Santos

Archer 3D Marine Seismic Survey Oil Pollution Emergency Plan

PROJECT / FACILITY	Archer 3D Marine Seismic Survey
REVIEW INTERVAL (MONTHS)	No Review Required
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Rev	Owner	Reviewer/s *Managerial/Technical/Site*	Approver
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Perth IMT room (100 SGT)		● x 4
Perth CST room (100 SGT)		●
AMOSC	●	
OSRL	●	
DoT	●	
AMSA	●	

REV No	DATE	REVISION
0	13/11/20	Submitted for public comment and NOPSEMA assessment

How to use this OPEP in the event of a spill

Sections 1 to 3 contain general information only:

- **Activity description and location**
- **OPEP requirements**
- **Spill Response Levels**
- **Spill Response Framework (Control Agencies and Jurisdictional Authorities),**
- **Santos WA Incident Management Structure**
- **Integration with other Organisations**
- **Identified spill risks**
- **Spill modelling and Protection Priorities**

Sections 4 to 16 contain directions on how to respond to the spill:

- **Initial Response (First Strike Activation)**
- **Notifications and Reporting**
- **Response Option Selection - IAP planning and NEBA**
- **Spill Response Plans:**
  - **Source Control Plan**
  - **Monitor and Evaluate Plan**
  - **Mechanical Dispersion Plan**
  - **Shoreline Protection Plan**
  - **Shoreline Clean-up Plan**
  - **Oiled Wildlife Response Plan**
  - **Waste Management Plan**
  - **Scientific Monitoring Plan**
  - **Forward Operations Plan**
  - **Spill Response Termination**

Sections 17 to 20 contain general information:

- **Performance outcomes, standards and measurement criteria**
- **Training and exercise requirements**
- **Stakeholder Engagement**
- **Maintenance of the OPEP and response capability**

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Acronyms and Abbreviations

Name	Description
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
AMOSC	Australian Marine Oil Spill Centre
ALARP	As low as reasonably practicable
ATV	All-terrain vehicle
CST	Crisis Support Team
CSR	Company Site Representative
CWTS	Controlled waste tracking system
DoT	Department of Transport
DBCA	Department of Biodiversity, Conservation and Attractions
DMIRS	Department of Mines, Industry Regulation and Safety
DWER	Department of Water and Environmental Regulation
EAP	Employee Assistance Program
ESC	Environmental Scientific Coordinator
ETL	Environmental Team Leader
FOB	Forward Operating Base
GPA	Government and Public Affairs
GIS	Geographic Information System
GRN	Global Response Network
HMA	Hazard Management Agency
HR	Human Resources
HDPE	High Density Polyethylene
IMT	Incident Management Team
ICMM	Incident Command and Management Manual
IRT	Incident Response Team
IRP	Incident Response Plan
ICC	Incident Command Centre

Name	Description
IC	Incident Commander
ITOPF	International Tanker Owners Pollution Federation
IAP	Incident Action Plan
IR	Incident Response
JV	Joint Venture
JSCC	Joint Strategic Coordination Committee
LEL	Lower Explosive Limit
MARPOL	International Convention for the Prevention of Pollution from Ships
MCT	Monitoring Coordination Team
MEE	Maritime Environmental Emergencies
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MoU	Memorandum of Understanding
MSP	Monitoring Service Providers
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NATPLAN	National Plan for Maritime Environmental Emergencies
NOK	Next of Kin
NEBA	Net Environmental Benefit Analysis
NWA	North West Alliance
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OPEP	Oil Pollution Emergency Plan
OSCP	Oil Spill Contingency Plan
OSRL	Oil Spill Response Limited
OWRP	Oiled Wildlife Response Plan
OASG	Operational Area Support Group
POB	Persons on Board
PPE	Personal Protective Equipment
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SMEEC	State Maritime Environmental Emergency Coordinator

Name	Description
SOPEP	Shipboard Oil Pollution Emergency Plan
SIMA	Spill Impact Mitigation Assessment
SITREP	Marine Pollution Situation Report
SMP	Scientific Monitoring Plan
TRP	Technical Response Plan
UHF	Ultra High Frequency
WA	Western Australia
WMA	Web Map Application
WSP	Waste Service Provider
WAOWRP	Western Australian Oiled Wildlife Response Plan

1. Oil Pollution Emergency Plan Overview

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Archer 3D Seismic Survey (MSS) Environment Plan (EP), as required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations).

