JOB AIDS FOR
SHORELINE PROTECTION ON BEACHES AND TIDAL INLETS

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ABSTRACT

Practical Job Aids that provide best practices guidelines have been developed for shoreline protection on sand beaches and tidal inlets. Washover channels and tidal inlets are potentially critical oil pathways for oil spilled in the marine environment to be transported into sensitive backshore environments such as salt-water ponds, lagoons or wetlands (marshes and mangroves). These passageways are potential key intercept points for protecting sensitive and vulnerable habitats. Job Aids identify generic on-land and on-water protection strategies and tactics, and describe best practices as well as practices to avoid.

INTRODUCTION

The American Petroleum Institute (API) Joint Industry Task Force (JITF) on Oil Spill Preparedness and Response initiated a series of studies to improve response decisions and operations. In 2011 the API Shoreline Protection and Cleanup R&D Technical Working Group, one of a series of groups which cover the range of spill response activities, funded seven projects, two of which are described in this presentation. The focus of these two studies is to create best practice guidelines and Job Aids for shoreline protection. The guidelines focus on strategies and tactics to: (a) contain oil as it washes ashore on beaches, and (b) intercept, divert or contain oil at tidal inlets. In both cases the objectives are to prevent oil being transported into potentially highly sensitive upper beach or backbarrier environments, such as wetlands, estuaries and lagoons.

SHORELINE PROTECTION GUIDELINES FOR BEACHES

Onshore protection may involve the construction of barriers or berms to contain oil as it is washing ashore on beaches to prevent movement landward across a beach over low areas or through temporary or semi-permanent channels cut through dune ridges extending into lagoons or wetlands. The guidelines describe the dynamics of beach and dune systems to provide a background for understanding the processes that control where oil is carried as it washes ashore. Under non-storm conditions, oil is typically stranded by the falling tide in the intertidal zone. Moderate- to high-energy waves combined with elevated water levels that accompany high spring tides and moderate storms cause wave swash to flow onto the supratidal berm pooling oil in low areas, such as berm runnels and at the base of the dunes. During severe events, oil can be washed across the beach either by broad overwash on low barriers or through overwash channels cut through dune ridges into sensitive backshore areas. Areas vulnerable to overwash can be identified and strategies developed for their protection in the event of a spill.

Three strategic protection options (Table 1) to intercept, contain and control oil that washes ashore are to: (a) create a fixed barrier (sand ridges, sand bags, Hesco Baskets, solid walls, sediment dams, etc.); (b) deploy an onshore boom (shore-seal booms, snares, sorbents, etc.); and/or (c) create a sump into which oil can flow for collection.

Table 1 Onshore Protection Tactics for Beaches

TACTIC	***DESCRIPTION***
FIXED BARRIERS AND DAMS	
Sand Barriers	**Berms or ridges** are constructed, manually or mechanically, parallel to the water line to act as a barrier to water washing over a beach. In most cases, beach sediment from the site would be used to construct this barrier.
Sand Bags	**Sand bags** are used to create a barrier or dam. They may be filled on site with local sediment or with non-beach sediments. Typically canvas bags or sediment-filled, military-type, cellular fabric/wire mesh (HESCO Bastions) baskets.
Solid Barriers	Wood sheets, metal sheets, or other solid materials are used to create a barrier or dam. These barriers include designs such as anchored, water-filled bladders or tubes (“Tiger Dams”), or geotextile barriers.
FLOATING BARRIERS OR BOOMS	
Shore-Seal Boom	**Shore-sea boom** has an air tube that sits on one or two water-filled tubes. Once deployed and anchored at the selected location, water is pumped into bottom tube(s). This water acts as ballast when the boom is floating; when the boom is grounded, these flexible tubes follow the surface to form a seal.
Sorbent Boom	**Sorbent boom** is constructed of a long fabric sock enclosing material that attracts oil but repels water. Unlike hard boom, sorbent boom does not have an attached skirt. Sorbent boom is anchored parallel to the water line to contain and absorb oil on the water surface as it is washed ashore.
Snare Boom	**Snare Boom** is constructed from a series of oleophilic polypropylene “pompoms” tied to a long line. Snare boom is anchored parallel to the water line to contain and absorb oil on the water surface as it is washed ashore.
SUMPS	
Ditches or trenches	**Ditches or trenches** are excavated, manually or mechanically, to collect oil as it washes ashore. Can be used in combination with one or more of the barrier and/or boom options.

