to remove any water-bottom that may collect beneath the oil inside the structure.
6. Monitor the containment structure on an appropriate basis.
7. If oil collects in the structure, utilize an appropriate recovery system to remove the oil.

Dikes, Berms, and Dams

TACTIC DESCRIPTION

This tactic involves building an embankment perpendicular to the flow of the oil slick or around a contaminated area. Dike, berm, and dam structures can be constructed with a wide variety of materials including: soil, gravel, snow, sand bags, oil boom, timbers and logs. Selection of the construction material depends on the operating environment, location, available materials, and whether the structure is to be temporary or permanent. The containment area should be lined with an impermeable membrane, such as plastic sheeting, to keep oil and oily water from leaking or migrating into the soil. The structure may include a method to regulate flow, such as a weir or spill way. Dikes, berms, and dams can be built by manual labor or with earth-moving equipment depending on the location and available resources.

Dikes, berms, and dams can cause significant impacts to the environment. If time allows, the Operations Section Chief should consult with the Environmental Unit Leader before authorizing the construction of any dike, berm or dam.

Operating Environments

MARSH AND TUNDRA

Marsh and tundra are wetlands that are sensitive habitats, where extra care must be taken to minimize damage when constructing and operating barriers. Excavation and other ground disturbances in these environments can cause more damage than a spill. Any activity that has the potential to push the contamination into the soft soils should be avoided. In some cases, it may be best to wait for cold weather to freeze the substrate before working on tundra or marsh. In other cases, the Environmental Unit may recommend no clean-up activity at all, leaving the marsh/tundra to recovery naturally.

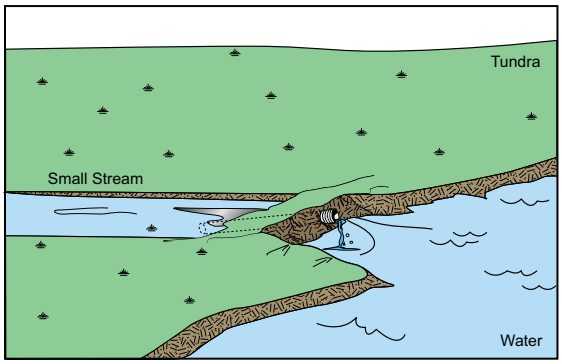


Figure DBD-1. Underflow dam configuration.

Travel across marsh and tundra with tracked vehicles, heavy equipment, and even foot traffic can seriously damage these sensitive habitats. Disturbance is greatly reduced by using sheets of plywood, outdoor carpet, or other similar material as a traveling surface and minimizing trips with equipment.

Before excavating in marsh or tundra, check for the presence of groundwater or permafrost. Do not excavate into frost-laden (cemented) soils, since disruption of the permafrost could accelerate thermal erosion. The depth of the excavation is limited by the depth of the permafrost or the water table.

OTHER LAND

Land and shorelines other than marsh and tundra are better places to construct dikes, berms, and dams. Still, care should be taken

to minimize damage during construction, especially if the structure blocks the flow of a creek or stream that contains fish or other aquatic life. Such structures should only be used to block stream flow during emergencies and should be opened or removed as soon as possible.

SOLID ICE AND FROZEN GROUND

Snow and ice work well as construction materials for embankment structures on solid ice and frozen ground, but other construction materials can be utilized.

Deployment Configurations

There are many deployment configurations for dikes, berms, and dams. A few examples follow.

BERMS

A containment berm can be constructed of available materials such as earth, gravel, or snow. Use earth-moving equipment or manual labor to construct the berm. Form the materials into a horseshoe shape ahead of the flow of oil. Use plastic sheeting to line the walls of a soil berm to prevent oil penetration. Sandbags filled with sand or other heavy material also make excellent containment barriers.

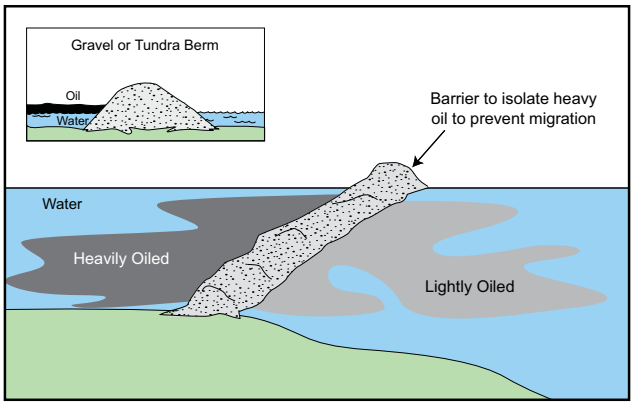


Figure DBD-2. Berm configuration.