1.1 Summary of Proposed Activity

Santos WA Northwest Pty Ltd (Santos WA) plan to conduct marine seismic survey activities in the Bedout Sub-basin within permit areas WA-437-P and WA-541-P, and surrounding waters. The seismic survey vessel will tow a seismic source array and a series of streamers across the survey area. The survey is estimated to take up to approximately 43 days to complete in total. Santos WA intends to acquire the full survey in 2021 or 2022, within a window between 1 February and 31 July.

The operational area is located entirely within Commonwealth waters, in water depths between approximately 63 m and 106 m, and 49 km from the nearest land (Bedout Island). The operational area is 87 km from the nearest mainland coastline (Larrey Point, near the De Grey rivermouth) and 102 km from Port Hedland.

1.2 Purpose and Scope of this OPEP

The OPEP is an operational document and contains all information necessary for Santos WA to carry out a response to an emergency oil spill arising from the Activity.

This OPEP has been developed to meet all relevant requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations). It is consistent with the National and State (WA) systems for oil pollution preparedness and response, being the National Plan for Maritime Environmental Emergencies (NatPlan) managed by the Australian Maritime Safety Authority (AMSA) and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE).

1.3 High Level Objective of OPEP

The overall aim of this OPEP is to prevent long term significant environmental impacts by safely limiting the adverse environmental effects from an unplanned release of hydrocarbons to the marine environment to a level that is as low as reasonably practicable (ALARP).

The objectives of this OPEP are to:

+ Provide guidance to the IMT in relation to spill response implementation; and
+ To demonstrate the capability requirements for response activities.

2. Oil Spill Response Framework

2.1 Spill Response Levels

Santos WA uses a tiered system of incident response consistent with State and National incident response plans including the State Hazard Plan: Maritime Environmental Emergencies (SHP-MEE) and the National Plan for Maritime Environmental Emergencies (NatPlan). Spill Response Levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos WA Incident Command and Management Manual (SO-00-ZF-00025) and further detailed in **Table 2-1** below for hydrocarbon spills.

Table 2-1: Santos WA oil spill response levels

Level 1	
An incident which will not have an adverse effect on the public or the environment which can be controlled by the use of resources normally available onsite without the need to mobilise the Santos WA Incident Management Team (IMT) or other external assistance.	
Spill is contained within the incident site. Spill occurs within immediate site proximity. Discharge in excess of permitted oil in water (OIW) content (15 ppm). Incident can be managed by the Incident Response Team (IRT) and its resources.	Source of spill has been contained. Oil is evaporating quickly and no danger of explosive vapours. Spill likely to naturally dissipate. No media interest/not have an adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or **An incident that can be controlled onsite but which may have an adverse effect on the public or the environment.**	
Danger of fire or explosion. Possible continuous release. Concentrated oil accumulating in close proximity to the site or vessel. Potential to impact other installations.	Level-1 resources overwhelmed, requiring additional regional resources. Potential impact to sensitive areas and/or local communities. Local/national media attention/may adversely affect the public or the environment.
Level 3 (*not anticipated for this Activity*)	
An incident which has a wide-ranging impact on Santos WA and may require the mobilisation of external state, national or international resources to bring the situation under control.	
Loss of well integrity. Actual or potentially serious threat to life, property, industry. Major spill beyond site vicinity. Significant shoreline environmental impact. Significant shoreline environmental impact.	Level-2 resources overwhelmed, requiring international assistance. Level-3 resources to be mobilised. Significant impact on local communities. International media attention.

2.2 Jurisdictional Authorities and Controlling Agencies

During a spill response there will be both a Jurisdictional Authority and a Control Agency assigned to the oil spill incident for all Spill Response Levels. The Jurisdictional Authority is the relevant Statutory Authority that has responsibilities for oil pollution in that jurisdiction. The Control Agency is the agency or company assigned by legislation, administrative arrangements or within the relevant contingency plan to control response activities to an oil pollution emergency (**Table 2-2**).

