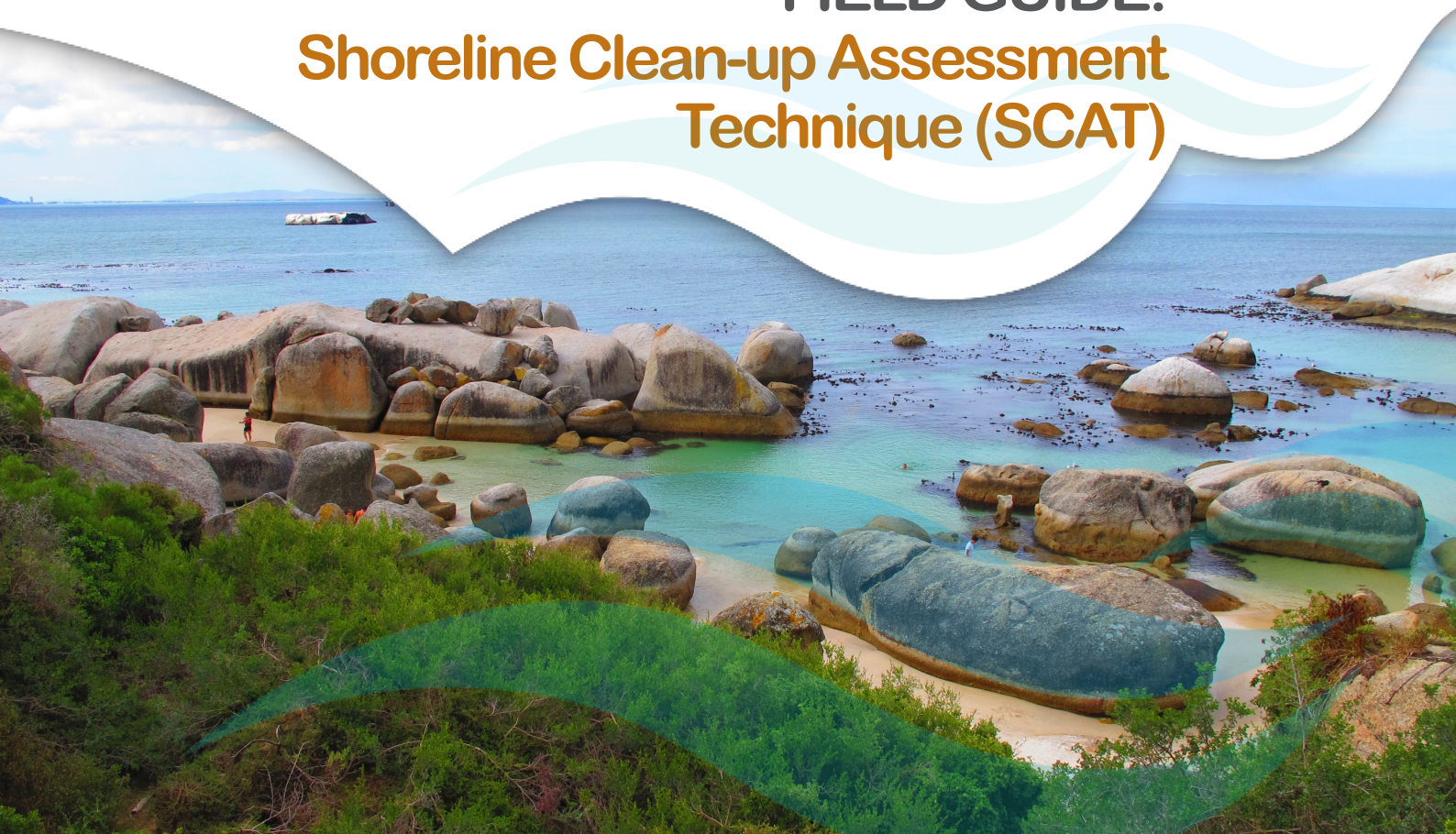
Oil Spill Response

FIELD GUIDE:
Shoreline Clean-up Assessment Technique (SCAT)



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Foreword and Contents

This Field Guide is intended to be used by anyone seeking an overview of the strategic and technical aspects of Shoreline Clean-up Assessment Technique (SCAT). Included within, is information on the key steps of SCAT; from how to prepare for shoreline surveys, through to how to conduct and document these surveys.

SCAT requires a good knowledge of the environment in and around where the oil spill has occured. To ensure a SCAT programme is successful, it is important to:

- Seek and adhere to advise on health and safety aspects of all oil spill response
- Prepare and train to reduce predicted risks
- Understand standard terminology
- Collect and document shoreline conditions in a clear and concise manner
- Select and advise on the response strategy most suitable to the environment and oiling conditions, always applying Net Environmental Benefit Analysis (NEBA)
- Ensure communication is effective amongst all parties
- Where available, seek and apply advice and input from local experts.

If shoreline surveys are planned, good operational procedures followed and the correct use of Personal Protective Equipment (PPE) adhered to, there should be minimal risk to the health and safety of personnel. However, residual risks to responders and the public will always exist.

These risks can be minimised by:

- Identifying the risks through a comprehensive risk assessment process and implementing mitigation measures to reduce them where practicable
- Communicating the risks and mitigation measures in place through a safety brief prior to any survey being carried out

PPE requirements will depend on the survey planned but the following should be considered:

- Overalls
- Oil resistant suit
- Life jacket (if operating near water)
- Safety glasses
- Oil resistant gloves
- Ear defenders (to be worn if working near running machinery
- Safety boots (oil resistant and with toe protection)

Shoreline conditions and composition can vary significantly. Ensure you are familiar with the local conditions and environment.

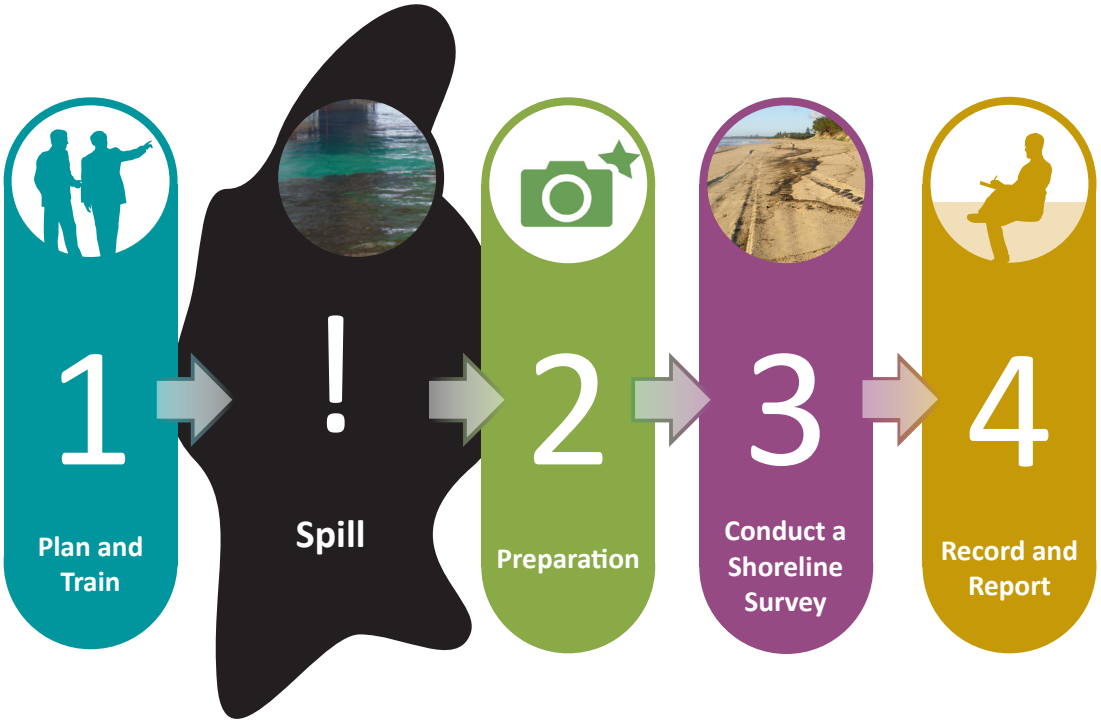
Always consider:

- Access
- Egress
- Tidal patterns
- Load bearing capacity
- Exposure to the elements

