

# THE UK SCAT MANUAL

## Shoreline Cleanup Assessment Technique

### A Field Guide to the Documentation of Oiled Shorelines in the UK

*adapted and reproduced from*

Owens, E.H. and Sergy, G.A. 2004. The Arctic SCAT Manual: A Field Guide to the Documentation of Oiled Shorelines in Arctic Environments. Environment Canada, Edmonton, AB, Canada.

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## **PREFACE**

The Shoreline Cleanup Assessment Technique (SCAT) process is now a familiar part of an oil spill response in many countries. SCAT teams play a key role in the assessment of the scale and scope of a shoreline response programme. The SCAT approach and documentation protocols were initially developed in 1989 during the *Nestucca* and *Exxon Valdez* spill response operations. In 1994 Environment Canada developed generic second-generation SCAT protocols to standardise the technique. Subsequent editions were published to reflect updates and modifications based on user experience (Owens and Sergy, 2000; 2004).

Since its inception, the SCAT approach has been used on many spills, in a variety of ways, and has been modified by SCAT teams to meet a range of specific spill conditions. This UK SCAT manual was adapted (with permission) from the most recent Environment Canada SCAT manual and materials. The electronic files were provided by Environment Canada and edited to make them relevant to the UK. In particular, modifications were made to make the manual compatible with the UK *National Contingency Plan for Marine Pollution from Shipping and Offshore Installations* (MCA 2006a) and various technical aspects of shoreline classifications in the UK.

Information on the UK Maritime and Coastguard Agency's Counter Pollution and Response Branch is available at:

<http://www.mcga.gov.uk/c4mca/mcga-environmental>

## **What is SCAT?**

As part of oil spill response, Shoreline Cleanup Assessment Technique (SCAT) teams systematically survey the area affected by the spill to provide rapid accurate geo-referenced documentation of shoreline oiling conditions. This information is used to develop real-time decisions and to expedite shoreline treatment planning and response operations.

A SCAT programme includes field assessment surveys, data management, and data application components as part of the spill management organisation. The field survey teams use specific and standard terminology to describe and define shoreline oiling conditions. The SCAT process itself, however, is flexible, and the assessment activities are designed to match the unique spill conditions.

The systematic approach provides for consistent data collection. This allows a comparison of data and observations between different sites, between different observers, and between the same sites over time. These data also provide the basis for cleanup evaluation. In most surveys, the SCAT teams complete forms and sketches for each segment in the affected area. A SCAT proforma is used for documentation.

SCAT surveys provide a geographic or spatial description and documentation of the shoreline or oiling conditions.

Frequently, SCAT teams are asked to provide recommendations regarding appropriate cleanup methods and to define constraints or limitations on the application of cleanup techniques, so that the treatment operations do not result in additional damage to the shoreline. In developing these recommendations, the teams refer to the relevant shoreline cleanup manuals and field guides (e.g., MCA 2006b)

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## **PART 1 PROCEDURES**

### **1.1 OBJECTIVES AND PRINCIPLES OF SCAT**

#### **1.1.1 Objectives of SCAT**

The basic objective of SCAT is to provide **operational support**. The cornerstone activity is the shoreline assessment survey and its fundamental objective is to

- collect and document real-time data on oil and shoreline conditions in a rapid, accurate, systematic and consistent fashion.

SCAT surveys conducted by trained SCAT teams provide information to build a spatial or geographic picture of the regional and local oiling conditions — an understanding of the nature and extent of shoreline oiling that is key to the development of an effective response. This information is provided in a format that can be interpreted easily and applied by planners and decision makers.

The primary focus of this manual is on the detailed systematic shoreline assessment surveys that are most effectively carried out when bulk shoreline oil is essentially static. However, shoreline assessment surveys are also required, often daily, during the emergency response phase when oil is still moving around. These surveys are generally simpler and require less training. Aerial reconnaissance surveys can also play a part in SCAT.

In addition to its primary objective, SCAT surveys can be used for

- development of treatment or cleanup recommendations
- development of treatment or cleanup standards or criteria
- net environmental benefit analysis
- post-treatment inspection and evaluation
- provision of long-term monitoring

Shoreline oiling conditions are described using a set of **standard terms and definitions**, so that the potential for misunderstanding

or misinterpretation is minimised. The use of this defined terminology enables a direct comparison to be made between segments, and it can be used to describe how conditions change through time within the same segment.

### **1.1.2 Principles of SCAT surveys**

SCAT surveys are based on several fundamental principles. These include

- 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 survey team that is objective and trained
- the timely provision of data and information for decision making and planning

The survey team should be composed of trained individuals with appropriate skills to complete the survey objectives. The team may include inter-agency personnel who represent the various interests of land ownership, land use, land management, or governmental responsibility.

Levels of SCAT expertise varies locally and regionally across the UK. In a major incident, on-site training by more experienced individuals will greatly assist the quality and consistency of SCAT surveys.



## 1.2 PLANNING A SCAT SURVEY

Some of the ingredients for a successful SCAT programme include

- suitable **training** and calibration for observers and the SCAT coordinator
- **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 key players who represent the response team

### 1.2.1 Scope of SCAT surveys and programmes

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 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

This manual describes the procedures, techniques and terminology for ground level surveys of oiled shorelines, using the standard proforma developed for UK SCAT. The proforma and components can be modified for use as required, but it is recommended that the basic techniques, terms and definitions are not changed.

The design of a SCAT programme considers

- the size and character of the affected area (see Section 1.2.2)
- the individuals or the representatives who will participate (see Sections 1.2.3 and 1.2.4)
- if the survey team is responsible for the development of treatment or cleanup recommendations (see Section 2.3)
- if the survey team is responsible for the development of treatment standards or cleanup end points (see Section 2.4)

## 1.2.2 Scale and method of surveys

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 (Table 1.1).

**Table 1.1** *Survey methods*

Survey method	Key objectives
Aerial Reconnaissance	Define overall scale of the problem to develop regional objectives. Mapping or documentation not required.
Systematic Ground Survey	Systematically document surface and subsurface shoreline oiling conditions in all segments within the affected area.
Spot Ground Survey	Systematically document surface and subsurface shoreline oiling conditions for selected segments within the affected area.

### Aerial reconnaissance

The purpose of an aerial reconnaissance is to obtain an observational overview of surface oiling conditions (not to map or document) over relatively large areas in a relatively short time period.

Aerial reconnaissance can provide a general picture of the extent and character of the oiled shorelines. This information is critical to develop regional objectives, to define the overall scale of the potential response operation, and to direct the initial deployment of response resources.

### **Systematic ground survey**

The systematic ground survey is used to methodically document shoreline oiling conditions in all segments within the affected area and to complete shoreline oiling summary forms and generate sketch maps for each segment. Photographs or videos are taken to record the oiling conditions.

Typically, systematic ground surveys are the primary source of detailed data and information. The systematic documentation of the location, character, and amounts of surface and subsurface oil in all of the segments within the affected area is the foundation for planning and implementing the shoreline treatment or cleanup operations.

If more than one survey team is in the field, or if the assessment team(s) does not have sufficient time to complete a field summary or report, a SCAT coordinator may be assigned to ensure that appropriate information is produced and distributed in a timely manner to the shoreline response / coordination centre.

### **Spot ground survey**

Spot ground surveys are used to systematically document oiling conditions for selected segments within the affected area, and to complete oiling summary forms and generate sketch maps for those segments. Photographs or videos are taken to record the oiling conditions.

A spot ground survey can focus on specific locations if the aerial reconnaissance identifies discontinuous oiling conditions, or if treatment or cleanup is planned only for selected segments within the affected area. In some cases, a simplified survey approach may involve a spot ground assessment with a verbal report of the

oiling conditions. When observations are reported in this manner, the use of standard terms and definitions becomes an essential part of the communications process.

### **1.2.3 Number of SCAT teams**

A common question is how to define an appropriate level of effort for a SCAT ground survey field programme. On a small spill, or one that is very restricted in area, if the affected segments can be covered in one day by one team, then usually that is all that is required. As the size of the affected area increases, the requirement for more teams depends on the complexity of the affected area and the required turn-around time for the information. If shoreline response / coordination centre requires data for an area to prepare the assignments for the next day, then the appropriate scale is ***“however many teams it takes to cover that area in time to provide the information.”***

A small-scale operation, for example, would be used for a spill that affects less than 50 km of coast or for a length of coast that can be surveyed in one to two days with one or two teams. A spill in a larger area or one that would require a longer coastal survey probably would involve more field teams and office-based data management support. In addition, it is important to consider a situation that might involve rapidly changing (day-to-day) oiling conditions that would require multiple teams to resurvey the same segments on a regular basis. Areas where access or along-shore movement is difficult, or where buried or penetrated oil requires the digging of pits and trenches, can take considerably more time to survey than a straight, flat, wide, sand beach segment.