Table 2-2: Jurisdictional Authorities and Control Agencies for oil spill response

Role	Spill Level	State Waters		Commonwealth waters	
		Facility	Vessel not classed as a Facility	Facility	Vessel not classed as a Facility
Control Agency	1	Petroleum Titleholder (Santos WA)	DoT	Petroleum Titleholder (Santos WA)	AMSA
	2/3	DoT	DoT	Petroleum Titleholder (Santos WA)	AMSA
Jurisdictional Authority	1/2/3	DoT	DoT	NOPSEMA	AMSA

The proposed Activity is located entirely in Commonwealth waters. The spill scenarios covered by this OPEP are from vessels. Santos WA proposes to conduct the survey using a suitable survey vessel that will have all necessary certifications and will be fully compliant with all relevant MARPOL and SOLAS convention requirements for vessels of this size and purpose.

During the survey, a seismic survey vessel will tow a seismic source array and a series of streamers across the survey area. Up to two support vessels will accompany the seismic vessel to provide logistical, safety and equipment management duties. The seismic vessel will have an onboard workboat, which may be launched to carry out streamer maintenance activities.

Vessels involved in the Activity are not considered to be a Facility under the OPGGS Act 2006 definitions and given that their operations are governed by the *Navigation Act 2012*, the relevant Jurisdictional Authority and Control Agency for the response in Commonwealth waters is AMSA. For any Level 2/3 spills reaching State waters the relevant Jurisdictional Authority and Control Agency for the response in State waters is DoT, regardless of the source of the spill.

2.2.1 Response to Vessel spills in Commonwealth Waters

For a vessel incident originating in Commonwealth waters, the Jurisdictional Authority and Control Agency is AMSA. AMSA is the national shipping and maritime industry regulator and was established under the *Australian Maritime Safety Authority Act 1990*. AMSA manages the NatPlan on behalf of the Australian Government, working with State and the Northern Territory governments, emergency services and private industry to maximise Australia's marine pollution response capability.

As with non-vessel spills, Santos WA is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within Commonwealth waters under *OPGGS Act 2006* and OPGGS (E) Regulations.

Santos WA will be responsible for coordinating a first-strike response to a vessel based spill in Commonwealth waters until such time as AMSA takes over the role as Control Agency, at which time Santos WA would provide all available resources as a Supporting Agency.

2.2.2 Cross-Jurisdictional Vessel Spills

For a large vessel spill (Level 2/3) that crosses Jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities exist (AMSA for Commonwealth waters and DoT for State waters). Control Agency responsibilities will be determined by DoT and AMSA, with Santos WA providing all necessary resources (including personnel and equipment) as a Supporting Agency.

2.3 Santos WA Incident Management Structure

The Santos WA Incident Management Team (IMT) (Perth), Crisis Support Team (CST) (Perth) and Crisis Management Team (CMT) (Adelaide) will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. As outlined above, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos WA response structure to a major emergency incident is detailed in the Incident Command and Management Manual (ICMM) (SO-00-ZF-00025). The ICMM describe response planning and incident management that would operate under emergency conditions – describing how the Santos WA IMT operates and interfaces with the CST and external parties.

The first priority when escalating from a Level 1 spill response to a Level 2/3 spill response is the formation of an IMT establishment of an Incident Command Centre (ICC). The ongoing involvement of the IMT, CST and CMT will be dependent on the severity and type of spill and the obligations of Santos WA and other agencies/authorities in the coordinated spill response.

Santos WA's incident response structure includes:

- Facility-based Incident Response Team (IRT);
- IMT – Perth based to coordinate and execute responses to an oil spill incident;
- CST and CMT - to coordinate and manage threats to the company's reputation and to handle Santos WA's corporate requirements as an operator; and
- Other field-based operational oil spill response and monitoring teams.

The Santos WA incident response organisational structure is defined in the Incident Command and Management Manual (SO-00-ZF-00025), and in **Figure 2-1** for reference.