Ensure full safety protocols are followed before conducting SCAT Surveys

RISKS	IMPACTS	MITIGATION MEASURES
Noise (>85dBA)	Danger of damage to hearing if exposed to loud machinery for prolonged periods of time.	Ear defenders to be provided and worn. Exclusion of non-essential staff from a zone around the noise source. Move the source away from the working area. Explore alternative machinery / methods
Exposure to Volatile Organic Compounds (VOCs) and potentially Hydrogen Sulphide (H_2S) from the oil	Could cause nausea and in the case of H_2S death in extreme cases. Presence of hydrocarbon vapours may also present an explosion risk.	Enforce a site entry protocol. Provide gas monitoring devices and appropriate respiratory PPE as required.
Slips, trips and falls	Potential for minor injuries such as cuts, bruises or minor fractures.	Dangers should be highlighted in the safety brief given prior to operations commencing. Appropriate footwear to be worn. Recognise high risks of working on or around oily surfaces. Ensure a secure access route to work area.
Dangerous wildlife	Potential for bites, stings or contracting disease leading to loss of limbs, illness or death.	Refer to local knowledge. Appoint a lookout and communicate the risks. Ensure that an emergency plan is in place.
Small boats operations	Possible injury from propeller when handling towing lines.	Ensure that boat operators are trained. Engine kill cord to be worn whilst operating the boat. Lifejackets should be worn.
Manual handling	Potential for back injuries.	Before any deployment manual handling training should be given to anyone involved in the deployment. Ensure that weights are clearly marked on equipment. Make sure that lifting equipment is available and employ group lifts where appropriate.
Water/currents	Potential for falling and drowning.	Ensure awareness of currents and tides. No lone working near water bodies. Life jackets should be worn.
Dermatitis skin contamination	Developing dermatitis from skin contact with oil.	Wear gloves/barrier cream and PPE to cover the skin. Ensure type of PPE is suited to oil type, likely exposure and environmental conditions.
Hypothermia/Heatstroke	Can lead to fatigue, confusion, loss of consciousness, and if left untreated, death.	Whilst surveying, take regular breaks in shaded areas or shelters. Wear appropriate clothing for the response environment. Keep hydrated and regulate core temperature.

Whilst this table lists some of the common hazards that are likely to be present whilst conducting shoreline surveys, a full site specific risk assessment should always be conducted prior to a survey.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Plan and Train

When oil contaminates shoreline habitats, responders must survey the affected areas to determine the appropriate response strategy. Planning and training are essential to ensure that specific clean-up recommendations are based on an understanding of oil, the environment and operational limitations.

Shoreline Clean-Up Assessment Technique

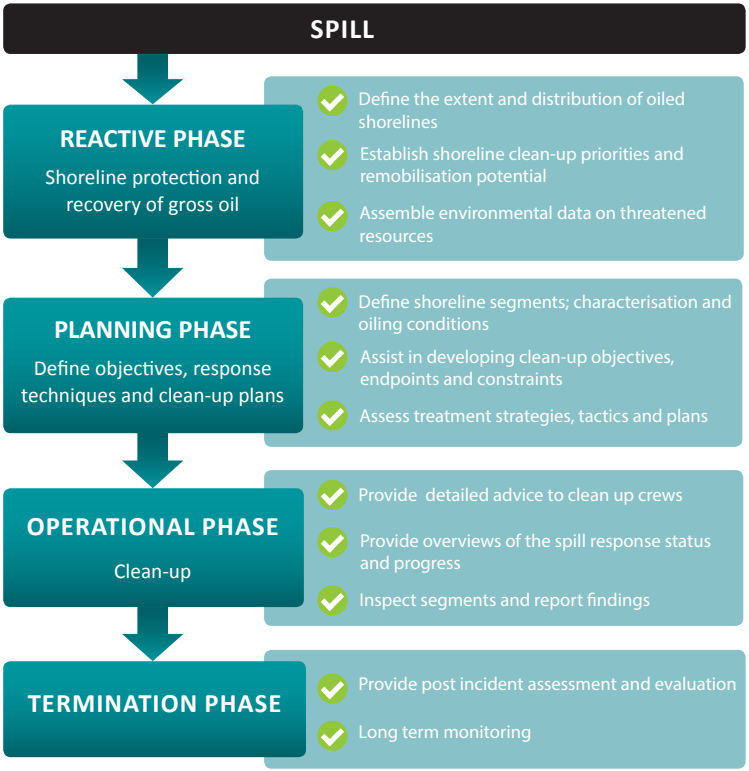
Shoreline Clean-up Assessment Technique (SCAT) is a well-established technique employed under the Planning Section of the Incident Command System (ICS) and is used to document the status of oiled shorelines and their subsequent treatment recommendations, in a methodical and scientific manner.

Objectives of a SCAT Survey

To collect and document real-time data on stranded oil and shoreline conditions in a rapid, accurate, systematic and consistent way in order to provide operational support and aid in the development of an effective response.

SCAT surveys can be used for:

- Development of shoreline treatment recommendations
- Development of clean-up standards or criteria
- Net Environmental Benefit Analysis (NEBA)
- Post-treatment inspection and evaluation
- Provision of long-term monitoring
- Establishing endpoints



Shoreline surveys can be conducted by different methods and at different scales depending on the size of the affected area, the character of the coastal area, and the level of detail that is required.

SCAT Programme

A successful SCAT programme should include:

- Suitable training and calibration for functional SCAT roles
- Appropriate segmentation of the shoreline
- Flexibility to adapt the basic concept for individual spill conditions and oiling characteristics
- Procedures that are as simple as possible, yet provide sufficient information to meet the requirements of the decision makers, planners, and operations crews
- A process that is efficient to ensure that information is processed and communicated in a timely manner
- Establishment of a data management system early in the programme
- Integration of stakeholders

SCAT Function Responsibilities

- Evaluating oil type and condition
- Factoring in shoreline types and coastal processes to oil behavior and clean-up methods
- Identifying environmentally and culturally sensitive resources
- Determining need for clean-up
- Recommending clean-up methods and endpoints
- Placing constraints on clean-up if necessary, due to ecological, economic or cultural concerns

SCAT Team

The Field Team should comprise of trained individuals with appropriate skills to complete the survey objectives. The team may include inter-agency personnel who represent the various interests of stakeholders. The number of persons in a SCAT team and the number of teams required will depend on the circumstances of the incident. A SCAT team may comprise of:

- A person with previous oil spill response experience with familiarity of shoreline surveys and the ability to quickly identify and document oil on shorelines
- A person familiar with the ecological sensitivities of the affected area who can advise on real-time environmental constraints, priorities and endpoints
- A person with operational experience who can identify practical and logistical issues of potential clean-up options
- A specialist who can advise on precautions and constraints to protect resources in areas where archaeological/cultural resources exist

Training and Knowledge

- Health and safety aspects of SCAT surveys
- Set-up and operation of equipment and techniques
- Response strategies and tactics
- NEBA
- SCAT terminology and processes
- Environmental impacts and constraints

Plan and Train: SCAT Surveys

The cornerstone activity of SCAT is the shoreline assessment survey and its fundamental objective is to collect and document data on oiled shoreline conditions in a rapid, accurate and systematic fashion. Shoreline surveys can be conducted by different methods and on different scales depending on the size of the affected area, the character of the coastline and the level of detail that is required.

Key principles of SCAT Surveys

SCAT surveys are based on several fundamental principles:

- A systematic assessment of all shorelines in the affected area
- A division of the coastline into homogeneous geographic units or "segments"
- The use of a standard set of terms and definitions for documentation
- A SCAT team that is objective and competent
- The timely provision of data and information for decision making and planning

SCAT surveys are flexible and adaptable to the spill conditions. They can be conducted:

- On spills of different oil types and with different types of shoreline oiling conditions
- On spills of different sizes; from small to large
- By using different methods; both aerial and ground level
- In various levels of detail, from simple single-discipline surveys to complex programmes with geomorphological, ecological, and cultural resource components

SURVEY METHOD	KEY OBJECTIVES
Aerial Reconnaissance	To obtain an observational overview of surface oiling conditions over large areas in a relatively short time To assist in the development of objectives, to define the overall scale of the potential response operation To direct the initial deployment of response resources
Systematic and Spot Ground Surveys	To methodically document shoreline oiling conditions in all segments; providing the primary source of data Systematic documentation of the location, character and amounts of surface and subsurface oil in all segments; spot surveying oiling conditions in selected segments
Reporting and Recommendations	Complete Shoreline Oiling Summary (SOS) Forms, generating sketch maps in the selected segments. Photographs and/or videos are taken to record oiling Develop Shoreline Treatment Recommendations (STRs) for the affected areas based on the information generated from all the gathered data

Plan and Train: Developing Clean-up Guidelines and Endpoints

Clean-up endpoints must be established early so that appropriate methods can be selected to meet the clean-up objectives.