### **1.2.4 Participation in SCAT**

The management of a spill response operation is a cooperative effort that can involve national, regional, and local government agencies, as well as the organisation responsible for the spill or a response contractor acting on behalf of that organisation. Local authorities usually have a responsibility for cleanup of the shoreline, and non-governmental organisations or local landowners or

managers have a direct interest in the condition of the shorelines. The information that is collected by the SCAT teams is of interest to many or all of these agencies or groups and often they wish to be represented on the field surveys. In the UK, SCAT teams will be appointed and managed by the shoreline response / coordination centre; with assistance from the Environment Group

Practical considerations limit an assessment team to two or three, and occasionally four or five participants. The ideal composition of a team combines

- an individual with **oil spill experience** and **SCAT training** who can identify and document oil on the shore from the air or on the ground
- an individual familiar with the **coastal ecology** of the affected area who can document the impacts of the oil and who can recommend priorities and cleanup end points
- in areas where **archaeological or cultural resources exist**, a **specialist** who can advise on precautions and constraints to protect those resources
- a representative from the **shoreline response / coordination centre** who can identify feasibility issues, logistical constraints and solutions, and who can evaluate the types of resources and level of effort that might be required for cleanup or treatment of a segment

For the efficiency of a field survey, it is important to include a team member with knowledge of the local coastal region. For example, a conservation agency biologist familiar with the affected area would be a valuable member of a field team.

Representatives of landowners and managers also can provide a local knowledge and understanding of issues and priorities that contribute to the knowledge base generated by the SCAT team.

If more than one team is in the field, or if the field team is in a remote location and cannot return daily to report their observations, then a SCAT coordinator provides the link between the field teams and the spill management team.

## **1.3 FIELD ACTIVITIES**

### **1.3.1 Shoreline 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 homogeneous in terms of physical features and sediment type (Table 1.2). Each segment is assigned a unique location identifier. Segment boundaries are established on the basis of prominent geological features (such as a headland), changes in shoreline or substrate type (Figure 1.1), a change in oiling conditions, or establishment of the boundary of an operations area.

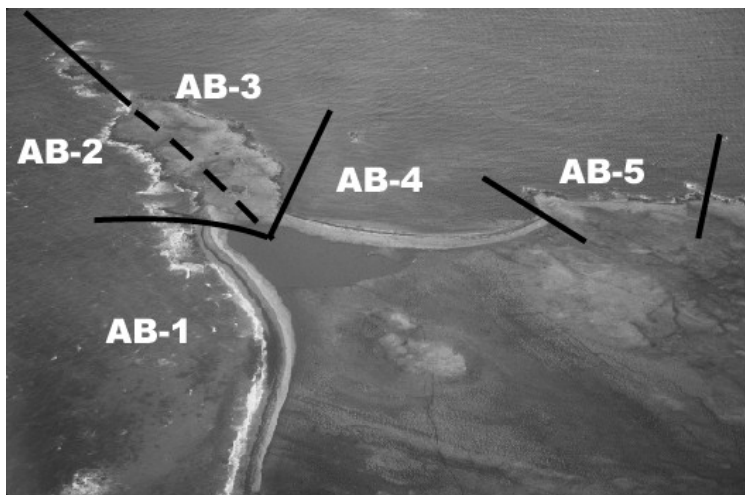
Segment lengths are small enough to obtain adequate resolution and detail on the distribution of oil, but not so small that too much data are generated. Most segments in oiled areas would be in the range of 0.2 – 2.0 km in length.

A common mistake on coastlines is to place the boundary in the middle of a stream. As a “rule of thumb,” where there is a stream or an inlet at the coast it is preferable to make that stream or inlet a separate segment so that it has its own physical and ecological identity. In some cases, it may be appropriate to have two separate segments, one for each side of the channel, so that data users then do not have to decide if the observed oiling conditions refer to one or the other or both sides of the entrance/outlet.

A second “rule of thumb” for segmentation is to divide the coast on the basis of practical aspects that can be used by the shoreline response / coordination centre to deploy cleanup crews. On a long uniform coast a segment may be centred on access points with a segment boundary approximately midway between two access points. Alternatively segments can be defined on the basis of distance. For example, segment boundaries could be every 500 m or some other length along-shore or downstream.

**Table 1.2 Definition of shoreline segmentation**

<p><b>Segments</b> are</p> <ul style="list-style-type: none"><li>– distinct along-shore sections of shoreline that can be used as operation units,</li><li>– relatively homogeneous physical features or sediment type,</li><li>– identified by a unique location code, and</li><li>– bounded by prominent geological or operational features, or by changes in shoreline type, substrate, or oiling conditions.</li></ul>
<p><b>Subsegments</b> are created if</p> <ul style="list-style-type: none"><li>– along-shore oiling conditions vary significantly within a pre-designated segment,</li><li>– along-shore oiling conditions change through time within a segment during a spill incident, or</li><li>– there is an operational division boundary within a segment.</li></ul>

**Figure 1.1 Example of shoreline segmentation.**

Segments are identified by a numbering scheme. In the case of a survey covering an extensive area an alpha-numeric scheme may be appropriate, with an alphabetical prefix (the Segment Group

code) keyed to a geographic place name (e.g., LB = Liverpool Bay) followed by a number based on an along-shore sequence (LB-24). Segmentation may already exist as part of a local access plan or sensitivity-mapping database. If this is the case, the segments should be reviewed for suitability along-shore because the segment boundaries may need to be adapted to existing spill conditions. Pre-designated segments could be subdivided if oiling conditions vary significantly along-shore within the segment. Subdivisions can be identified by a suffix, e.g., LB-24A, LB-24B. For narrow estuary surveys, segments are numbered in a downstream direction and labelled with “L” or “R” to indicate the appropriate bank when facing downstream.

Although the numerical designation suffix for a series of segments is generally based on the order in which segments are surveyed, it may be practical to pre-assign a set of numbers if more than one team is surveying a region. For example, one team may be assigned segment numbers LB-1 through LB-50, and another team assigned LB-51 through LB-100.

Variations in across-shore oiling conditions are documented on the SCAT forms as **Zones**. For consistency, zones are numbered from the low water sections up to the higher water or back-shore sections.

### 1.3.2 Field equipment checklist

The following is a checklist of survey equipment that can be used by the field teams.

- SCAT forms on waterproof writing paper
- Clipboard or similar (e.g. weather proof writing board)
- Spare blank waterproof writing paper or waterproof Field notebooks
- Ordnance Survey (1:10,000) maps of relevant shore segments on waterproof writing paper.
- Office supplies - pencils, waterproof markers, rulers, paperclips
- Other relevant maps or nautical charts of area



- ❑ Compass, liquid-filled, 1-degree graduations, preferably a sighting compass for more accurate records of bearings
- ❑ Shovels - folding or clam, best with the pick on the backside
- ❑ Global Positioning System (GPS), hand-held, portable
- ❑ Tape measure or range finder (hand-held,  $\geq 0$  -500 m)
- ❑ Digital camera (see Section 1.7)
- ❑ Video camera and storage media (if required)
- ❑ Batteries, charged battery packs (for GPS, cameras, etc.)
- ❑ 10-cm or 25-cm long photo scale with 1-cm increments
- ❑ Small backpack (waterproof)
- ❑ Communication equipment (e.g. hand-held 2-way radio(s), VHF radio, mobile phones; as appropriate)
- ❑ Flags/stakes for marking locations of buried oil
- ❑ UK SCAT manual

The surveyors should also have appropriate clothing and personal protective equipment for the conditions. These should be detailed in a health and safety risk assessment.

### **1.3.3 Ground surveys**

Generally, ground surveys should be coordinated between the shoreline response / coordination centre and the Environment Group to ensure that the areas are surveyed within the context of the spill response priorities and that they provide up-to-date information for upcoming (e.g. following day) operations activities.

The following are general elements of a ground survey.