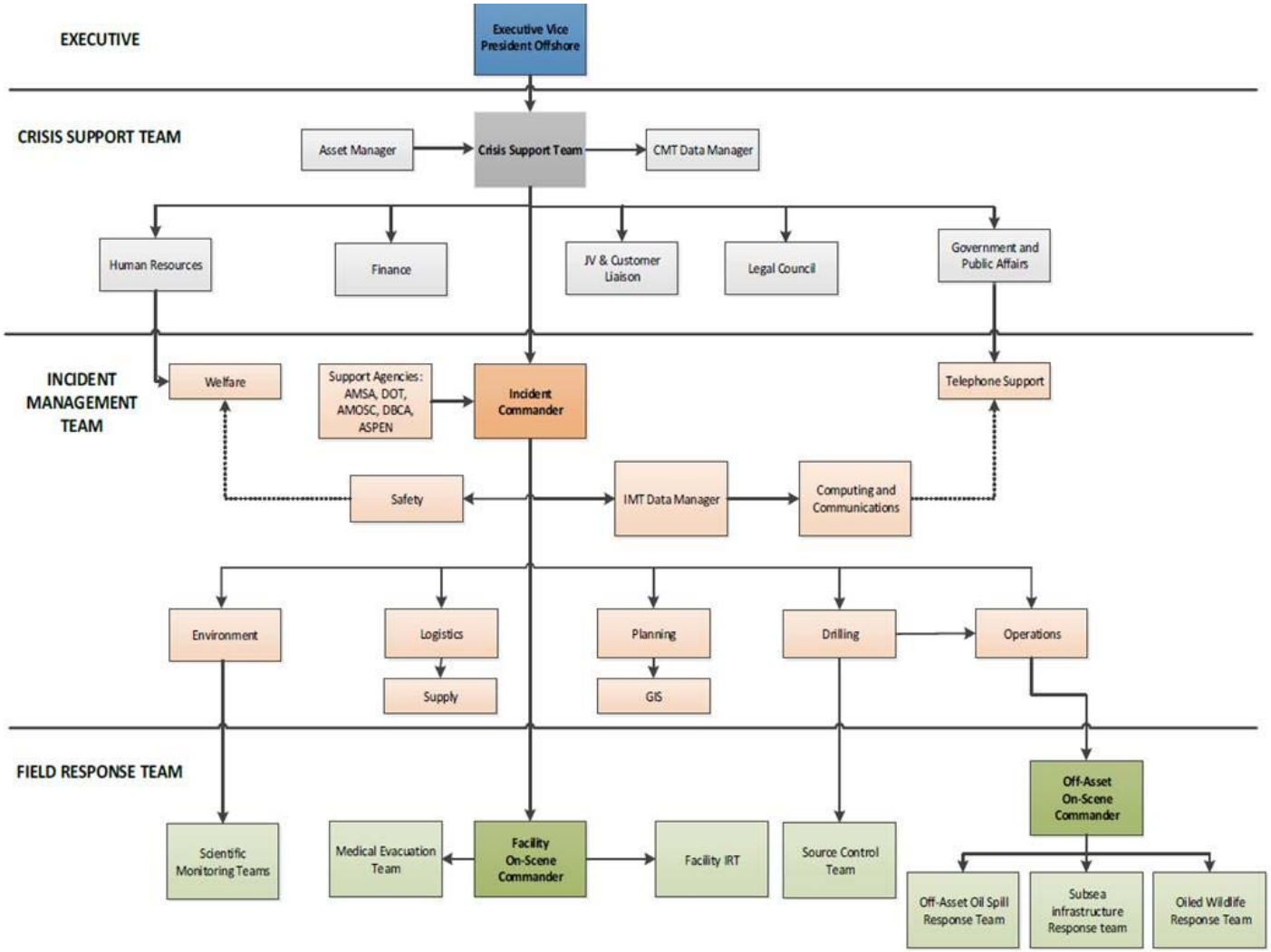


Figure 2-1: Santos WA Incident Response Organisational Structure

Note: *For a Level 2/3 Petroleum Activity spill whereby DoT is involved as a Control Agency, i.e. cross-jurisdictional (spills from Commonwealth to State waters), Santos WA will work in partnership with the DoT in providing spill response capability. Santos WA's expanded organisational structure for these situations is detailed in* ***Section 2.3.1****.*

2.3.1 Roles and Responsibilities

Table 2-3 to **Table 2-7** below provide an overview of the responsibilities of Santos WA CST, IMT, and Field-based response team members in responding to an incident.

Also provided are the roles and responsibilities of Santos WA personnel required to work within DoT's organisational structure, where DoT has responsibilities for spill response as a Control Agency, as per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020).

DoT will provide two roles to the Santos WA CST/IMT in a coordinated response. These are also outlined for reference.