Clean-up endpoints are an important part of spill-specific clean-up guidelines. Endpoints are selected based on NEBA with the overarching clean-up objectives to:

- Minimize risk to human health
- Reduce the threat of additional or prolonged impacts
- Facilitate the natural recovery of impacted areas

These objectives lead to developing clean-up strategies that do not cause more harm to the environment than good. Ideally, clean-up efforts will return the resource to its baseline condition without suffering further impact or affecting resources not initially impacted by the spill. Aggressive and inappropriate clean-up techniques can make matters worse. Less intrusive methods or natural recovery are often preferable. The best clean-up strategy is not the one that removes the most oil, rather it is the strategy that has the greatest net environmental benefit.

ENDPOINT	No visible oil - not detectable by sight, smell or feel	Visible oil, but no more than back-ground	No longer releases sheens that will affect sensitive areas, wildlife or human health	No longer rubs off on contact	Oil removal to allow recovery/ recolonisation
EXAMPLE	Can be used on sand beaches where oil removal can be effective without delaying resource recovery	This endpoint is often applied where there is a significant background rate of tarball deposition on the shoreline, due to natural seeps or local industrial activitiy	This endpoint is used where sheening persists after clean-up efforts become ineffective, or on sensitive habitats where further clean-up efforts will cause more harm than natural removal	This endpoint is usually defined as oil removal to a stain or coat, or weathering to the point that is no longer sticky. It is appropriate for hard substrates and vegetation	This endpoint is used where further oil removal will result in excessive habitat disruption

Establishing effective methods of communication is essential for a SCAT program to ensure consistency and information flow to incident command.

Communications Plan

In order to ensure effective communications it is important to produce a communications plan which will document:

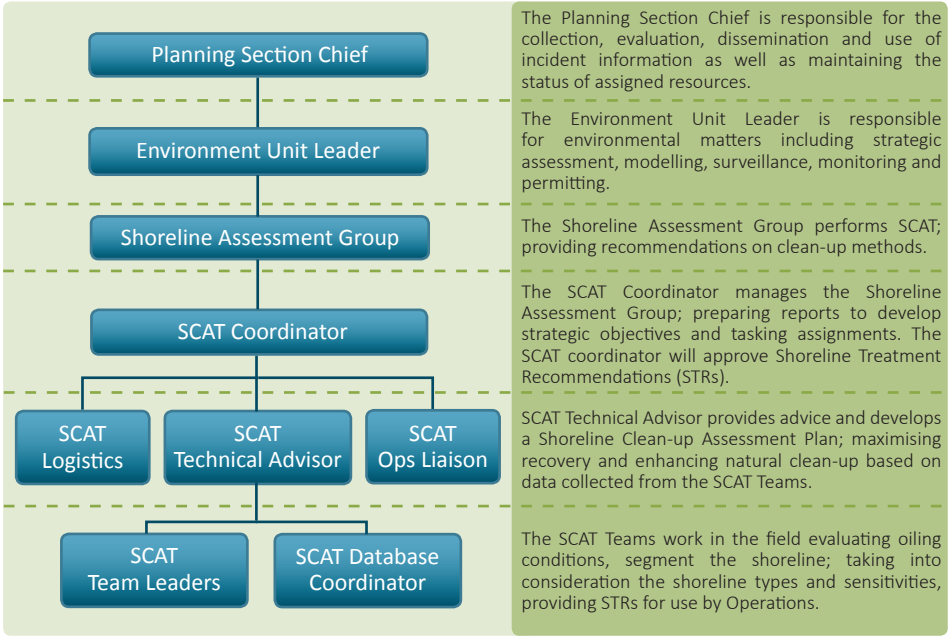
- A communications protocol for operational communication
- Emergency procedures
- Names of assets deployed, call signs and frequencies they are operating on

Span of Control

To ensure the safety and success of any SCAT program, it is important that personnel involved are adequately supervised. The Incident Command System (ICS) recommends a finite 'span of control' of 5-7 direct reports to ensure correct levels of supervision.

Command and Control Organisation

SCAT operations fall under the Environment Unit in the Planning Section. SCAT operations can be structured as follows dependant on the size of the response:



More information regarding the Incident Command System can be found in the OSRL Incident Management Handbook (IMH).

Preparing the SCAT Survey Team

Prior preparation is required before any field activities are carried out by the SCAT team(s). The team(s) should be given a basic briefing, which should not be time consuming but is crucial to ensuring systematic and consistent results. At the briefing the following should be covered:

- Health, safety and welfare issues
- Allocation of segments to be surveyed
- Communications and reporting channels
- Distribution of maps, assessment forms and guidance
- Check field equipment and supplies
- All team members are comfortable with the assessment methodology

Pre-Survey Standardisation

If there are multiple teams, it is likely to be beneficial to have a pre-survey session with all the teams focusing on terminology of oiling categories, shoreline types and standard definitions. This will ensure a high degree of consistency and calibration between the teams.

SCAT Team Considerations

Consideration should always be given to:

- Extent and duration of environmental impacts if the oil is not removed
- Natural removal rates
- Potential for remobilised oil to affect other sensitive resources
- Likelihood of clean-up to cause greater harm than oil alone

TOOLS CHECKLIST		✓
	SCAT Field Guide, SOS Form, clipboard and relevant maps	
	A method of communication (e.g. mobile/satellite phones, VHF radio)	
	Handheld GPS	
	Digital camera	
	Spade	
	Additional batteries	
	Ruler (or other) for scale when taking photos	
	Tape measure	
	Flags or stake (to mark location of buried oil)	

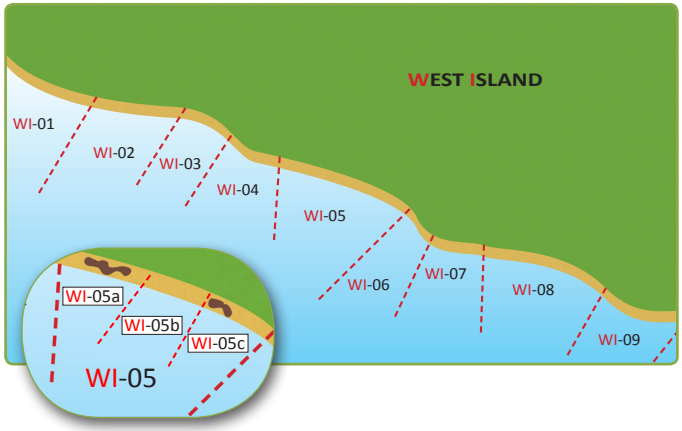
Refer to the "Conduct a Shoreline Survey - SOS Form" section of this Field Guide for detail on the information to be obtained during SCAT surveys.

Preparation: Segmentation

The essential first step of a SCAT survey is to divide the coastline into working units called **SEGMENTS**, within which the shoreline character is relatively uniform in terms of physical features and sediment type.

Key Principles of Segmentation

- Segmentation is the basis for the development of treatment plans. Each segment of shoreline is considered individually in both planning and operational stages
- Boundaries between segments are generally geological features such as a headland or change in shoreline type however they can also be a change in oiling conditions, river mouths or juristictional boundaries
- Satellite images, charts and sensitivity maps may assist in defining shorelines
- Segment lengths are typically 0.2- 2.0 km. If there is long uniform coast, segment boundaries may be based on operational features, such as access, or simply by set distances along the shore



Segment Characteristics

- Distinct sections of shoreline that can be used as operational zones/areas
- Relatively homogeneous physical features or sediment type
- Identified by a unique location code
- Bounded by prominent geological or operational features, or by changes in shoreline type, substrate, or oiling conditions

Sub-Segmentation

- Sub-segments are created if along-shore oiling conditions vary significantly within a pre-designated segment
- Along-shore oiling conditions change throughout time within a segment during a spill incident
- If there is an operational division boundary within a segment
- Sub-segment lengths are small enough to obtain adequate resolution and detail on the distribution of oil, but not so small that too much data is generated

Conduct a Shoreline Survey: SOS Form

Completion of an Shoreline Oiling Summary (SOS) form for each segment is a fundamental part of recording information.