Photographs of each tactic and case examples illustrate of the deployment of these various strategies and tactics along open beaches, broad tidal flats and at overwash or tidal channels (Figure 1). The guidelines outline best management practices as they relate to wildlife (e.g. birds, turtles, etc.) and shore-zone processes (e.g. sand sources, culverts in channel dams, etc.).

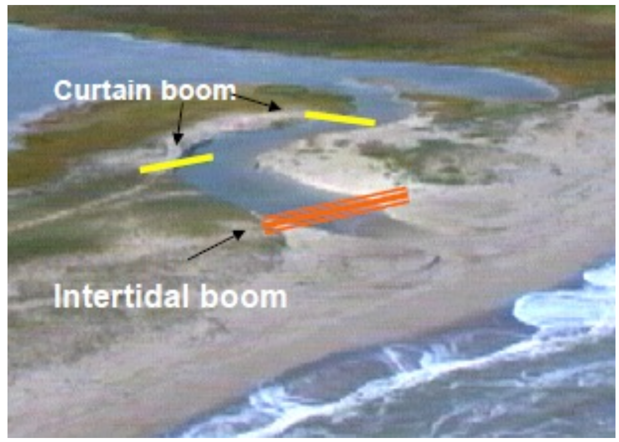

Figure 1. Sand bags deployed at the waterline: an overwash protection strategy

TIDAL INLET PROTECTION STRATEGY (TIPS) GUIDELINES

Tidal inlets are common features along sandy barrier coasts throughout the world and allow exchange of tidal waters between backbarrier bays and lagoons and the coastal ocean. Tidal inlets are dynamic systems in which the patterns of water exchange (i.e. tidal currents) directly affect the practicality and feasibility of protection strategies and tactics, particularly boom deployments. Due to the constricting effect of the inlet on the tide, current velocities are greatest in the narrowest throat section of the inlet. Sediments that are carried through the throat of the inlet by the ebbing or flooding tides are deposited as the current slows down after passing through the throat, forming shoals or underwater tidal deltas on either side of the inlet throat. Effective control tactics to intercept, divert and/or recover oil as flood currents transport oil through an inlet rely on avoiding areas of high current velocities. Figures 2 and 3 indicate the locations where boom deployment can be effective, depending on actual current velocities, which vary as a function of the flooding stage of the tide. Most protection strategies are more effective landward of the inlet throat where current velocities are lower and booms are sheltered from wave action (e.g. Figure 3).

The Tidal Inlet Protection Strategy (TIPS) guidelines include a ranking system for tidal inlets (Table 2) that defines the degree of difficulty for protection (i.e. the potential for a successful protection operation), and a template that can be used by regional or local agencies to summarize the physical characteristics of an inlet and the appropriate protection strategies and tactics.

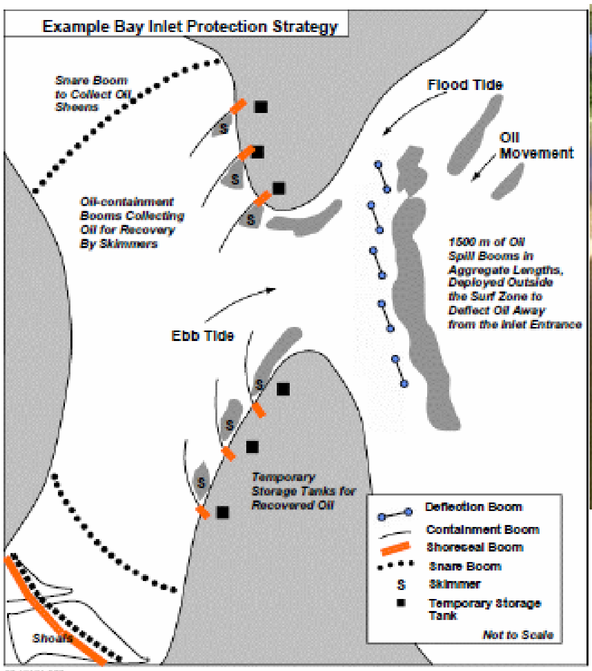

Figure 2 Examples of tidal inlet protection strategies

Figure 3 Example of flood tide control strategy at a small overlapping tidal inlet (narrow inlet with small tidal prism and sand beach shorelines)