#### **Pre-survey planning**

- Divide shoreline into segments, or adapt existing segmentation (see Section 1.3.1).
- Create segment numbering scheme.
- Print a series of Ordnance Survey (1:10,000) maps on waterproof writing paper – one for each segment – preferably

including the segment number, a suitably placed key to the main symbols for survey annotations (see Section 1.6) and a space for the survey date.

- Decide on segments to be surveyed based on survey priorities, logistics, and low-tide window.
- Select alternate areas in case weather conditions prevent access to primary target(s).
- Review existing information and data.
- Carry out health and safety risk assessment
- Collect all necessary equipment and supplies.
- Brief all team members on objectives, methodology, forms, and safety concerns.

#### **Pre-survey training / calibration** (for consistency of approach)

- For multiple survey teams, the accuracy and comparability of the survey data will be greatly improved if the teams have at least one pre-survey session together on one or more representative oiled shores. The primary purpose should be to go through the proforma and the terms and definitions to ensure that all survey personnel have a similar understanding of what each category of oil thickness / character and substrata / habitat looks like.

#### **On-site activities**

- Conduct segment overview; gain an overall perspective.
- Complete observations and measurements of the segment.
- Take photos and/or videos.
- Annotate / draw maps and profiles
- Fill in required forms, or take appropriate notes to be able to complete forms later.
- Discuss assessments/major observations prior to departure.
- If appropriate, mark areas of buried oil with flags or stakes so that operation crews can easily locate the oil.

- **Important:** Wildlife casualties should be reported as soon as possible (preferably by mobile phone) to the Environment Group and appropriate wildlife response hotline (Section 1.8).

### Post-survey Activities

- Finalise and copy all forms, maps, field notes, and photo/video logs.
- Submit copies to the SCAT coordinator.
- File a daily report form with the SCAT coordinator; including a record of all time spent.
- Review day's activities, discuss improvements, and prepare for next day, if necessary.

### Segment overview on arrival

- If working from a boat, conduct a radio check before departing and agree on calls, channels, and ETA's (estimated times of arrival) with the captain.
- On arrival at the site view the segment from an elevated vantage point to:
  - verify if the pre-determined segment boundaries are correct,
  - acquire a good perspective of the extent of stranded oil,
  - estimate the level of effort required to complete the assessment.

### Survey strategy

- Once on shore, the team spreads out and begins walking from one end of the segment to the other while observing and documenting important oil features, and occasionally digging pits. If little or no oil is observed and treatment is not recommended, only a cursory assessment of ecological or cultural resource features is required.
  - On short segments: Walk the entire segment while making general observations and then return to areas that require more detailed documentation.

- On long segments: It is more efficient to make extensive notes as team members progress along the shore to avoid backtracking.
- Site activities consist of systematic observation, collection, and documentation of the information on field forms, sketches, maps, and by photo and video recording methods.
- Completion of the SCAT Form (Section 1.5) focuses on the physical aspects of the shoreline and the oiling conditions (typically, the mid- and upper-intertidal zones).
- If present, the Environment Group representative would focus on the biological environment and would typically pay particular attention to the lower intertidal/swash zone (usually the most ecologically productive area).
- If present, an archaeologist would focus on the supratidal and back-shore or over-bank regions, as this is where most archaeological or cultural features would be found.
- If operations or agency personnel are present on the assessment team, they can assist in a variety of ways (e.g., photos, measuring, documentation, digging pits) as well as assessing operations features such as access, potential staging areas, safety issues, etc.
- OS maps are annotated, sketch maps are generated (see Section 1.6) and photos/videos taken.

### **Prior to departing the site**

- As a team, review the individual assessments and discuss treatment or cleanup options to ensure nothing has been overlooked, and reach agreement on major points. At a minimum there must be a consensus on oil character and distribution.
- Check that forms and sketch maps are complete and consistent, or ensure that adequate notes and measurements have been taken to complete them later.

- Ensure that all photographs and videos have been accurately logged in the field notes and that all of the documented and unusual features of the segment have been photographed.
- Check that all equipment, survey gear, personal items, and litter are taken when leaving the site.

### 1.3.4 Field documentation

Basic steps in the collection and documentation of on-site field data are summarised in Table 1.3 and Section 1.3.3.

**Table 1.3 Basic steps of on-site field data collection**

- |  |
|--|
| <ul style="list-style-type: none"><li>– Reconnoitre the site to gain an overview perspective</li><li>– Define segment (sub-segment and zones) boundaries</li><li>– Describe shoreline substrata / habitats within the segment</li><li>– Describe surface oiling conditions</li><li>– Describe subsurface oiling conditions</li><li>– Annotate OS map</li><li>– Draw sketch map and profiles</li><li>– Take photos or video</li><li>– Review forms and discuss major observations with team</li></ul> |
|--|

SCAT programmes are designed so that the scale of the field activities and the type of information that is collected are appropriate for the spill incident. A modification of the standard SCAT form or the development of new SCAT forms may be part of the design. However, modifications should not be carried out unnecessarily and should not affect the core information or the standard terms. It is recommended that modifications are primarily to include additional information.

When more than one SCAT team is fielded or multiple surveys are conducted over the same areas, then repetition, calibration, and consistency in reporting by field observers are important components of data accuracy.

Attempts to estimate shoreline oil volumes, or budgets, are doomed to inaccuracy if the data are not complete and systematic. For example, if the oil distribution box for a “Patchy” surface oil cover is checked, the actual range may be any number between 11 and 50%. So calculation of volume of oil for that particular shoreline data set could be inaccurate by as much as 20%. Simplification in the field description that uses categories, rather than actual observed values or measurements, reduces the quality and accuracy of the information that is collected. Some guidelines or “rules of thumb” for the collection and documentation of shoreline oiling conditions are provided in Table 1.4.

**Table 1.4 SCAT documentation “Rules of Thumb”**

- The role of the SCAT is to be the “eyes and ears” for the shoreline response / coordination centre and Environment Group.
- Record, on a form or in a field notebook, any and all information required to recreate later the character and location of the oil.
- Define practical segments, based on the physical shoreline character, oiling conditions, or operational units.
- Be more, rather than less, detailed and do not categorise (i.e., enter the actual value of 15% for Distribution, not Patchy; enter the value 15 m for Width of Oiled Band, not >3 m).
- Always make a sketch (or draw a map or on a map) to indicate important features and the location of the oil.
- If there is no standard term or definition that fits an observed feature, then define and describe the feature.
- Look around and identify advantages or constraints that might help or hinder the field cleanup crew.

## **1.4 RESULTS**

### **1.4.1 Data management**

Field activities are of little value to decision makers or planners if the information is not available quickly. Data management activities can be carried out by the SCAT field team for small-scale or single-team surveys, or on incidents where there is sufficient time to organise and present a summary of the observations. But if the scale of the field activities involves several SCAT teams, a data bottleneck most likely will be created without a committed data management system.

Often, and particularly in the early stages of a spill response, the information from the field teams is used to plan cleanup activities for the following day. This information probably would be required by late afternoon or early evening to be of value in the planning process. In these circumstances, field teams may be required to communicate key information by telephone or radio to a person who can collate and process the data. In other circumstances, particularly after the initial response phase, the planning process may be several days ahead of operations.

Typically a précis of each SCAT survey is provided to the shoreline response / coordination centre and would briefly highlight oiling and treatment recommendations.

One role of the SCAT coordinator is to collect and review the incoming field forms, sketches, and other information (films, videos etc.) as they are received and to log or distribute the information. The review should involve a quality check to make sure that all sections of the forms have been completed and that the information appears reasonable and consistent. Any questions regarding missing information or apparent inconsistencies should be discussed with the field teams before the next field assignment. After the checking is complete, forms are copied and distributed.

Note: Detailed records of staff time and expenses will be important for cost recovery purposes.

## 1.4.2 Data outputs

Data generated by SCAT surveys may be combined and used in a variety of ways:

**Length**, by itself, is mainly useful for initial scoping on a regional-scale and operational planning.

**Length x Width** of the total oiled area can be used in planning cleanup operations and in monitoring changes through time.

**Length x Width x Surface Distribution** of the actual surface area that is covered by oil, i.e., the total oiled area x % coverage (also known as “equivalent area” oiled). This value is useful when trying to quantify the degree of oiling or to monitor changes and oil removal rates.

**Depth of Burial** or **Penetration** measurements assist in the selection of cleanup options and predictions of oil persistence.