Oil Spill Response

Shoreline Oiling Summary (SOS)

Please ensure a full site specific risk assessment is carried out prior to commencing shoreline oiling assessment.

1. General Information	Incident		Segment ID:	
Date (DD/MM/YY)		Survey Time (local)	From:	To:
Survey From	☐ Air	☐ Foot	☐ Viewpoint	☐ Vehicle
Weather				
2. Survey Team	Name	Organisation	Contact Details	
3. Segment	Total Length		Length Surveyed	
Start	Lat		Long	
Finish	Lat		Long	

4. Shoreline Type					Please Indicate ONE Primary shoreline type (1) and secondary shoreline types (2) for both the intertidal and supratidal environment									
Shoreline Type	Intertidal		Supratidal		Shoreline Type	Intertidal		Supratidal		Shoreline Type	Intertidal		Supratidal	
	1	2	1	2		1	2	1	2		1	2	1	2
Exposed Rocky Shores 1A	☐	☐	☐	☐	Coarse to Medium Sandy Beaches 4	☐	☐	☐	☐	Sheltered Rocky Shores 8A	☐	☐	☐	☐
Exposed Manmade 1B Structures	☐	☐	☐	☐	Mixed Sand and Gravel 5	☐	☐	☐	☐	Sheltered Man Made 8B	☐	☐	☐	☐
Exposed Rocky Platforms 2A	☐	☐	☐	☐	Gravel Beaches 6A	☐	☐	☐	☐	Sheltered Tidal Flats 9A	☐	☐	☐	☐
Fine - Medium Sandy Beaches 3A	☐	☐	☐	☐	RipRap 6B	☐	☐	☐	☐	Salt Marshes 10A	☐	☐	☐	☐
Scarps and Steep Slopes in Sand 3B	☐	☐	☐	☐	Exposed Tidal Flats 7	☐	☐	☐	☐	Mangroves 10D	☐	☐	☐	☐
Other	☐	☐	☐	☐	If other please indicate									

Other Features	☐ Amenity area	☐ Estuary	☐ Historical	☐ Cracks and Crevices	☐ Pools	☐ Biological Deposits
Please provide details of other features						

5. Operational features		Load Bearing Capacity	
Access		Ongoing Clean-up Activities	
Suitable Laydown Area		Additional Details	

6. Surface Oil ☐ Tick here if no oil observed

	Position				Oil Cover		Distribution					Oil Thickness					Oil Character					
Zone ID	L	M	U	S	Length	Width	TR	SP	PT	BR	CN	TO	CV	CT	ST	FL	FR	MS	TB	PT	SR	AP
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

7. Subsurface Oiling ☐ Tick here if no investigation conducted

	Position				Pit Depth	Oiled Zone	Sub-Surface Oil Character							Water Table Depth
Pit ID	L	M	U	S	(cm)	Depth (cm)	SAP	OP	PP	OR	OF	TR	NO	cm
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	

1. GENERAL INFORMATION

This section is important for data management:

- Incident name
- Segment ID- Issued by command during prepation
- Survey time
- Survey type
- Weather- this can affect observation

2. SURVEY TEAM

The names of all survey team members should be entered, along with their affiliation and telephone contact number (in case of need for subsequent clarifications).

3. DEFINE SEGMENT

Total length and length surveyed- In most cases the total segment length and length surveyed will be the same. Latitude and longitude of segment- Grid references can be used instead, ensure units are clear and consistent.

4. DEFINE SHORELINE

It is important to identify the nature of the shoreline types within the segment, paying particular attention to the oiled areas.

5. OPERATIONAL FEATURES

Operational features will assist decision makers and logistics or operational personnel in making an initial evaluation of the viable options for clean-up activity. Ensure the following is recorded:

- Access information
- If debris is present
- Ongoing clean-up recommendations

6. DESCRIBE SURFACE OILING

Detailed recording of oiled areas is one of the most important elements of shoreline assessment. The form requires quantitative measurement of oiled zones, using widely recognised descriptive terminology.

7.DESCRIBE SUBSURFACE OILING

The presence of subsurface (buried) oil can only be revealed by digging trial pits or trenches in the shoreline. Such investigation should only be undertaken if there is an expectation or suspicion that oil is buried.

8. PHOTOS AND SKETCHES

Photographs and sketchs are very useful tools in documenting the appearance of the shore. However, some discipline is needed and care should be taken not to take too many photographs.

Conduct a Shoreline Survey: Define the Shoreline

It is important to identify the nature of the shoreline types within the whole segment, paying particular attention to the oiled areas.

Shoreline Type

Identify all notable shoreline types and other features present within the segment.

- Select **ONE** primary shoreline type for both intertidal and supratidal zones. Typically for the intertidal zone, it is the upper intertidal zone in which oil usually becomes stranded and where clean-up activities take place. If there is no clear predominant characteristic, then it is based on the type most sensitive to oil (highest ESI).
- There can be several secondary shoreline types within a segment.

ESI Values	Shoreline Type
1	Exposed Rocky Shore
2	Exposed Rocky Platform
3	Fine-grained Sand Beaches
4	Coarse-grained Sand Beaches
5	Mixed Sand and Gravel Beaches
6a	Gravel Beaches
6b	Riprap Structures
7	Exposed Tidal Flats
8a	Sheltered Rocky Shores
8b	Sheltered Man-made Structures
9	Sheltered Tidal Flats
10a	Salt to Brackish Marshes
10b	Freshwater Marshes
10c	Swamps
10d	Mangroves

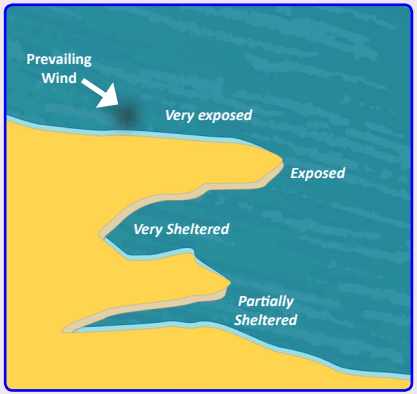
Sediment Type

- Identify sediment type this is important for oil spill clean-up activities.

Description	Sediment Size
Boulder	> 256 mm
Cobble	64-256 mm
Pebble	4-64 mm
Granule	2-4 mm
Sand	0.6-2 mm
Silt and Clay	< 0.6 mm

Wave Exposure

- Define the exposure rating of the upper shore parts of the segment; this may affect prioritisation of clean-up sites and clean-up recommendations.



See the Tools Section of this Field Guide (pages 18-25) for descriptive and photographic guidance in defining the shoreline.

Making a detailed record of oiled areas is one of the most important elements of the shoreline assessment. The SOS form requires some quantitative measurement of oiled zones, using descriptive terminology widely recognised.

Is Surface Oil present?

NO → Tick the "**No oil observed**" box

YES

STEP 1
Identify as many oiled Zones as necessary for an accurate description of oiling conditions.

Give each **Zone an ID**; A, B, C etc.

Zones are defined up the beach from the lower intertidal to the supatidal

STEP 2
Define for each zone:
- **Position** (in relation to tide)
- **Oil Cover** (i.e. Length and width of the oiled zone)
- Percentage **Distribution** of oil
- **Oil Thickness** (estimate actual thickness in cm or mm for 'Thick Oil' and 'Cover')
- **Oil Character**

STEP 3
Annotate map and/or draw sketch map with the location of oiled zone(s).

Ensure photographs or videos of zones are taken and mark the position on a sketch map.

Surface Oil
OIL THAT IS VISIBLE ON THE SURFACE AND THAT IS UP TO 5 CM BELOW THE SURFACE OF SANDY BEACHES

6. Surface Oil ☐ Tick here if no oil observed

	Position				Oil Cover		Distribution					Oil Thickness					Oil Character					
Zone ID	L	M	U	S	Length	Width	TR	SP	PT	BR	CN	TO	CV	CT	ST	FL	FR	MS	TB	PT	SR	AP
A	X				200 m	2 m			X				X								X	
B		X			300 m	6 m					X				X			X				

Summarising the Degree of Oiling

The information collected in this section can be combined to create indices to characterise the degree or relative severity of oiling in a particular segment.

See the Tools Section of this Field Guide (pages 26-31) for descriptive and photographic guidance in defining surface oil.