Table 2-3: Roles and Responsibilities in the Crisis Support Team (CST)

CST Member	Main Responsibilities
CST Leader	Notify Santos WA Crisis Duty Manager Provide incident briefing and ongoing updates to CMT Identify reputational issues and relevant local stakeholders Set objectives and tasks for CST functional roles
Legal Counsel	Advise CST Leader on on-going legal aspects Manage insurance issues Liaise with CMT Legal & Insurance
Government Relations/Media Advisor	Liaise with Santos WA CMT GPA Team with respect to overall media strategy Liaise with State government agencies and other local stakeholders Manage messaging to Santos WA employees Activate Santos WA external call centre arrangements Manage release of communications briefs to the external call centre
Joint Venture (JV) Coordinator / Customer Liaison	Manage all communication between Santos WA and JV partners/ customers Liaise with the GPA to ensure consistent message with JVs and Customers
Finance	Track costs and advise CMT Finance and JV Partners of financial commitments in the response Liaise with CMT Finance Team with respect to access to funds
Human Resource Team Leader	Liaise with CMT HR Team Keep CST updated of personnel activities Validate media and holding statements releasable information with regards to Santos WA personnel matters Work with CST Public Affairs on content of internal statements to staff Put EAP on alert if appropriate Work with Police welfare person or doctors as required Be prepared to accompany police to provide initial company support Arrange Next of Kin (NOK) notifications for affected personnel (excluding Police managed fatalities) Determine NOK assistance required i.e. family travel to hospital, child support, etc. Arrange for dedicated management support for families and next-of-kin, if appropriate Arrange EAP counselling at airports and homes where required – HR personnel to attend where possible
CST Data Manager	Ensure CST Centre resources are in place and functional Distribute manuals, contact lists and supporting information to CST personnel Records and collects all information associated with the response to the incident Maintain filing system for Incident Response

Table 2-4: Roles and Responsibilities in the Incident Management Team (IMT)

IMT Member	Main Responsibilities
Incident Commander	• Coordinate all support in accordance with the IRP and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan • Set the response objectives and strategic direction • Oversee the development and implementation of Incident Action Plans • Oversee implementation of MoUs and contracted support for 'mutual aid' • Ensure co-ordination with external organisations/police, etc. • Prepare and review strategic and tactical objectives with the CST • Liaise with the CST and provide factual information • Set response termination criteria in consultation with regulatory authorities
Planning Team Leader	• Collect and document situational awareness information of the incident • Develop, document, communicate and implement Incident Action Plans to achieve incident objectives • Determine the status of action/s or planned activities under the Incident Action Plans and assess and document performance against the objectives. • Assess long term consequences of incident and plan for long term recovery • Manage the GIS Team in a response
Operations Team Leader	• Coordinate operational aspects of Incident Response • Provide the key contact for On-Scene Commanders • Liaise with contractors or third parties • Mobilise additional Santos WA staff and external experts to form Technical Support Team • Assist Planning Team Leader with overall general plan preparation and preparation of Incident Action Plans • Implement Incident Action Plans • Manage field response teams and activities
Logistics Team Leader	• Mobilise response equipment, helicopters, vessels, supplies and personnel • Provide transport and accommodation for evacuated personnel • Oversee the implementation of the Waste Management Plan throughout a Tier 2 or Tier 3 oil spill response. • Liaise with the Supply Team to activate supply contracts and arrange procurements • Coordinate authorities for search and rescue
Supply Team Leader	• Arrange fast track procurement • Activate supply contracts as required • Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident
Environmental Team Leader	• Manage notification to Designated Environmental Authorities and liaise as required • Assist in the development of Incident Action Plans • Advise on the Net Environmental Benefit Analysis of oil spill response strategies and tactics • Oversee the implementation of scientific monitoring programs in an oil spill response • Provide liaison for implementation of the WA Oiled Wildlife Response Plan in an oil spill response

IMT Member	Main Responsibilities
Welfare Team Leader	• Obtain personnel status involved in the incident • Review POB lists and clarify accuracy through Safety Team Leader • Obtain list of Contractor Companies involved in the incident and obtain 3rd-Party Contractor contact to advise of situation and safety of personnel when appropriate • Liaise with 3rd-Party Contractor contact regarding their personnel and organise handover • Obtain employee's emergency contact list (NOK) to advise of situation and safety of personnel when appropriate • Take instructions from the CST HR Team Leader • Work with Logistics Team Leader to arrange transport for affected families to hospitals etc. • Assist with arrangements through EAP to support families/employees
Safety Team Leader	• Manage notification to Designated Safety Authorities and liaise as required • Assist in the development of Incident Action Plans • Oversee the development and implementation of incident Safety Management Plans as required. • Work with the Welfare Team Leader to support personnel safety
Computing and Communications Leader	• Set up computing and communications in the IMT and CST Centres • Establish video monitoring between IMT and CST • Set up the incident response telephone room upon request
IMT Data Manager	• Ensure IMT resources are in place and functional in the ICC • Oversee the setting up of communications systems by the Computing and Communications Leader • Distribute manuals, contact lists and supporting information to IMT personnel • Record and collect all information associated with the response to the incident • Maintain filing system for Incident Response
GIS Support	• Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database'. • Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database'. • Manage and keep up-to-date marine maps in the 'GIS in IMT Database'. • Provide IMT with quick access to up-to-date drawings and data sets in the ICC. • Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps.