**Depth x Surface Area** is the oiled sediment volume that might have to be handled in cleanup.

**Oil Volume** calculations require the oil concentration data in combination with the knowledge of oiled sediment volume or equivalent area oiled, or oil loading data, together with sediment porosity/retention estimates.

### Rating the degree of oiling

In the case of a small spill or when information is needed quickly to plan operations, the planners may require a summary of the more detailed field observations. This summary should be simple, but accurately reflect oiling conditions. Figure 3.2 is an example of a **Surface Oil Cover Category** matrix that combines the width of the oiled area with the surface oil distribution using standard terms and definitions. This index can be used to provide spill managers with a concise measure of the oiling conditions for each segment and can be summarised verbally from the field.



The use of such indices allows a single-value, site-to-site relative comparison that provides a perspective to describe, summarise, or compare multiple areas or long sections of oiled coast in an easily understandable manner. The rating can be adjusted to the local conditions.

The two indices described in this manual are:

**Surface Oil Cover Category** = width x surface distribution of the oil (see Figure 3.2)

**Surface Oil Category** = width x surface distribution x thickness of the oil (see Figure 3.3)

These indices are a rating of the degree of oiling in that segment (Very Light, Light, Moderate, or Heavy). Typically, the rating category is combined with along-shore length (e.g., "Segment AB-1 has 20 m of 'heavy' surface oiling").

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. Maps that can be produced from the SCAT data to support a response operation include the following:

- segment limits and operational areas
- oiling category by segment (including changes over time)
- estimated surface oil volume (including changes over time)
- risk of remobilisation of oil
- estimated oil persistence
- segment treatment or cleanup priority
- recommended cleanup or treatment methods
- SCAT survey or cleanup status

Tables can be created to show:

- lengths of oiled shoreline (by oil rating or shoreline type)
- lengths treated (by oil rating and/or treatment method)

## 1.5 SCAT FORM INSTRUCTIONS

Terms and definitions are detailed in Section 3.1.

### Boxes 1 – 3

Complete boxes 1, 2 and 3.

### Box 4

Tick (✓) boxes for all notable substrata and features present on the whole shore; double tick (✓✓) the one primary substrata that characterises the upper part of the shore.

Circle the boxes of those substrata and features that have been oiled.

Tick (✓) one box for the wave exposure that best describes the shore.

### Box 5

Record whether debris is present on the shore and the approximate amount that is oiled.

Record any useful information on access to the site (private property, locked gates, ploughed fields etc.); features that may limit movement across the shore; and the amount of back-shore space for laydown of equipment and temporary storage.

Briefly note if cleanup or treatment is ongoing on the site at the time of the SCAT survey and the type and approximate scale of that activity (e.g. number of workers and vehicles).

### Box 6

#### If No Surface Oil Is Present:

- check the NO box in “Oil Character”

#### If Surface Oil Is Present:

- STEP 1 Decide if the segment has relatively uniform along-shore and across-shore oiling conditions:

- if YES, then go to STEP 2;
- if NO, then (a) subdivide the segment into as many along-shore **Sub-Segments** and/or across-shore **Zones** as necessary for an accurate description, then (b) go to STEP 2. Use a separate form for each sub-segment.

STEP 2 Define the location (*Tidal zone*), *Oil cover*, *Thickness* (estimate actual thickness in cm for TO), *Character* and primary and any secondary (in parentheses) *Surface substratum type(s)* for each zone in the segment or sub-segment in which oil is observed.

STEP 3 Annotate OS map and/or draw sketch map(s) (see Section 1.6) to locate sub-segments, zones, and oiled areas. Take photographs or videos.

### **Box 7**

#### **If No Subsurface Oil Is Present:**

- check the NO box in **Subsurface Oil Character** and go to Box 8

#### **If Subsurface Oil Is Present:**

STEP 1 Decide if the segment has relatively uniform along-shore and across-shore subsurface oiling conditions:

- if YES, then go to STEP 2
- if NO, then (a) subdivide the segment into as many along-shore **sub-segments** and/or across-shore **zones** as are necessary for an accurate description, then (b) go to STEP 2. Note: use a separate form for each sub-segment.

STEP 2 Define the location (*Pit zone*), *Pit depth*, *Oiled zone* depths, *Character*, and *Sediment type(s)* for each pit.

**STEP 3** Annotate OS map and/or draw sketch map(s) (see Section 1.6) to locate pits. Take photographs or videos.

**Box 8A**

Add notes on actual or potential resource sensitivities observed or known to be present; including ecological, recreational, cultural, commercial or any other socio-economic issues/constraints that may be relevant to a Net Environmental Benefit Analysis (see Section 2.5).

Include any notable wildlife observations, particularly any casualties.

**Box 8B**

Add recommendations on cleanup or other treatment (see Section 2.3). These should include a description of the recommended technique, suggested scale of operation required (e.g. number of workers), likely timescale (including potential limitations on the time available) and any other practical constraints.

Add recommendations on appropriate end points for terminating the cleanup (see Section 2.4).

**Box 9**

A sketch map should be drawn for each segment to show the location of the oil, samples, pits, and photographs in relation to the physical layout of the shoreline (see Section 1.6). A vertical profile may be useful for some sites.

If you run out of space you can provide additional notes/sketches on separate pieces of paper; each of which should be labelled with segment code and date and kept with the main form.

Note photo and/or tape number(s) at the bottom of the form.

## Shoreline Clean-up Assessment Technique Survey Form

Page.....of.....

**1 General** Incident: \_\_\_\_\_ Local authority: \_\_\_\_\_ Date: \_\_\_\_\_  
 Segment: \_\_\_\_\_ Time: \_\_\_\_\_ to \_\_\_\_\_ Low tide: \_\_\_\_\_ m @ \_\_\_\_\_  
 Surveyed from: Air / Boat / Viewpoint / ATV / Foot Sun / Cloud / Fog / Drizzle / Rain / Snow / Calm / Breeze / Wind

**2 Surveyors** \_\_\_\_\_ Org./Tel.: \_\_\_\_\_  
 \_\_\_\_\_ Org./Tel.: \_\_\_\_\_  
 \_\_\_\_\_ Org./Tel.: \_\_\_\_\_

**3 Segment** Total segment length: \_\_\_\_\_ m Length surveyed: \_\_\_\_\_ m Max intertidal width: \_\_\_\_\_ m  
 Start: Easting: \_\_\_\_\_ Northing: \_\_\_\_\_ Notes: \_\_\_\_\_  
 End: Easting: \_\_\_\_\_ Northing: \_\_\_\_\_

**4 Shore substrata** ✓ = primary (upper shore) ✓ = secondary Circle those oiled Bedrock [r]  cliff / slope / platform  
 Stable boulders/cobbles [b/c]  Mobile boulders/cobbles/pebbles [m/b/c/p]  Solid seawalls [w]  Revetment [v]   
 Coarse sediment [r/c]  Mobile sand [m/s]  Stable sand [s]  Clay/Peat [c]  Stable mixed substrata [x]   
 Firm muddy sand [m/s]  Soft mud [m]  Saltmarsh [s]  Reed swamp [rsw]  Other: \_\_\_\_\_  
 Prominent features: Pools  Deep cracks/crevices  Pockets of sediment between rocks   
 Wave exposure: Very exposed  Exposed  Partially sheltered  Very sheltered  Extremely sheltered

**5 Operational features** Debris  Oiled  \_\_\_\_\_ bags / trucks Notes \_\_\_\_\_  
 Access: Direct backshore  Alongshore from next segment  \_\_\_\_\_  
 Backshore cliff  Ht \_\_\_\_\_ m Suitable shore substrata for trucks/JCB  \_\_\_\_\_  
 Suitable laydown area  Ongoing clean-up activity : \_\_\_\_\_

**6 Surface Oiling** (mark location of area on map/sketch)

Loc.	Tidal zone (tick one)				Oil cover			Surface oil											Surface substratum type (c.f. codes in 4)						
	LI	MI	UI	SU	Length m	Width m	Dist/bt %	Character (tick one)																	
								Thickness (tick one, cm for TO)	FR	MS	TB	PT	TC	SR	AP	NO									
A																									
B																									
C																									
D																									

(Tidal zone: Lower, Middle &amp; Upper Intertidal) (Distribution: Coarse soss = 100-91%; Broken = 90-51%; Patchy = 50-11%; Sporadic = 10-1%; Trace = &lt;1%)