Perform a Shoreline Survey: Define Subsurface Oil

The presence of subsurface (buried) oil can only be revealed by digging trial pits or trenches in the shoreline. Such investigation should only be undertaken if there is an expectation or suspicion that oil is buried. This may be due to the nature of the beach material; e.g. gravel that may allow penetration by oil, or because of known movement in beach material during the incident; e.g. due to a storm event or naturally high-energy beach.

Has subsurface oil been investigated? NO → Tick the "**No Investigation**" box

YES

Subsurface Oil:
OIL THAT IS >5 CM BELOW THE SURFACE OF FINE SEDIMENT OR BOTTOM OF FIRST LAYER ON COARSE SEDIMENTS

STEP 1
Give each Pit an ID; 1, 2, 3 etc.

STEP 2
For each pit define:
- **Position** (in relation to tide)
- **Pit Depth**
- **Oiled Zone Depths** (the upper and lower height of penetrating or buried oil). If no subsurface oil is present write 'NONE'
- **Oil Character**
- **Water Table Depth** (if evident)

STEP 3
Annotate map and/or draw sketch map with the location of pit(s).

Ensure photographs or videos of pits are taken, including a scale.

7. Subsurface Oiling ☐ Tick here if no investigation conducted

	Position				Pit Depth	Oiled Zone	Sub-Surface Oil Character							Water Table Depth
Pit ID	L	M	U	S	(cm)	Depth (cm)	SAP	OP	PP	OR	OF	TR	NO	cm
1	☐	☒	☐	☐	19 cm	10 - 15 cm	☐	☐	☒	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	
	☐	☐	☐	☐			☐	☐	☐	☐	☐	☐	☐	

See the Tools Section of this Field Guide (pages 32-33) for descriptive and photographic guidance in defining subsurface oil.

Perform a Shoreline Survey: Sketches and Photographs

Sketches

The field sketch is an important component of the shoreline assessment process because it provides more detail on location of the oil, and samples taken, pits dug, and photographs captured in relation to the physical layout of the shoreline.

- North arrow, segment number, approximate scale, segment and sub-segment boundaries, high water and low water levels, major features and landmarks
- Oil conditions should be shown as shaded areas
- An alphabetic designation is given to each oiled area on the sketch that corresponds to a letter designation for the ZONE on the field form or field notes. Indicate the dimensions for each oiled area, as well as the percent oil cover estimates, oil character, and substrate
- Indicate pits by a triangle, and give them a numerical designation that corresponds to the one on the SCAT form. The triangle is filled in to represent oil found in the pit; an open triangle is used if no oil is found
- Include notes about flora/fauna within oiled areas; nesting locations, etc.
- Indicate photograph locations with a dot and connecting arrow showing the direction in which the photo was taken, with photo number on sketch
- Indicate location(s) where a video was recorded

Photographs

Photographs and/or video footage can be very useful for illustrating the distribution and extent of oiling, the location and character of the affected areas, the location of any pits, potentially sensitive resources, access points, possible laydown areas and the shoreline response.

Be aware that oil itself does not photograph very well, so images may not illustrate its character/thickness (particularly in bright lighting).

- If you intend to use the images for showing changes over time, take time to set up the shots in such a way that they can be repeated and make notes to help you reframe exactly the same view
- Ensure that the correct date and time have been set in the camera
- Use a suitable scale in any view where the size of the features is not obvious
- Mark location of the viewpoint and direction on map, take a GPS fix of the viewpoint to aid relocation
- Record the photograph numbers on the SOS form
- Meticulously maintain a storage and cataloguing system for the image files

Example Sketch/Map Symbols

Record and Report

Recording and reporting during shoreline surveys is integral to the SCAT process. After data collection occurs, it must be collated and analysed so recommendations for clean-up can be made.

Data Collation

The data collected by SCAT Teams needs to be made quickly available to decision makers.

- Data generated from SCAT surveys may be combined and used in a variety of ways. In smaller incidents the raw data may be useful, however, in larger incidents the data can be combined to create standard oiling categories to assist in determining priorities and planning clean-up operations

Surface Oil Coverage Category = width x surface distribution of the oil

Surface Oil Thickness Category = Surface Oil Coverage x thickness of the oil

See pages 28 and 31 of this Field Guide for more details.

- Data management system requirements will depend on the size of the incident

Analysis

- A wide range of maps and tables can be generated to assist in the understanding of the oiling conditions or simply to document the operational activities or the changes in oiling conditions

Recommendations

- The information generated by the SCAT surveys is an important part of the decision making process for setting response priorities, clean-up objectives, and standards for acceptable levels of clean-up
- Recommendations for clean-up techniques will be made by the SCAT Teams based on NEBA in the form of Shoreline Treatment Recommendations (STRs), which maximise recovery and enhance natural clean-up, whilst minimising impacts to habitats and resources. Stakeholder representatives and historical/cultural specialists will be involved in providing input into the STRs

	Exposed Rocky Shores: ESI 1A	Exposed Man-Made: ESI 1B	Exposed Rocky Platforms: ESI 2A
Key Characteristics	• Steep intertidal zone (>30 degree slope) with very little width and high energy • Strong vertical zonation of intertidal biological communities • Species density and diversity vary	• Typically sea walls, groynes, piers and port faciliities built to protect the shore and provide shelter • Attached animals and plants are sparse/ moderate • A wide range of habitats may be present	• The intertidal zone consists of a flat rock bench of highly variable width • There may be a beach of sand to boulder sized sediments at the base of the scarp • These habitats can support large populations of animals and plants
Example			
Oil Behaviour	• Oil can be held offshore by waves reflecting off the shore • Any oil that is deposited is likely to be rapidly removed from exposed faces • Persistant oil may remain as a patchy band at or above the high-tide line • Impacts to intertidal communities are likely to be limited in duration unless heavy concentrations of a light refined product come ashore very quickly	• Oil can be held offshore by waves reflecting off the shore • Oil is likely to adhere to the dry, rough surfaces, but is unlikely to adhere to wet substrates • Persistant oil would remain as a patchy band at or above the high-tide line	• Oil is held offshore by waves reflecting off the steep, hard surface in exposed settings • Oil readily adheres to the dry, rough surfaces, but it does not adhere to wet substrates • The most persistant oil would remain as a patchy band at or above the high-tide line • Tide pools common

Fine-Medium Sand Beaches: ESI 3A

Key Characteristics

- Generally flat and hard-packed
- Possible heavy accumulations of seaweed utilised by wildlife for nesting and feeding
- Wildlife and plants can be moderately abundant, but highly variable

Example

Oil Behaviour

- Light oil accumulations will be deposited as oily bands along the upper intertidal zone
- Heavy oil accumulations will cover the entire beach surface; oil may be lifted off the lower beach with the rising tide
- Maximum penetration of oil into fine-grained sand is about 10 cm
- Burial of oiled layers by clean sand may occur

Scarps & Steep Slopes in Sand: ESI 3B

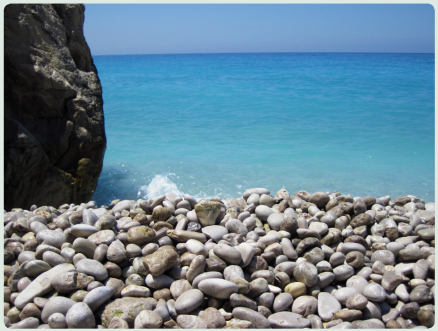
- Occurs where sandy bluffs are undercut by waves or currents and slump
- Some scarps are fronted by narrow beaches, if the erosion rates are moderate and episodic
- Biological utilisation by birds and infauna is low

- Any stranded oil will concentrate at the high-water line and may penetrate sandy sediments
- Oil will adhere to the dry surfaces of any woody debris accumulated at the base of the scarp
- There is little potential for burial except when a major slumping of the bluff occurs
- Active erosion of the scarp will remove the oil

Medium-Coarse Sandy Beaches: ESI 4

- Relatively steep beach faces and soft substrates
- Coarse-sand beaches can undergo rapid erosion/deposition cycles, even within one tidal cycle
- The amount of seaweed varies considerably

- Light oil accumulations will be deposited as oily bands along the upper intertidal zone
- Heavy oil accumulations will cover the entire beach surface; oil will be lifted off the lower beach with the rising tide
- Maximum oil penetration is about 20 cm
- Burial of oiled layers by clean sand within the first week after a spill can be up to 50 cm