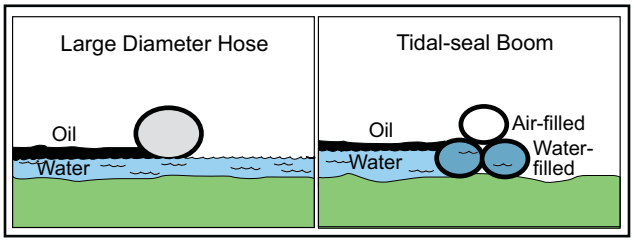


Figure DBD-3. Using boom to form a berm

DAMS

An underflow dam can be used when there is too much water flow to allow for a complete blockage of a drainage channel. The dam is built of earth, gravel, or other barriers such as sandbags or plywood sheets. Wherever possible, line the upstream side of the dam with plastic sheeting to prevent erosion and penetration of oil into the dam material.

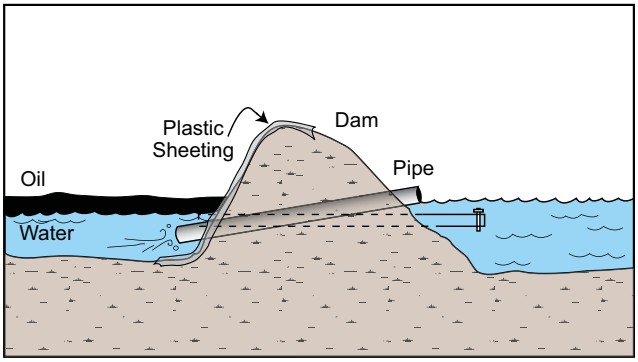


Figure DBD-4. Underflow dam.

Underflow dams use inclined culverts or pipes to move water downstream while leaving the spill contained behind the dam. The capacity of the pipe(s) should exceed the stream flow rate. It may be necessary to use pumps to remove water behind a dike. Valves or culvert plugs can also be used to control flow rate.

Dikes, Berms, and Dams

Pipes must be placed on the upstream side of the dam, with the elevated end on the downstream side. Make sure that the upstream end of the pipe is submerged and below the oil/water interface. The height of the elevated downstream end of the pipe will determine the water level behind the dam.

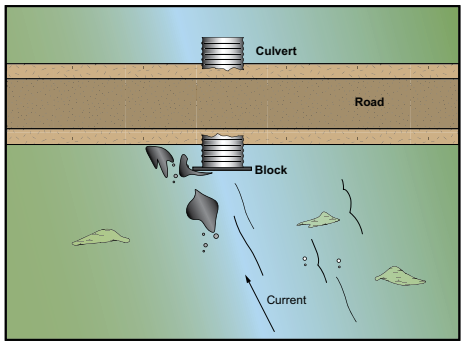


Figure DBD-5. Using a roadway as a dike.

EXISTING ROADS

Roadways that are built up above the terrain can be used as dikes. However, road construction usually allows for natural drainage through culverts or bridges. These drainage structures must be controlled to turn the road into a barrier.

CULVERT BLOCKING

A culvert can be blocked using sheet metal, plywood barriers, or inflatable culvert plugs. Use a full block only when the culvert will be blocked for the entire cleanup operation, if the oil floating on the water will not contaminate additional soil or tundra, and if blocking the water flow will not threaten the road. Otherwise, an adjustable weir or culvert plug should be used.

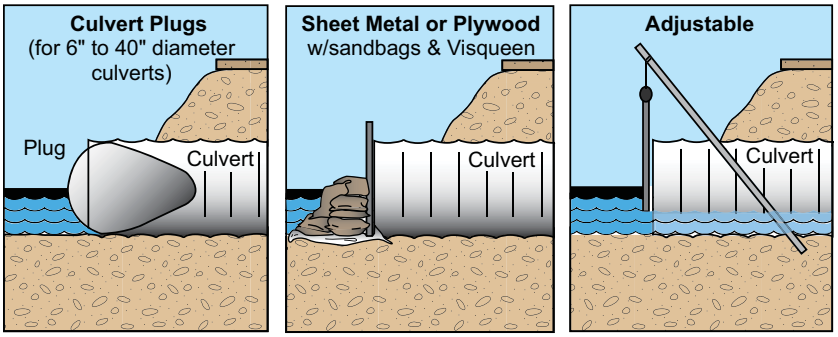


Figure DBD-6. Culvert blocking options.

Plywood and/or sandbags can also be used as culvert blocks, but are more labor-intensive and pose a higher potential for injury. A wood block may require a headwall with kickers oriented to support the boards or plywood. Place the blocking materials over the upstream end of the culvert. Plastic sheeting over the outside of the block will prevent oil penetration.

EARTH MOVING EQUIPMENT

A bulldozer, road grader, or front-end loader drives around the spill with its blade angled towards the spill, pushing earth or snow into a berm. Once the perimeter has been covered with an initial berm, shore-up areas as necessary.

SNOW

Because of the absorbent quality of snow, it makes an excellent berm for both containment and recovery. A snow berm can be strengthened by spraying it with a fine water mist that forms an ice layer on top of the snow. A snow berm is built around the areas of heaviest oiling to contain oil or diesel spilled to tundra and/or ice in winter.