(Oil Thickness: TO = Thick oil; CV = Cover; CT = Coat; ST = Stain; FL = Film)

(Character: FR = Fresh; MS = Mousse; TB = Tar Balls; PT = Tar Patches; TC = Tar; SR = Surface Oil Residue; AP = Asphalt Pavement; NO = No Oil Observed)

**7 Subsurface Oil** (mark location of pits on map/sketch)

Use Location letter from Section 6 plus number of Pit (e.g. A1)

Pit No.	RT zone (tick one)				RT depth cm	Oiled zone cm - cm	Character (tick one)							Water table cm	Shore colour B, R, S, N	Clean below?	Sediment type (c.f. codes in 4)
	LI	MI	UI	SU			SAP	OP	PP	OR	OF	TR	NO				

(Character: SAP = Asphalt Pavement; OP = Oil-filled Pores; PP = Partially Filled Pores; OR = Oil Residue as a Cover; OF = Film or stain; TR = Trace; NO = No oil)

(RT zone: Lower, Middle &amp; Upper Intertidal) (Shore Colour: B = Brown; R = Rainbow; S = Silver; N = None)

Other materials: Map  Sketch  Photos  (No. \_\_\_\_\_) Video Tape  (tape # \_\_\_\_\_)

Figure 1.2 SCAT form (page 1)

SCAT survey of Segment ..... Date: ..... Page ..... of .....

**8A Resource sensitivities and other constraints on clean-up** (ecological / recreational / cultural / economic; incl. wildlife casualties)**8B Clean-up recommendations****9 Sketch maps / profiles**JM 4<sup>th</sup> April 2007**Figure 1.3 SCAT form (page 2)**

## 1.6 MAPS

### 1.6.1 Ordnance Survey map

Ordnance Survey maps at a scale of 1:10,000 are available for most coastal areas around UK and can be printed onto waterproof paper for each segment (if copyright issues allow). They can be annotated using the same symbols as sketch maps (see below).

### 1.6.2 Sketch map

A sketch map (Figure 1.2) should also be drawn for each segment to provide more detail on location of the oil, samples, pits, and photographs in relation to the physical layout of the shoreline. If only a portion of the segment is sketched or several sketch maps are drawn for a site, include a sketch location map to indicate how the sketches match or overlap. Some guidelines are given below.

- Include north arrow, segment number, approximate scale, segment and sub-segment boundaries, HWL/LWL (high tide & low tide 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 biota within oiled areas - nesting locations, etc.
- Show photograph locations by a dot with a connecting arrow indicating the direction in which the photo was taken, with frame number/roll number on sketch.
- Indicate location(s) where a video was recorded.

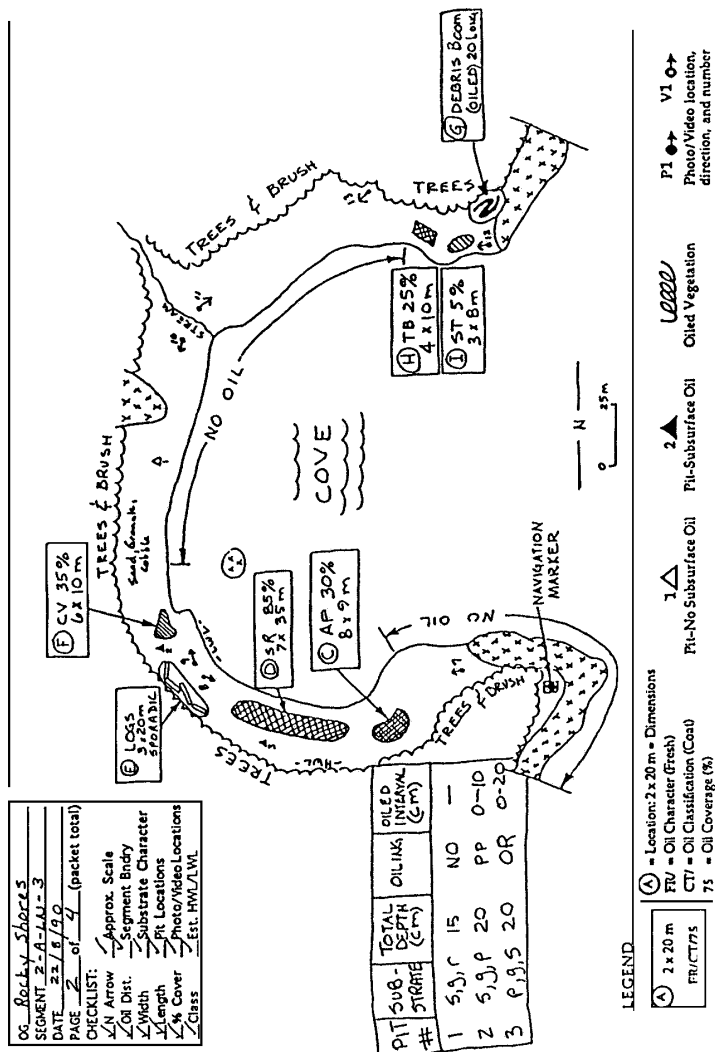


Figure 1.4 A typical sketch map.



## 1.7 PHOTOGRAPHY & VIDEO

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 dug pits, potentially sensitive resources, access points, possible laydown areas, the shoreline response, etc. However, be aware that oil itself does not photograph very well, so images may not illustrate its character/thickness (particularly in bright lighting).

Digital cameras / video are preferred (for viewing on same day).

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. Small changes in position, height, zoom angle (focal length) can make a big difference to the perceived changes between images. Try to include permanent features in the view that stand out (e.g. uniquely shaped rocks).

Other guidelines:

- Ensure that the correct date and time have been set in the camera. Set the image file numbering system on the camera so that it gives every photograph a unique number (not re-set back to '1' after each download).
- 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 (Section 1.6.2). Take a GPS fix of the viewpoint to aid relocation.
- Record the photograph numbers and video times (start and end) on the SCAT form. Make any other relevant notes to make sure you will remember what the images illustrate.
- Meticulously maintain a storage and cataloguing system for the image files and video media that links with the SCAT data and allows rapid retrieval. The system must be able to cope with different cameras and photographers working on different sites on the same day.

## 1.8 WILDLIFE CASUALTIES

It is likely that SCAT teams will come across wildlife casualties of the oil spill. These could include dead or live (oiled) birds, mammals (e.g. seals), fish and invertebrates (e.g. limpets, clams, crabs, urchins). As these casualties are unattached it is possible that they will not remain on the shore for long. While recording of such casualties is not one of the primary objectives of the SCAT survey, it is important that they are promptly reported to the Environment Group. For some spills there may also be a hotline number for wildlife response to live oiled birds and mammals.

It will normally be appropriate to make the report as soon as possible by mobile phone.

Information to include in report:

- *Casualty type and numbers* – but only attempt to identify it to species if you are absolutely sure.
- *Condition of casualty* – alive, probably dead or definitely dead; apparently fresh or in state of decay; clearly oiled or no conspicuous oil; being eaten by other birds/animals.
- *Location* – as detailed as necessary for someone to re-find it
- *Date and time of observation*
- *Your name and contact details*

Photos may be useful, particularly if the location is remote or no one is available to visit the site.

If you are asked to take specimens – place a representative sample (up to 10 individuals) in a container (a plastic bag will normally do) and label it with the information listed above.

## **PART 2 APPLICATIONS**

### **2.1 SCAT AND THE OIL SPILL RESPONSE**

In the UK (see National Contingency Plan, MCA 2006a), SCAT surveys are the responsibility of the shoreline response / coordination centre; with assistance from the Environment Group. In many situations it is likely that the Environment Group (and associated nature conservation agencies) would carry out much of the coordination as they have considerable expertise in shoreline habitat surveys. If more than one field team is deployed, a SCAT coordinator is usually required.

On some spills, a SCAT survey may be carried out at the same time as surveys for the purpose of environmental/resource damage assessment. These types of surveys usually are, and should be, a separate activity, although the SCAT data and information may be used as part of the damage assessment (see Environment Group STOP Notice, MCA 2001a and Moore *et al.* 2005).