Table 2-5: Key Field Based Roles and Responsibilities

Field-Based Position	Main Responsibilities
Off-Asset On-Scene Commander	• Coordinates the field response as outlined in the Incident Action Plan developed by the IMT • Commands a Forward Operating Base (FOB) for the coordination of resources mobilised to site
Off-Asset Oil Spill Response Team	• Undertake oil spill response activities as defined in Incident Action Plans and Oil Pollution Emergency Plans.
Oiled Wildlife Response Team	• Respond to oiled wildlife incidents to minimise the impacts to wildlife • Refer to the Western Australia Oiled Wildlife Response Plan for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team
Scientific Monitoring Teams	• Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions • Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities

Table 2-6: Santos WA Personnel Roles Embedded within the State Maritime Environmental Emergency Coordination Centre (MEECC) / Department of Transport (DoT) IMT

Santos WA Personnel roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
CST Liaison Officer	• Provide a direct liaison between the Santos WA CST and the State Maritime Environmental Emergency Coordination Centre (MEECC) • Facilitate effective communications and coordination between the Santos WA CST Commander and the State Maritime Environmental Emergency Coordinator (SMEEC) • Offer advice to SMEEC on matters pertaining to Santos WA crisis management policies and procedures
Deputy Incident Controller	• Provide a direct liaison between the DoT IMT and the Santos WA IMT • Facilitate effective communications and coordination between the Santos WA Incident Commander and the DoT Incident Controller • Offer advice to the DoT Incident Controller on matters pertaining to the Santos WA incident response policies and procedures • Offer advice to the Safety Coordinator on matters pertaining to Santos WA safety policies and procedures particularly as they relate to Santos WA employees or contractors operating under the control of the DoT IMT
Deputy Intelligence Officer	• As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness • Facilitate the provision of relevant modelling and predictions from the Santos WA IMT • Assist in the interpretation of modelling and predictions originating from the Santos WA IMT • Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the Santos WA IMT • Facilitate the provision of relevant mapping from the Santos WA IMT • Assist in the interpretation of mapping originating from the Santos WA IMT • Facilitate the provision of relevant mapping originating from the DoT IMT to the Santos WA IMT
Deputy Planning Officer	• As part of the Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans • Facilitate the provision of relevant IAP and sub plans from the Santos WA IMT

Santos WA Personnel roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
	• Assist in the interpretation of the Santos WA OPEP • Assist in the interpretation of the Santos WA IAP and sub plans from the Santos WA IMT • Facilitate the provision of relevant IAP and sub plans originating from the DoT IMT to the Santos WA IMT • Assist in the interpretation of Santos WA's existing resource plans • Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the Santos WA IMT (Note this individual must have intimate knowledge of the relevant Santos WA OPEP and planning processes)
Environmental Support Officer	• As part of the Planning Team, assist the Environmental Officer in the performance of their duties in relation to the provision of environmental support into the planning process • Assist in the interpretation of the Santos WA OPEP and relevant Tactical Response Plans (TRP) plans • Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos WA IMT • Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos WA IMT
Deputy Public Information Officer	• As part of the Public Information Team, provide a direct liaison between the Santos WA Media team and DoT IMT Media team • Facilitate effective communications and coordination between Santos WA and DoT media teams • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information & Warnings team • Offer advice to the DoT Media Coordinator on matters pertaining to Santos WA media policies and procedures • Facilitate effective communications and coordination between Santos WA and DoT Community Liaison teams • Assist in the conduct of joint community briefings and events • Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos WA community liaison policies and procedures • Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the Santos WA IMT
Deputy Logistics Officer	• As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort • Facilitate the acquisition of appropriate supplies through Santos WA's existing Oil Spill Response Limited (OSRL), Australian Marine Oil Spill Centre (AMOSC) and private contract arrangements • Collects Request Forms from DoT to action via the Santos WA IMT (Note this individual must have intimate knowledge of the relevant Santos WA logistics processes and contracts)
Deputy Finance Officer	• As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Santos WA's existing OSRL, AMOSC and private contract arrangements • Facilitate the communication of financial monitoring information to the Santos WA to allow them to track the overall cost of the response