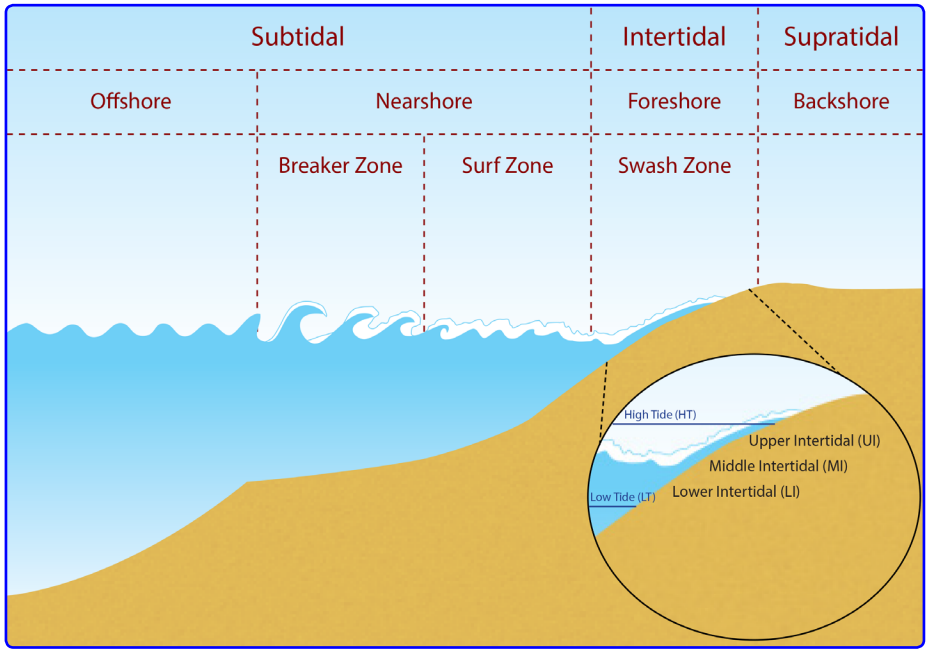
	Mixed Sand and Gravel: ESI 5	Gravel Beaches: ESI 6A	RipRap: ESI 6B
Key Characteristics	• These beaches are moderately sloping and composed of a mixture of sand and gravel • There can be large-scale changes in the sediment distribution patterns depending upon season • Animal and plant life will vary significantly with levels of exposure	• Gravel beaches are composed of sediments ranging in size from pebbles to boulders • They can be very steep, with multiple wave-built berms forming the upper beach • The presence of attached biota indicates beaches that are relatively sheltered	• Riprap is composed of cobble to boulder sized blocks of granite, limestone, or concrete • Riprap structures are used for shoreline protection and channel stabilization (jetties) • Attached biota are sparse
Example			
Oil Behaviour	• During small spills, oil will be deposited along and above the high-tide swash • Large spills will spread across the entire intertidal area • Oil penetration into the beach sediments may be up to 50 cm • Burial of oil may be deep particularly where beaches are only intermittently exposed to waves • In sheltered areas of asphalt, pavements can form	• Deep penetration and rapid burial of stranded oil is likely on exposed beaches • On exposed beaches, oil can be pushed over the high-tide and storm berms, pooling and persisting above the normal zone of wave wash • On the more sheltered portions of beaches, formation of asphalt pavements is possible where accumulations are heavy	• Oil adheres readily to the rough surfaces of the blocks • Deep penetration of oil between the blocks is likely • Uncleaned oil can cause chronic leaching until the oil solidifies

	Exposed Tidal Flats: ESI 7	Sheltered Rocky Shores: ESI 8A	Sheltered Man-Made: ESI 8B
Key Characteristics	• Broad intertidal areas composed primarily of sand and minor amounts of shell and mud • Biological utilisation can be very high, with large numbers of infauna, heavy use by birds for breeding and feeding, and use by feeding fish	• Bedrock shores of variable slope; vertical cliffs to wide, rocky ledges, sheltered from exposure • Wide shores may have some surface sediments, but bedrock is the dominant substrate type • Species density and diversity vary greatly, but are often very abundant	• Often there is no exposed beach at low tide, but a wide variety habitats may be present • Attached animal and plant life can be moderate to high
Example			
Oil Behaviour	• Oil does not usually adhere to the surface of exposed tidal flats, but rather moves across the flat and accumulates at the high-tide line • Deposition of oil on the flat may occur on a falling tide if concentrations are heavy • Oil does not penetrate water-saturated sediments • Biological damage may be severe, primarily to infauna, thereby reducing food sources	• Oil will adhere readily to the rough rocky surface, particularly along the high-tide line, forming a distinct oil band • The lower intertidal zone usually stays wet preventing oil from adhering to the rock surface • Heavy and weathered oils can cover the upper zone with little impacts to the rich biological communities of the lower zones	• Oil will adhere readily to the rough surface, particularly along the high-tide line, forming a distinct oil band • The lower intertidal zone usually stays wet (particularly if algae covered), preventing oil from adhering to the surface

	Sheltered Tidal Flats: ESI 9A	Salt Marshes: ESI 10A	Mangroves: ESI 10D
Key Characteristics	• Composed mainly of mud with small amounts of sand and shell which cannot support weight, often backed by marshes • Sparsely to heavily covered with algae and/ or seagrasses, possible large concentrations of biota on and in the sediments • Heavily utilised by birds and fish for feeding	• Width of the marsh can vary, from a narrow fringe to extensive areas • Sediments are composed of organic-rich muds except on the margins of barrier islands where sand is abundant • Resident wildlife and plants are abundant	• Mangroves are several different tropical evergreen trees or shrubs that have stiltlike roots and stems forming dense thickets along tidal shores • Mangrove forests are physically intricate making access difficult • Resident wildlife and plants are abundant with high use for feeding and breeding
Example			
Oil Behaviour	• Oil does not usually adhere to the surface, but tends to move across the flat and accumulates at the high-tide line • Deposition of oil on the flat may occur on a falling tide if concentrations are heavy • Oil does not tend to penetrate the water-saturated sediments, but could penetrate burrows and root cavities • Biological damage may be severe	• Oil adheres readily to intertidal vegetation • Oiling will depend on the water level at the time, there may be numerous bands • Penetration will depend on marsh thickness and oil type • Medium to heavy oils can pool on the surface/burrows • Light oils can penetrate the top few centimeters of sediment and deeply into burrows	• Oil adheres readily to intertidal vegetation. • Oiling will depend on the water level at the time, there may be numerous bands • Penetration will depend on oil thickness, oil type and substrate type • Medium to heavy oils can pool on the surface • Light oils can penetrate the top few centimeters of sediment and deeply into burrows

Tools: Tidal Zones

Tidal zones are defined by the position on the shore relative to the tidal range for that area.



Lower Intertidal Zone

LI The lower approximate one-third of the intertidal zone.

Mid Intertidal Zone

MI The middle approximate one-third of the intertidal zone.

Upper Intertidal Zone

UI The upper approximate one-third of the intertidal zone.

Supratidal Zone

SU The area above the mean high-tide that occasionally experiences wave activity.

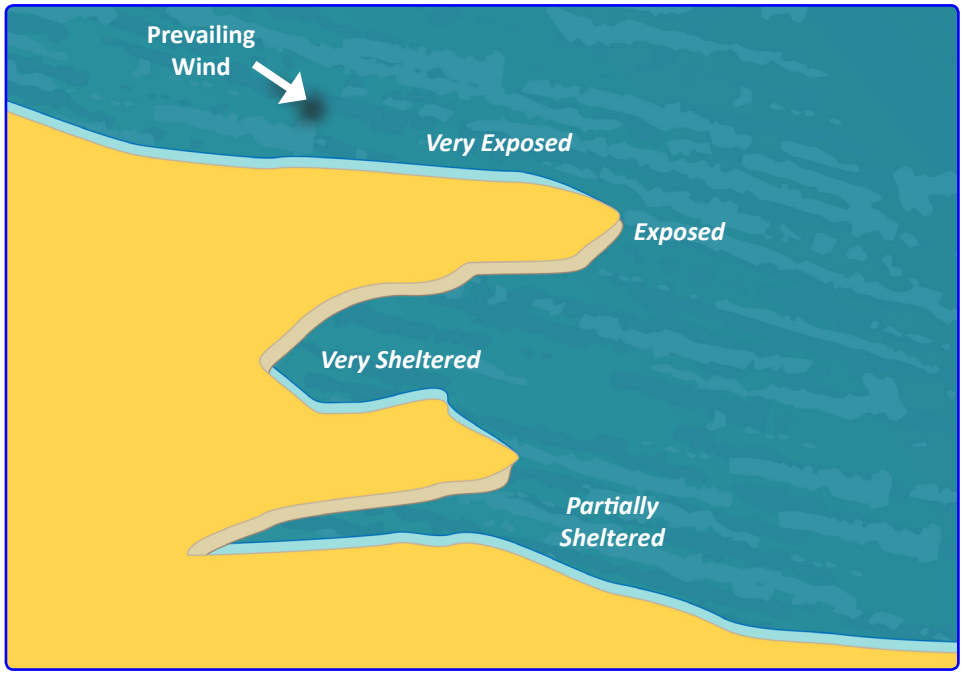
Also known as the Splash Zone.