### **2.2 WHO USES SCAT DATA?**

The groups that typically use the information and data generated by the SCAT programme include the following teams within the shoreline response / coordination centre (see MCA 2001b):

- **Management team**, to:
  - define regional and segment treatment objectives
  - define regional shoreline treatment priorities
- **Technical team**, to:
  - select cleanup or treatment methods
  - identify the required level of effort for shoreline operations
  - locate the work sites and the oil and to implement the cleanup task
  - define and apply cleanup or treatment end-point criteria
  - monitor cleanup and treatment progress
- **Procurement team**, to estimate the resources required on a site-by-site or segment-by-segment basis.

- **Waste management team**, to determine the type and quantity of waste generated at each site.
- **Health and Safety adviser(s)**, to identify hazards and other safety issues at each work site.
- **Media and public relations team**, to provide accurate data to the media and others on the scale of the oiling and on the progress of the cleanup operation.
- **Administration team**, to:
  - record what happens
  - update the status boards

and:

- **Environment Group**, to:
  - identify potential environmental sensitivities and constraints
  - carry out Net Environmental Benefit Analyses
  - carry out damage assessments

## 2.3 CLEANUP RECOMMENDATIONS

The information generated by the SCAT survey(s) is a basic component of the decision process for setting regional response priorities, cleanup objectives, and standards for acceptable levels of treatment.

Recommendations for treatment or cleanup techniques can be made by the SCAT team in the field or by discussions following the field survey that might involve representatives from the Technical team, Environment Group, Maritime & Coastguard Agency, and local government representatives.

The Maritime and Coastguard Agency Marine Pollution Clean-up Manual (MCA 2006b) provides detailed information on methodologies for cleanup and treatment of oiled shorelines.

## 2.4 CLEANUP END POINTS

The decision to end the treatment or cleanup of an oiled segment should be based upon goals, standards (termination criteria), or levels of effort that are established before the operation begins. Data and recommendations from the SCAT surveys provide a fundamental basis for the development of end-point standards. The primary intent of those standards is as follows:

- Assist the management and technical teams in the selection of cleanup objectives and techniques for a specified area before the response operation begins.
- Provide beach masters with a clear objective or target so that they can tailor their activities towards a known point of completion.
- Provide an inspection team with cleanup criteria and standards upon which to evaluate the results of the treatment activities and to reach closure.

Typically the establishment of the cleanup end points is a joint decision by the management and technical teams in the shoreline response / coordination centre; with advice provided by the Environment Group. If the Environment Group has carried out a Net Environmental Benefit Analysis, part of that process will include the provision of advice on cleanup / treatment end points. There may be range of criteria that vary depending upon the following:

- the shoreline type (e.g. bedrock, sea walls, saltmarsh)
- the environmental character and habitat value of the segment
- the use of the segment (e.g. residential area, park, remote area, statutory conservation site)
- operational factors (e.g. access, staging, techniques)
- the degree of oiling
- the anticipated rate of natural cleaning

Treatment standards or cleanup end points may vary from one area or segment to another and may be based on:

- qualitative field observations
- quantitative field measurements (such as SCAT survey data)
- analytical measurements (e.g. chemical, toxicological)
- interpretative assessments (such as a Net Environmental Benefit Analysis)

Following termination the inspection process may also involve members of the SCAT team(s), to establish that the treatment criteria or cleanup standards have been met and possibly provide further recommendations on any further cleanup. Whether members of the SCAT teams are involved or not, the SCAT data will be invaluable to show the changes in oiling conditions.

As the circumstances of each spill are different, the endpoints must meet the specific conditions of the event. Direction and guidance in the selection and measurement of treatment endpoints for oiled shorelines can be found in Sergy and Owens (2007). Some guidance is also given in Moore (2007).

## 2.5 NET ENVIRONMENTAL BENEFIT ANALYSIS

Net Environmental Benefit Analysis is a process that facilitates decisions when considering different cleanup or treatment options during an oil spill response, taking into account the importance of all the environmental resources and factors. It (and the acronym NEBA) is now a common phrase in the oil spill response industry and its literature. While it is fundamentally the age old process of applying common sense and experience to oil spill response decision making, a formal Net Environmental Benefit Analysis demands an objective considered approach within a formalised structure that provides a rationale for environmental advice.

The Environment Group is required to provide environmental advice, based on a Net Environmental Benefit Analysis, when requested to do so by the response centre. The Environment Group's representative on the SCAT team should therefore endeavour to record all relevant information from the oiled site and adjacent resources that may be useful for this process. Some guidance on the required information and a possible approach to a Net Environmental Benefit Analysis for shoreline cleanup is available in Moore (2007). Information requirements will include:

- presence/abundance of resources that are both sensitive and vulnerable; including resources that have already been oiled and adjacent resources that could be oiled or affected by the cleanup activity.
- detailed description of the quantity, character and distribution of oil
- description of various site characteristics; including, topography, distribution of substrata and substratum features (e.g. pools & fissures), loading characteristics of the sediments, tidal elevations, wave exposure, freshwater streams etc.

The SCAT survey is also a good opportunity for the Environment Group's representative to quiz the cleanup specialist(s) on the reasoning behind their recommendations (and *vice versa*).

## PART 3 SUPPORT MATERIALS

### 3.1 STANDARD TERMS AND DEFINITIONS

The terms and definitions in this section provide an explanation for completion of the SCAT forms. Some modification may be appropriate based on local or regional geographic conditions or the specific character of the stranded oil.

#### 3.1.1 Shore substrata (Box 4)

The following categorisation of commonly occurring substrata is designed for oil spill cleanup purposes, not ecological character.

Table 3.1 gives the precise grain size definitions for sediments

**Bedrock [R]** – distinguish between vertical, sloping and near horizontal platforms of bedrock.

**Stable boulders/cobbles [B/C]** – characterised by attached seaweed (but not ephemeral species), lichens or animals (e.g. mussels, barnacles, sponges, etc.), on upper or underboulder surfaces, indicating that they are not often turned over by the sea.

**Mobile boulders/cobbles/pebbles [mB/C/P]** – characterised by a lack of attached seaweed (although some ephemeral species may be present) or animals (e.g. barnacles, sponges, etc.), on upper or underboulder surfaces, indicating that they are often turned over by the sea. Mobile snails, crabs and sand-hoppers may be present.

**Solid seawalls [W]**

**Revetment [V]** – coastal protection structures, particularly riprap and gabion.

**Coarse sediment [P/G]** – composed primarily of pebbles and granules; without notable mud content.

**Mobile sand [mS]** – typical of exposed sandy beaches or in tidal channels.



**Stable sand [S]** – typical of sand flats, without notable mud but characterised by many sediment animals (e.g. worm tubes, lugworm, clams).

**Clay/Peat [Cl]** – very firm impermeable layers.

**Stable mixed substrata [X]** – typical of areas that are sheltered from wave action, particularly marine inlets. Coarse material on surface, often with attached life (e.g. mussels, barnacles, seaweeds), with firm sediments just below.

**Firm muddy sand [MS]** – adult footprint sinks no more than heel depth (<3cm); (can incl. some coarser sediment)

**Soft mud [M]** – soft muddy sediment; adult footprint sinks more than heel depth (>3cm).

**Saltmarsh [St]** – only in areas that are very sheltered from wave action. Upper shore areas of mud dominated by rooted saltmarsh vegetation.

**Reed swamp [Rd]** – only in areas that are very sheltered from wave action and the water is brackish (very low salinity). Dominated by reeds.

**Table 3.1 Grain size scale**

Description (Wentworth scale)		Grain diameter (mm)
Boulder		>256
Cobble		64 – 256
Pebble		4 – 64
Granule		2 – 4
Sand	Very coarse	1 – 2
	Coarse	0.5 – 1.0
	Medium	0.25 – 0.5
	Fine	0.125 – 0.25
	Very fine	0.0625 – 1.125
Silt		0.004 – 0.625
Clay		0.00024 – 0.004

**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 swell without any offshore breaks (such as islands or shallows) for several hundred kilometres but where deep water is not close (>300 m) to the shore.

**Exposed** – sites where onshore strong winds are frequent (but not necessarily prevailing) but also a degree of shelter because of extensive shallow areas or other obstructions to seaward, or a restricted (<90°) window to open water. These sites will not generally be exposed to strong or regular swell.

**Partially sheltered** – sites with a restricted fetch and/or open water window. Sites can face prevailing winds but with a short fetch (say <20 km) or extensive shallow areas to seaward or may face away from prevailing winds.

**Very sheltered** – sites with a fetch less than 20 km (possibly more if the window to open water is narrow [<30°]), and which face away from prevailing winds or have obstructions such as reefs to seaward.