Santos WA Personnel roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
	• Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to Santos WA
Deputy Operations Officer	• As part of the Operations Team, assist the Operations Officer in the performance of their duties in relation to the implementation and management of operational activities undertaken to resolve an incident • Facilitate effective communications and coordination between Santos WA Operations Section and the DoT Operations Section • Offer advice to the DoT Operations Officer on matters pertaining to Santos WA incident response procedures and requirements • Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of Santos WA and DoT response efforts.
Deputy Waste Management Coordinator	• As part of the Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters • Facilitate the disposal of waste through the Santos WA existing private contract arrangements related to waste management and in line with legislative and regulatory requirements • Collects Waste Collection Request Forms from DoT to action via Santos WA IMT.
Deputy Division Commander	• As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between the Santos WA FOB and DoT FOB. • Facilitate effective communications and coordination between the Santos WA Division Commander and the DoT Division Commander. • Offer advice to the DoT Division Commander on matters pertaining to Santos WA incident response policies and procedures. • Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to Santos WA employees or contractors. • Offer advice to the Safety Coordinator deployed in the FOB on matters pertaining to Santos WA safety policies and procedures.

Table 2-7: DoT Roles Embedded within Santos WA's CST/IMT and Responsibilities

DoT roles embedded within Santos WA's CST/IMT	Main Responsibilities
DoT Liaison Officer (prior to DoT assuming Controlling Agency) / Deputy Incident Controller – State waters (after DoT assumes Controlling Agency)	• Provide a direct liaison between the Santos WA CST and the MEECC • Facilitate effective communications between DoT's SMEEC and the Incident Controller and Santos WA's appointed CST Commander and Incident Controller • Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters • Assist in the provision of support from DoT to Santos WA • Facilitate the provision of technical advice from DoT to Santos WA's Incident Controller as required

DoT roles embedded within Santos WA's CST/IMT	Main Responsibilities
Media Liaison Officer	• Provide a direct liaison between the Santos WA Media team and DoT IMT Media team • Facilitate effective communications and coordination between the Santos WA and DoT media teams • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information & Warnings team • Offer advice to the Santos WA Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures

2.3.2 Incident Response Authority

During the course of the incident, team members may be required to make technical and financial decisions that exceed those levels set for normal operations.

The IMT Leader has full technical authority to request all Santos WA and contracted resources deemed necessary to manage the incident, and to call in additional resources if required.

The IMT Leader is to request the CST Leader to obtain authority from the CMT for financial commitments to respond to the incident consistent with the level of authorisation required for normal operations.

2.4 Integration with Other Organisations

2.4.1 Australian Marine Oil Spill Centre (AMOSC)

Santos WA is a Participating Company of AMOSC and as such, has access to AMOSC's Level 2 and 3 resources as outlined in the AMOSPlan.

Response equipment and personnel are allocated on a first-come-first-served basis, with the intent, under best efforts, to address any short-fall through AMOSC's affiliation with UK-based oil spill response company, Oil Spill Response Limited (OSRL), of which Santos WA is a direct subscriber. Further support can be gained through OSRL to the Global Response Network (GRN).

AMOSC has contracts with all its member companies to enable the release of Core Group personnel to be made available for any Santos WA requirements as soon as possible, as outlined in Santos WA's *Master Service Contract* and *Principle and Agency Agreement* with AMOSC.

The mutual aid arrangements that AMOSC operates under are collaborated under the AMOSPlan. This provides the mechanism for members of AMOSC to access oil spill response capability of other members. To further enhance the mutual aid arrangements, Santos WA, BHPB and Woodside have signed a Memorandum of Understanding (MoU) that defines the group's mutual aid arrangements. Under this MoU, Santos WA, BHPB and Woodside have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

2.4.2 Australian Maritime Safety Authority (AMSA)

The Australian Maritime Safety Authority (AMSA) is the designated Combat Agency for oil spills from vessels within Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond in accordance with AMSA's Marine Pollution Response Plan. AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-source incidents. AMSA is to be notified immediately of all ship-sourced incidents through the Rescue Coordination Centre (RCC) Australia.