The following can be used as a guide to sediment size to determine the nature of the beach:

Sediment Size				
Description	Boulder	> 256 mm	 Bigger than a basket ball	
	Cobble	64-256 mm	 Bigger than a tennis ball but smaller than a basket ball	
	Pebble	4-64 mm	 Bigger than a golf ball but smaller than a tennis ball	
	Granule	2-4 mm	 Bigger than a grain of rice but smaller than a golf ball	
	Sand	0.6-2 mm	 Grain of sugar	
	Silt and Clay	< 0.6 mm	Smaller than a grain of sugar	

Tools: Wave Exposure

Wave exposure refers to the approximate overall exposure rating of the upper shore (or oiled parts) of the segment.



Very Exposed

Sites which face into prevailing winds and receive oceanic, long fetch swell.

Exposed

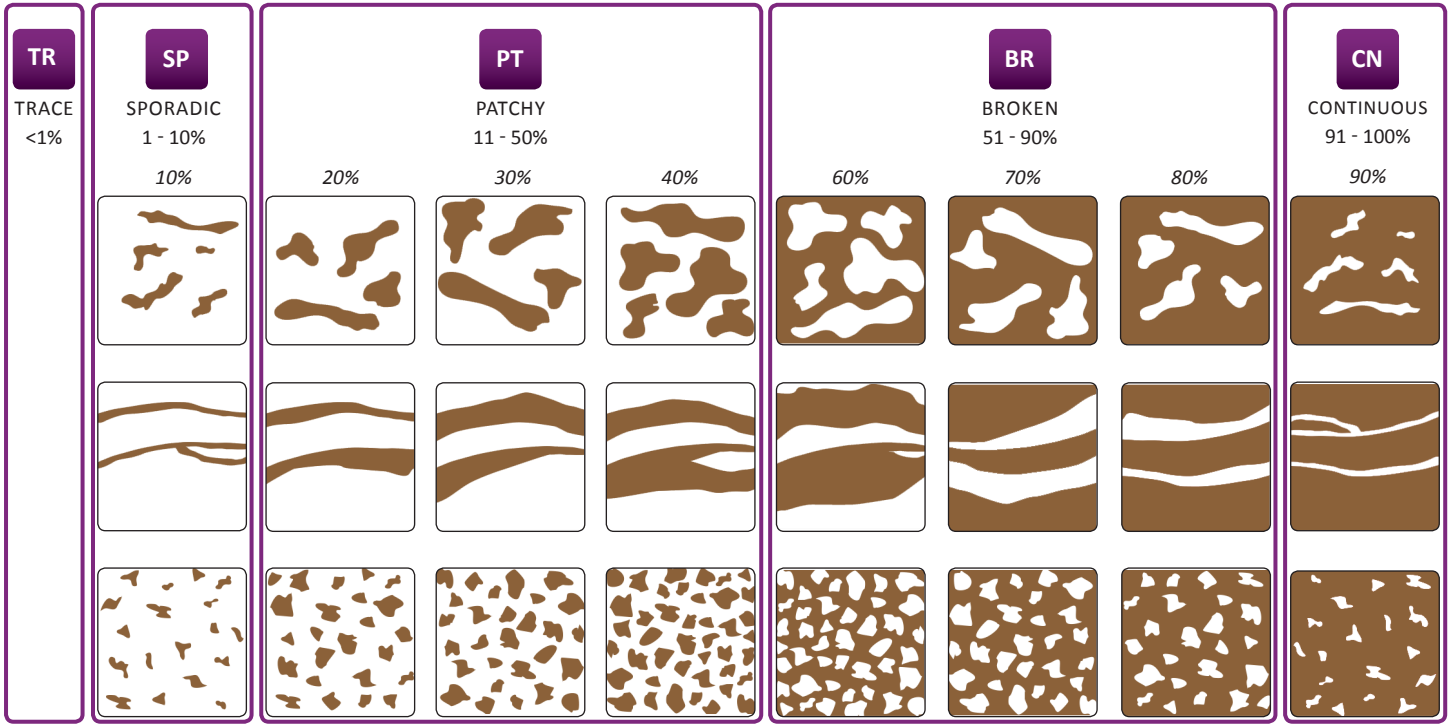
Sites where onshore strong winds are frequent (but not necessarily prevailing) but also with a degree of shelter provided by extensive shallow areas or other obstructions to seaward.

Very Sheltered

Sites with a very restricted sea area over which the wind blows (e.g. <2 km) and which face away from prevailing winds or have obstructions such as reefs to seaward or are fully enclosed.

Partially Sheltered

Sites with a restricted sea area over which the wind blows (e.g. <10 km). They can face prevailing winds but with extensive shallow areas to seaward or they may face away from prevailing winds.


TR
TRACE
<1%
SP
SPORADIC
1 - 10%
10%
PT
PATCHY
11 - 50%
20%
30%
40%
BR
BROKEN
51 - 90%
60%
70%
80%
CN
CONTINUOUS
91 - 100%
90%

SP

SPORADIC
1 - 10%

PT

PATCHY
11 - 50%

BR

BROKEN
51 - 90%

CN

CONTINUOUS
91 - 100%

Wide	(W)	>6m
Medium	(M)	>3m and ≤6m
Narrow	(N)	>0.5m and ≤3m
Very Narrow	(VN)	≤0.5m

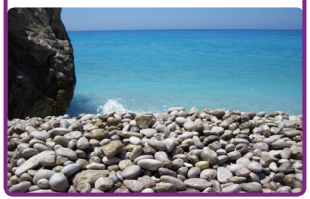
The two parameters (**Width**, above, and **Distribution**, prior page) are combined on the Initial Surface Oil Cover Matrix detailed below:

Initial Surface Oil Cover Matrix

Oil Distribution	Width of Oiled Zone: Wide >6m	Medium >3m - ≤6m	Narrow >0.5m - ≤3m	Very Narrow ≤0.5m
Continuous 91 - 100%	Heavy	Heavy	Moderate	Light
Broken 51 - 90%	Heavy	Heavy	Moderate	Light
Patchy 11 - 50%	Moderate	Moderate	Light	Very Light
Sporadic 1 - 10%	Light	Light	Very Light	Very Light
Trace <1%	Very Light	Very Light	Very Light	Very Light

Tools: Surface Oil Character

This provides a qualitative description of the form of oil.

Characteristic	Description	Example
FR Fresh	Unweathered, low viscosity oil	
MS Mousse	Emulsified oil (oil and water mixture) existing as patches or accumulations, or within interstitial spaces	
TB Tar Ball	Discrete balls, lumps or patches on a beach or adhered to the substrate. Tar ball diameters are generally <10 cm	
PT Tar Patties	Discrete lumps or patches >10 cm diameter that are on a beach or adhered to the substrate	
TC Tar	Weathered coat or cover of tarry, almost solid consistency	
SR Surface Oil Residue	Consists of non-cohesive, oiled, surface sediments, either as continous patches or in coarse-sediment interstices	
AP Asphalt Pavement	Cohesive mixture of oil and sediments	
NO No Oil Observed		

Characteristic	TO Thick Oil	CV Cover	CT Coat
Description	Accumulations of fresh oil (including pools) or mousse >1cm thick	Oil or mousse from >0.1cm and ≤1cm thickness	>0.01cm and ≤0.1cm thick. It can be scratched off with a fingernail on coarse sediments
Example			

Characteristic	ST Stain	FL Film
Description	≤0.01cm thick. It cannot be scratched off easily on coarse sediments or bedrock	Transparent or translucent film or sheen
Example		

Tools: Surface Oil Thickness and Categorisation

This refers to the average or dominant oil thickness within the segment or zone.