**Extremely sheltered** – sites that are fully enclosed, with a fetch no greater than about 3 km.

### 3.1.2 Operational features (Box 5)

**Debris** can consist of logs, rubbish, and flotsam stranded on the shoreline; dead animals or vegetation; and spill response items such as sorbents, booms, snares, etc.

**Laydown areas** are relatively flat areas above the high tide mark and with good access to the shore; where response equipment and vehicles, etc. can be parked / organised.

**Suitable shore substrata for response vehicles** will need to consider its softness or rugged nature.

### 3.1.3 Surface oiling (Box 6)

The definition of Surface Oil is “oil that is visible on the surface and that is up to 5 cm below the surface.” Oil that is not visible on the surface but that is present below the surface or oil that has penetrated more than 5 cm below the surface would be considered Subsurface Oil.

This information is recorded for each segment, sub-segment, or zone within the survey area.

**TIDAL ZONE** refers to height on the shore in relation to the tide.

- LI** *Lower Intertidal Zone* — the lower approximate one-third of the intertidal zone.
- MI** *Mid Intertidal Zone* — the middle approximate one-third of the intertidal zone.
- UI** *Upper Intertidal Zone* — the upper approximate one-third of the intertidal zone.
- SU** *Supratidal Zone* — the area above the mean high tide that occasionally experiences wave activity. Also known as the splash zone.

**LENGTH** refers to along-shore (parallel to the shoreline) distance of the oiled area within a segment, sub-segment, or zone.

**WIDTH** refers to the average across-shore (perpendicular to shore) distance of the intertidal oil band within a segment, sub-segment, or zone. If multiple across-shore bands are grouped, then width represents the sum of their widths. The actual oiling width can also be categorised by the following terms, which can be modified according to the regional shoreline character within the area affected by a spill.

- Wide** > 6 m
- Medium** > 3 m to 6 m
- Narrow** > 0.5 m to 3 m
- Very Narrow** < 0.5 m

**DISTRIBUTION** represents the actual percentage of the surface that is covered by oil within a fixed area. A visual aid to surface distribution is provided in Figure 3.1. In the event of grouped multiple bands, distribution refers to the average oil conditions for the zone. While an estimated percentage value is preferred, the oil distribution measurements can also be categorised or grouped according to the following scale:

<b>Trace (TR)</b>	<1%
<b>Sporadic (SP)</b>	1–10%
<b>Patchy (PT)</b>	11–50%
<b>Broken (BR)</b>	51–90%
<b>Continuous (CN)</b>	91–100%

**SURFACE OIL THICKNESS** refers to the average or dominant oil thickness within the segment or zone.

- TO *Thick oil*** — accumulations of fresh oil (incl. pools) or mousse >1 cm thick.
- CV *Cover*** — >0.1 cm and <1 cm thick.
- CT *Coat*** — >0.01 cm and <0.1 cm thick. It can be scratched off with fingernail on coarse sediments or bedrock.
- ST *Stain*** — <0.01 cm thick. It cannot be scratched off easily on coarse sediments or bedrock.
- FL *Film*** — transparent or translucent film or sheen.

**SURFACE OIL CHARACTER** provides a qualitative description of the form of the oil.

- 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 Balls*** — 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.

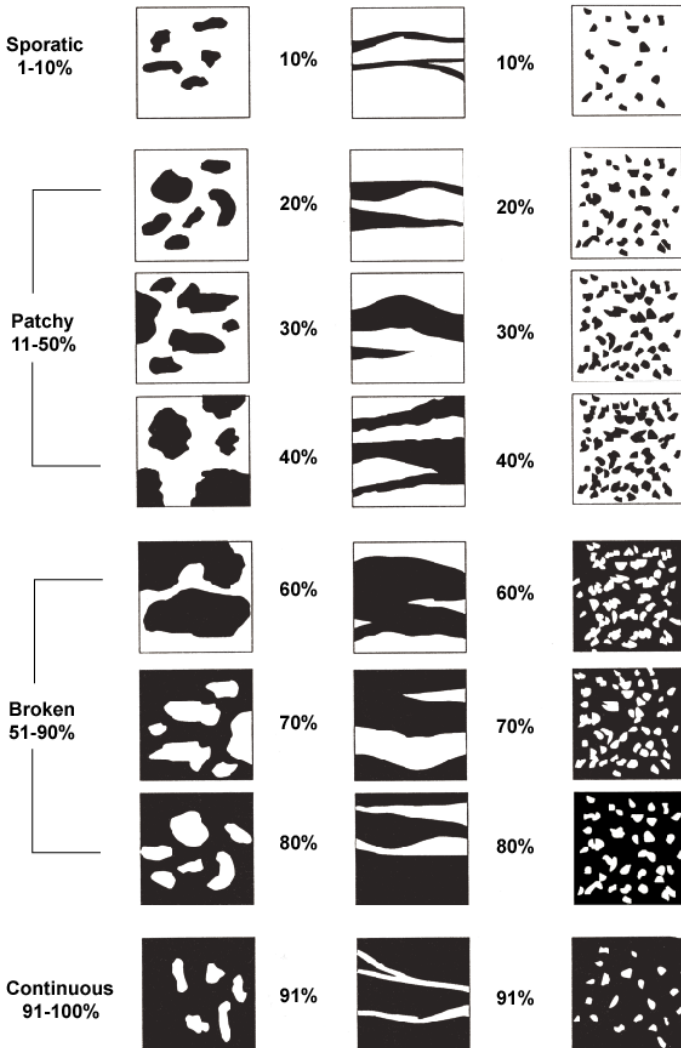
**TC *Tar*** — weathered coat or cover of tarry, almost solid consistency.

**SR *Surface Oil Residue*** — consists of non-cohesive, oiled, surface sediments, either as continuous patches or in coarse-sediment interstices.

**AP *Asphalt Pavement*** — cohesive mixture of oil and sediments.

**NO *No Oil Observed.***

**SURFACE SUBSTRATUM TYPES** – the substratum codes described in Section 3.1.1 are also applicable for Box 6. The code letters can be combined as appropriate:



**Figure 3.1** Visual aid for estimating oil distribution.

## Summarising the degree of oiling

Several of the above data can be combined to create indices to rate the degree or relative severity of oiling in a particular segment. Potential indices are depicted in Figures 3.2 and 3.3.

		Width of Oiled Area			
		Wide	Medium	Narrow	Very Narrow
Oil Distribution	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

**Figure 3.2** *Surface oil cover category  
(width x surface distribution data)*

		Initial Categorization of Surface Oil			
		Heavy	Moderate	Light	Very Light
Average Thickness	Thick > 1 cm	Heavy	Heavy	Moderate	Light
	Cover 0.1 – 1.0 cm	Heavy	Heavy	Moderate	Light
	Coat 0.01 – 0.1 cm	Moderate	Moderate	Light	Very Light
	Stain/Film < 0.01 cm	Light	Light	Very Light	Very Light

**Figure 3.3** *Surface oil category.  
(surface oil cover category x thickness data)*

### 3.1.4 Subsurface oil

Subsurface oil is usually described in terms of depth of penetration or thickness of the buried oil lens when viewed in profile by digging a pit or trench; and a qualitative description of the character or concentration of the oil.

Due to problems associated with defining the beach surface when differentiating between what is considered surface and subsurface, the following guides have been developed and are further illustrated in Figure 3.4.