MESH FENCE

Plastic mesh fencing may be used to quickly construct an underflow dam system. The mesh fencing is placed across the drainage and held in place with stakes. Absorbent boom, oil boom, plywood, or even dry dead grass can be placed on the upstream side of the fencing. Running water will find its way under the barrier fence, but oil floating on top of the water will be trapped. The advantages of this system are that it is lightweight and mobile.

DEPLOYMENT CONSIDERATIONS AND LIMITATIONS

SAFETY

- A spotter is recommended when working with earth-moving equipment.
- Response personnel should wear PPE as required by the incident-specific Site Safety Plan.

DEPLOYMENT

- A Title 41 Fish Habitat permit is required to work inside any anadromous stream. Due to the possibility of contaminating spawning habitat, avoid diverting and/or collecting oil inside a stream mouth if possible.
  - Damming of stream mouth may block fish passage. The dam must be removed immediately after it is no longer needed.
  - In larger streams, consider the use of bulk bags for dam construction.
- Consult with the Environmental Unit to determine if permits are required before constructing a dike, berm, or dam.
- Select location to avoid or minimize damage to historic property sites and biologically-sensitive habitats.
- A plastic liner or sheeting can be used on the walls of the soil or gravel embankments to inhibit spill penetration into the soils or gravel.
- Disposal of construction material should be taken into account before using this tactic.
- The least intrusive methods for building berms are preferred on tundra and marsh.
- Do not excavate where excavation will cause more damage than the spill.
- If wildlife or historic properties are encountered, see Wildlife Checklist on page A-19 or Historic Properties Checklist on page A-20.
- Ice-reinforced snow berms are useful to contain oil that melts out during breakup.
- Check dams periodically for leakage and integrity, replace eroded materials, and continually monitor the water/oil interface. Valved pipes, pumps, or a number of siphons may require periodic adjustment to compensate for minor changes in stream flow.

- If sufficient underflow cannot be maintained, or if excessive overflow occurs, additional dams downstream may be required.
- Gravel or topping may have to be added continually to the dam if erosion is a problem.
- Sandbags are labor-intensive and should be the last consideration.

REFERENCES TO OTHER TACTICS

Other tactics associated with dikes, berms, and dams include:

- BB Beach Berms and Exclusion Dams
- PTS Pits, Trenches, and Slots
- SR Shoreside Recovery
- OR On-land Recovery

EQUIPMENT AND PERSONNEL RESOURCES

There are too many variations of dikes, berms, and dams to be specific on equipment and personnel resources. The following tables provide typical resource requirements for construction using earth moving equipment and manual labor.

Dikes, Berms, and Dams Built with Earth Moving Equipment

Typical Equipment	Function	Quantity	Notes
Bulldozer, road grader, front-end loader, excavator	Construct dikes, berms, or dams	Site-specific	Depending on configuration
Dump truck	Optional - for moving construction materials	Site-specific	Depending on configuration, currents, and sea states
Typical Supplies	**Function**	**Quantity**	**Notes**
Soil, gravel, sand, or snow	Material for embankments	Site-specific	May be available on-site or may have to be transported to the location
Culvert	Optional for underflow dam	Site-specific	Sized to be capable of handling surface water flow
Culvert plug, weir, or blocking materials	Optional to control flow through underflow dam	1 per culvert	
Plastic sheeting or other impermeable membrane	Liner to prevent the embankment from leaking	Site-specific	Care must be taken when placing the sheeting to maintain its integrity
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	May not always be on-site
Equipment Operators	Operate earth moving equipment	1 per equipment per shift	Depending on number of pieces of equipment
General Technicians	Work under the direction of field team leader as laborers and spotters	2 to 8	Depending on configuration and pieces of equipment

Dikes, Berms, and Dams Built with Manual Labor

Typical Equipment	Function	Quantity	Notes
ATV with trailer	Optional - for moving construction materials	Site-specific	Depending on configuration, currents, and sea states
Hand tools, shovels	Filling sand bags, modifications to structure	12	
Typical Supplies	**Function**	**Quantity**	**Notes**
Sand bags	Optional material for embankments	Site-specific	Sand may be available on-site or may have to be transported to the location
Plywood sheets	Optional material to protect marsh or tundra during site access	Site-specific	Plywood may be reused
Culvert	Optional for underflow dam	Site-specific	Sized to be capable of handling surface water flow
Culvert plug, weir, or blocking materials	Optional to control flow through underflow dam	1 per culvert	
Hose and tidal-seal boom	Optional for creating berms on level ground or ice to block the spread of oil	Site-specific	
Plastic sheeting or other impermeable membrane	Optional liner to prevent the embankment from leaking	Site-specific	Care must be taken when placing the sheeting to maintain its integrity
Typical Personnel	**Function**	**Quantity**	**Notes**
Field Team Leader	Supervises operations	1	May not always be on-site
Equipment Operators	Operate ATV	1 per ATV per shift	Depending on number of ATVs
General Technicians	Work under the direction of field team leader as laborers and spotters	4 to 12	Depending on configuration and site

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