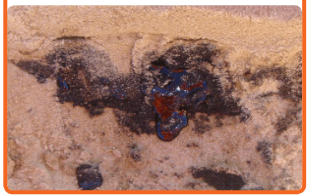
TO	Thick Oil	Accumulations of fresh oil (including pools) or mousse >1cm thick
CV	Cover	>0.1cm and ≤1cm thick
CT	Coat	>0.01cm and ≤0.1cm thick. It can be scratched off with a fingernail on coarse sediments or bedrock
ST	Stain	≤0.01cm thick. It cannot be scratched off easily on coarse sediments or bedrock
FL	Film	Transparent or translucent film or sheen

The Initial Surface Oil Cover Matrix is combined with Oil Thickness in the Surface Oil Categorisation Matrix below:

Initial Surface Oil Categorisation Matrix

		Initial categorization of surface oil			
		Heavy	Moderate	Light	Very Light
Average thickness	Thick >1cm	Heavy	Heavy	Moderate	Light
	Cover >0.1-≤1.0cm	Heavy	Heavy	Moderate	Light
	Coat >0.01-≤0.1cm	Moderate	Moderate	Light	Very Light
	Stain/film ≤0.01cm	Light	Light	Very Light	Very Light

This provides a qualitative description of subsurface oil.

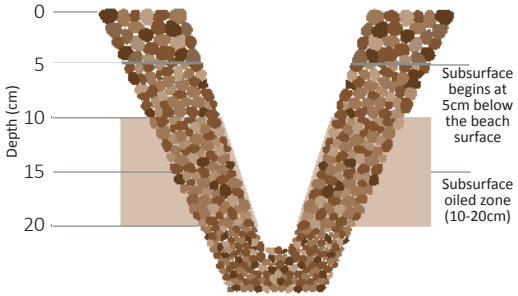
Characteristic	Description	Example
SAP Subsurface Asphalt Pavement	Cohesive mixture of weathered oil and sediment situated completely below a surface sediment layer (record thickness)	
OP Oil-Filled Pores	Pore spaces in the sediment matrix are completely filled with oil; often characterised by oil flowing out of the sediments when disturbed	
PP Partially Filled Pores	Pore spaces filled with oil, but generally does not flow out when exposed or disturbed	
OR Oil Residue as a Cover	0.1-1cm or Coat - 0.01-0.1cm of oil on sediments and/or pore spaces partially filled with oil. It can be scratched off easily on coarse sediments or bedrock	
OF Film or Stain	<0.01cm of oil residue on the sediment surfaces. Non-cohesive. It cannot be scratched off easily on coarse sediments or bedrock	
TR Trace	Discontinuous film or spots of oil on sediments, or an odour or tackiness with no visible evidence of oil	

Tools: Surface Oil Thickness and Categorisation

This is described in terms of depth of penetration or thickness of the buried oil with a qualitative description of the character or concentration of oil.

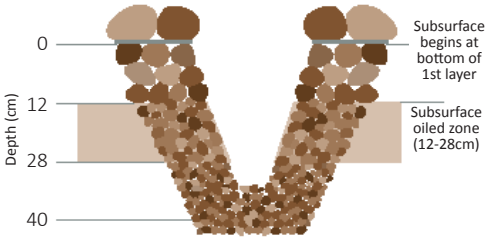
Fine Sediments

Fine sediments (pebble, granules, sand, mud) and/or fine mixed sediments. The subsurface begins at 5 cm below the beach surface. For the purpose of measurement, the beach surface is the 0 cm reference level.



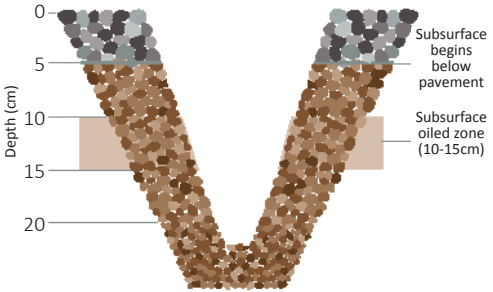
Coarse Sediments

Coarse sediments (pebble, cobble, boulder) and armoured beaches. The subsurface begins at the bottom of the first layer of surface material (i.e. disregard the surface layer). For the purpose of measurement, the beach surface reference point (0 cm) begins at the bottom of the first layer.

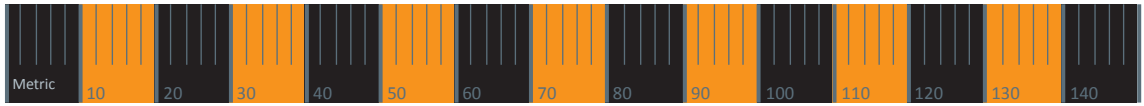


Asphalt Pavement

Where asphalt pavement exists on the surface, the subsurface begins at the underside of the pavement. For the purpose of measurement, the beach surface reference point (0 cm) begins at the top surface of the pavement.



Oil Spill Response



CONVERSION TABLE

VOLUME		
1 US Oil Barrel	42 US Gallons	159 Litres
1 US Oil Barrel	35 Gallons (Imp)	
1 Gallon (Imp)	1.2 US Gallons	4.546 Litres
1 US Gallon	0.833 Gallons (Imp)	3.785 Litres
1 Cubic Metre	1000 Litres	6.29 US Oil Barrels
1 Litre	0.26 US Gallons	0.03531 Cubic Feet
1 Cubic Yard	0.765 Cubic Metres	
1 Cubic Foot	0.0283 Cubic Metres	
1 Cubic Decimetre	0.001 Cubic Metres	1 Litre
1 Met Tonne	7.33 US Oil Barrels	257 Gallons (Imp)
AREA		
1 Acre	0.405 Hectares	4050 Square Metres
1 Hectare	10,000 Square Metres	2.471 Acres
1 Square Kilometre	100 Hectares	247 Acres
1 Square Metre	1.196 Square Yards	
1 Square Yard	0.836 Square Metres	9 Square Feet
1 Square Foot	0.093 Square Metres	
1 Square Mile	2.59 Square Kilometres	640 Acres
LENGTH/DISTANCE		
1 Kilometre	0.54 Nautical Miles	0.622 Miles
1 Nautical Mile	1.852 Kilometres	1.151 Miles
1 Mile	1.609 Kilometres	1760 Yards
1 Metre	1.094 Yards	3.282 Feet
1 Yard	0.914 Metres	
1 Foot	0.305 Metres	
1 Inch	25.4 Millimetres	

SPEED		
1 Knot	1.85 km/Hour	0.51 Metres/Second
1 Metre/Second	3.6 km/Hour	1.94 Knots
MASS		
1 Metric Tonne	1000 Kilogrammes	0.984 Tons
1 Ton (Imp)	20 Hundredweight	1016.05 Tonnes
1 Hundredweight	50.8 Kilograms	112 lbs
1 Kilogramme	2.205 lbs	1 Litre of Water
1 Gramme	0.025 ounces	
FLOW		
1 Cubic Metre/Hour	16.7 Litres/Minute	3.671 Gallons (Imp) /Minute
1 Litre/Second	2.119 Cubic Feet/Minute	13.21 Gallons (Imp)/Minute
1 Cubic Foot/Minute	0.1039 Gallons (Imp)/Second	0.472 Litres/Second
1 US Gallon/Minute	0.0631 Litres/Second	
1 Gallon (Imp)/Minute	0.0767 Litres/Second	0.5825 Gallons (Imp)/Minute
1 Barrel/Hour	2.65 Litres/Minute	
1 US Gallon/Acre	9.354 Litres/Hectare	
1 Gallon (Imp)/Acre	11.224 Litres/Hectare	
PRESSURE		
1 Psi	0.069 Bar	6901 Pascal
1 Bar	100,000 Pascal	14.49 Psi
1 Bar	30 Feet of Water	
ENGINE POWER		
1 Horsepower	0.7457 Kilowatts	

TEMPERATURE

F to C - deduct 32, multiply by 5, divide 9. C to F - mulitply 9, divide 5, add 32

Celcius	0	10	20	30	40	50	60	70	80	90	100
Farenheit	32	50	68	86	104	122	140	158	176	194	212