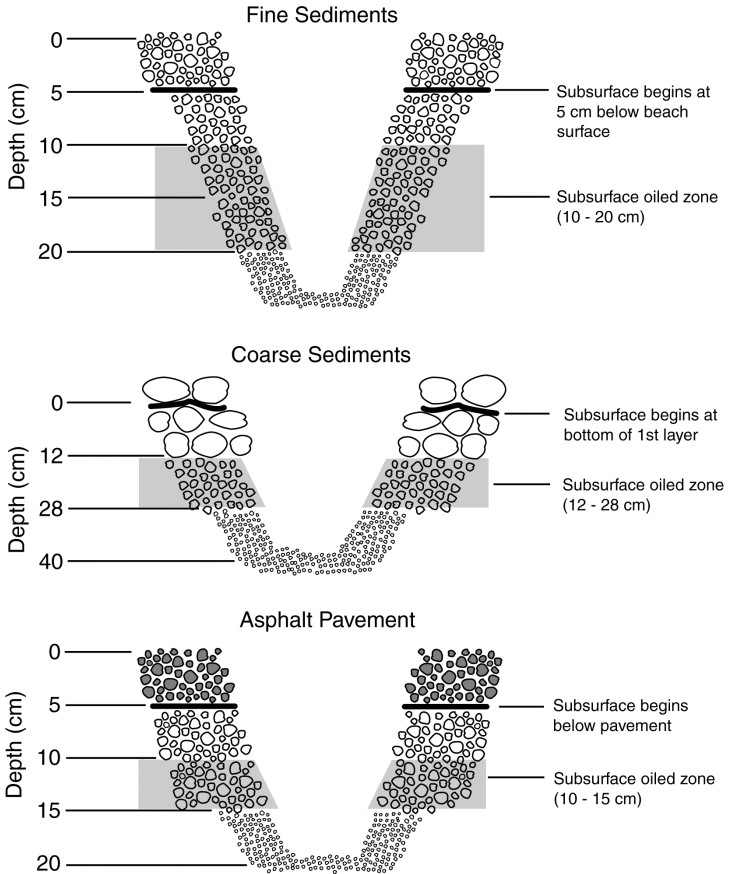
- Fine sediments (pebble/granule/sand/mud) and/or fine mixed sediments. The subsurface begins at 5 cm below the beach surface. For the purpose of measurement, the beach surface is the 0 cm reference level.
- Coarse Sediments (pebble/cobble/boulder) and armoured beaches. The subsurface begins at the bottom 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 AP 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.

**PIT ZONE** refers to height on the shore in relation to the tide. Apply the same definitions as used for the Surface Oiling (Section 3.1.3).

**PIT DEPTH** – the total depth of the pit or trench

**SUBSURFACE OILED ZONE** - The top and bottom boundaries of the lens are recorded. The bottom boundary is equal to the maximum depth of oil penetration. The top boundary may equal 0 (the beach surface) or a greater number depending on whether clean sediments have been deposited on top of the oiled sediment.





**Figure 3.4** *Subsurface definitions.*

**SUBSURFACE OIL CHARACTER** provides a qualitative description of the character and/or quantity of the oil.

**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 – 1 cm) or **Coat** (0.01 – 0.1 cm) of oil on sediments and/or some pore spaces partially filled with oil. It can be scratched off easily with fingernail on coarse sediments or bedrock.
- OF Film or Stain** (< 0.01 cm) 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.
- NO No Oil** — no visible or apparent evidence of oil.

**WATER TABLE** – refers to the depth (in the pit) of any water layer

**SHEEN COLOUR** - may be roughly indicative of the oil layer thickness and quantity.

**S Silver**                      **R Rainbow**                      **B Brown**                      **N None**

Colour	Thickness	Volume of oil per unit area
Silver	<0.0001 mm	<100 L oil/km <sup>3</sup> /km <sup>2</sup> (<0.1 m <sup>3</sup> /km <sup>2</sup> )
Rainbow	0.0001-0.001 mm	100-1000 L oil/km <sup>3</sup> /km <sup>2</sup> (0.1-1.0 m <sup>3</sup> /km <sup>2</sup> )
Brown	>0.001 mm	>1000 L oil/km <sup>3</sup> /km <sup>2</sup> (0.1-1.0 m <sup>3</sup> /km <sup>2</sup> )

**CLEAN BELOW?** – tick to confirm that there is no oil below the bottom boundary of the Oiled zone. If there is another lower band of oil, describe it in the next row.

**SEDIMENT TYPES** – the sediment codes described in Section 3.1.1 are also applicable for Box 7. The code letters can be combined as appropriate:

## 3.2 REFERENCES

- MCA 2001a. *Maritime Pollution Response in the UK. The Environment Group. STOp Notice 1/2001.* The Maritime & Coastguard Agency, Southampton. 39pp. [\[MCA web page\]](#)
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- MCA 2006a. *National Contingency Plan for Marine Pollution from Shipping and Offshore Installations.* The Maritime & Coastguard Agency, Southampton. 127pp. [\[MCA web page\]](#)
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- Moore, J.J., Hill, A.S. & Sanderson, W.G. 2005. *Development of CCW Impact Assessment Response Framework for a Marine Oil Pollution Incident.* Bangor, CCW Marine Monitoring Report No: 20. Prepared for CCW by Coastal Assessment, Liaison & Monitoring, Cosheston, Pembrokeshire.
- Moore, J. 2007. *Net Environmental Benefit Analysis: Guidance for oil spill response on shorelines in West Wales.* Prepared for CCW by CALM, Cosheston, Pembrokeshire.
- Owens, E.H. and Sergy, G.A., 2000. *The SCAT Manual - A Field Guide to the Documentation and Description of Oiled Shorelines* (2<sup>nd</sup> Edition). Environment Canada, Edmonton AB
- Owens, E.H. and Sergy, G.A. 2004. *The Arctic SCAT Manual: A Field Guide to the Documentation of Oiled Shorelines in Arctic Environments.* Environment Canada, Edmonton, AB, Canada.
- Sergy, G.A. and E.H Owens. 2007. *Guidelines for the Selection of Shoreline Treatment Endpoints for Oil Spill Response.* Emergencies Science and Technology Division, Environment Canada, Ottawa, ON, Canada. 27pp.

### 3.3 CONVERSIONS

#### Length

1 centimetre	=	0.394 inches
1 inch	=	2.54 cm
1 foot	=	0.3048 metres
1 kilometre	=	0.6214 statute miles
1 kilometre	=	0.5399 nautical miles
1 metre	=	3.281 feet
1 nautical mile	=	6076 feet
1 nautical mile	=	1.852 kilometres
1 nautical mile	=	1.1508 statute miles
1 statute mile	=	1.609 kilometres

#### Area

1 acre	=	43,560 feet <sup>2</sup>
1 acre	=	0.4047 hectares
1 hectare	=	2.471 acres
1 hectare	=	10,000 metres <sup>2</sup>
1 square kilometre	=	0.3861 miles <sup>2</sup>
1 square mile	=	640 acres
1 square mile	=	2.60 kilometres <sup>2</sup>
1 square nautical mile	=	848.8 acres
1 square nautical mile	=	1.326 statute miles <sup>2</sup>

#### Speed

1 knot	=	0.514 cm/second
1 knot	=	1.688 feet/second
1 knot	=	1.15 statute (st.) miles/hour
1 st. mile/hour	=	0.869 knots
1 st. mile/hour	=	0.45 metres/second
1 metre/second	=	1.95 knots
1 metre/second	=	3.28 feet/second
1 metre/second	=	2.24 st. miles/hour

**Volume**

1 barrel (U.K.)	=	35 Imperial gallons (approximate)
1 barrel (U.S.)	=	42 US gallons (approximate)
1 barrel (U.S.)	=	5.6 feet <sup>3</sup> (approximate)
1 barrel (U.S.)	=	159 litres (approximate)
1 barrel (U.S.)	=	0.16 metres <sup>3</sup> (approximate)
1 cubic foot	=	6.2288 Imperial gallons
1 cubic foot	=	7.4805 US gallons
1 cubic foot	=	0.1781 US barrel
1 cubic foot	=	28.316 litres
1 cubic foot	=	0.02832 metres <sup>3</sup>
1 cubic inch	=	16.39 centimetres <sup>3</sup>
1 litre	=	0.22 Imperial gallons
1 litre	=	0.2642 US gallons
1 litre	=	0.00629 US barrels
1 litre	=	0.03532 feet <sup>3</sup>
1 litre	=	1000 centimetres <sup>3</sup>
1000 litres	=	1 metre <sup>3</sup>
1 cubic metre	=	220.0 Imperial gallons
1 cubic metre	=	264.172 US gallons
1 cubic metre	=	6.289 US barrel
1 cubic metre	=	35.31 feet <sup>3</sup>
1 cubic metre	=	1000 litres
1 Imperial gallon	=	1.2009 US gallons
1 Imperial gallon	=	0.02859 US barrels
1 Imperial gallon	=	0.1605 feet <sup>3</sup>
1 Imperial gallon	=	4.546 litres
1 millilitre	=	1 centimetre <sup>3</sup>
1 US gallon	=	0.83268 Imperial gallons
1 US gallon	=	0.02381 US barrel
1 US gallon	=	0.13368 feet <sup>3</sup>
1 US gallon	=	3.7853 litres