A Memorandum of Understanding (MoU) has been established between Santos WA and AMSA, outlining respective roles and responsibilities when responding to vessel-sourced marine pollution incidents and petroleum activity related marine pollution incidents.

AMSA manages the National Plan for Maritime Environmental Emergencies (NatPlan), Australia's key maritime emergency contingency and response plan. All resources under the NatPlan are available to Santos WA through request to AMSA under the arrangements of the MoU.

For any oil pollution event, Santos WA agrees to notify AMSA immediately in the interests of facilitating the most efficient and effective response to the incident.

2.4.3 WA Department of Transport (DoT)

In the event that a Level 2/3 enters, or has potential to enter State waters, the HMA (DoT Marine Safety General Manager or proxy) will take on the role as the State Maritime Environmental Emergency Coordinator (SMEEC) and DoT will take on the role as a Control Agency.

Santos WA will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring). On notification, the HMA will activate their Maritime Environmental Emergency Coordination Centre (MEECC) and the DoT Incident Management Team.

Santos WA will work in coordination with DoT during such instances, as outlined within the DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp). The coordinated response may occur within a single jurisdiction (spill within State waters) or cross-jurisdiction (spill crossing from Commonwealth to State waters).

2.4.3.1 Single Jurisdiction Arrangements

For Level 2/3 spills originating within State waters, DoT will assume control as the Control Agency with the exception of source control activities (for example well intervention and relief well drilling) which will remain under the control of Santos WA's IMT.

The initial first strike response will be undertaken by Santos WA; formal protocols for the transfer of Control Agency responsibility from Santos WA to DoT are outlined within Section 6.4.2 of DoT's Marine Oil Pollution (MOP): Response and Consultation Arrangements.

At the request of the SMEEC, Santos WA will be required to provide all necessary resources, including personnel and equipment, to assist the DoT's IMT in performing duties as the Control Agency for State waters response. This includes providing an initial 11x personnel to work within the DoT IMT located at Marine House, Fremantle, no later than 8 am following the day of the request. It also includes providing 1x personnel to serve in DoT's Forward Operating Base no later than 24 hours following formal request by the SMEEC.

Two DoT personnel will be provided from DoT's command structure into Santos WA's CST/IMT as CST / Media Liaison Officers.

The roles and responsibilities of Santos WA activated personnel working within DoT's command structure and DoT personnel working within Santos WA's command structure are provided in **Section 2.3.1**.

In addition to these incident management roles, Santos WA, at the request of the SMEEC, will be required to provide an appropriate number of operational field personnel to assist with field response activities, such as shoreline protection and clean-up and oiled wildlife response, with the required number determined based on the nature and scale of the spill and response requirements. DoT may also stand-up field response capability through the State Response Team and request National Response Team support.

Any matters of contention between Santos WA and DoT, with respect to the partitioning of resources and responsibilities between IMTs will be referred to the SMEEC for resolution.

2.4.3.2 Cross Jurisdictional Arrangements

For Level 2/3 spills that cross from Commonwealth waters to State waters, both DoT and Santos WA will be Control Agencies until such time that AMSA takes control as the relevant agency for Commonwealth waters vessel spills. Until this time, there will be a Lead IMT (DoT or Santos WA) for each spill response activity, with DoT's control resting primarily for State waters activities.

Appendix 2 within DoT's MOP: Response and Consultation Arrangements provides guidance on the allocation of a Lead IMT to response activities for a cross jurisdictional spill.

To facilitate coordination between DoT and Santos WA during a cross jurisdiction response a Joint Strategic Coordination Committee (JSCC) will be established. The JSCC will be jointly chaired between the SMEEC and a nominated senior representative of Santos WA and will ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests.

As with a single jurisdiction response Santos WA will be responsible for ensuring adequate resources are provided to DoT as Control Agency, including 11x personnel to fill roles in the DoT IMT or FOB (refer **Section**

2.3.1) and operational personnel to assist with those response strategies where DoT is the Lead IMT. **Figure 2-2** shows Santos WA's organisational structure for a Petroleum Activity spill within (single jurisdiction) or entering (cross-jurisdiction) State waters. In both instances, the Santos WA IMT and DoT IMT will provide a coordinated response. While Santos WA will stand up its IMT structure in both single and cross jurisdiction incidents, the scale of operations will likely be lesser for a single jurisdiction response (State waters only) where Santos WA will primarily be controlling Source Control activities.

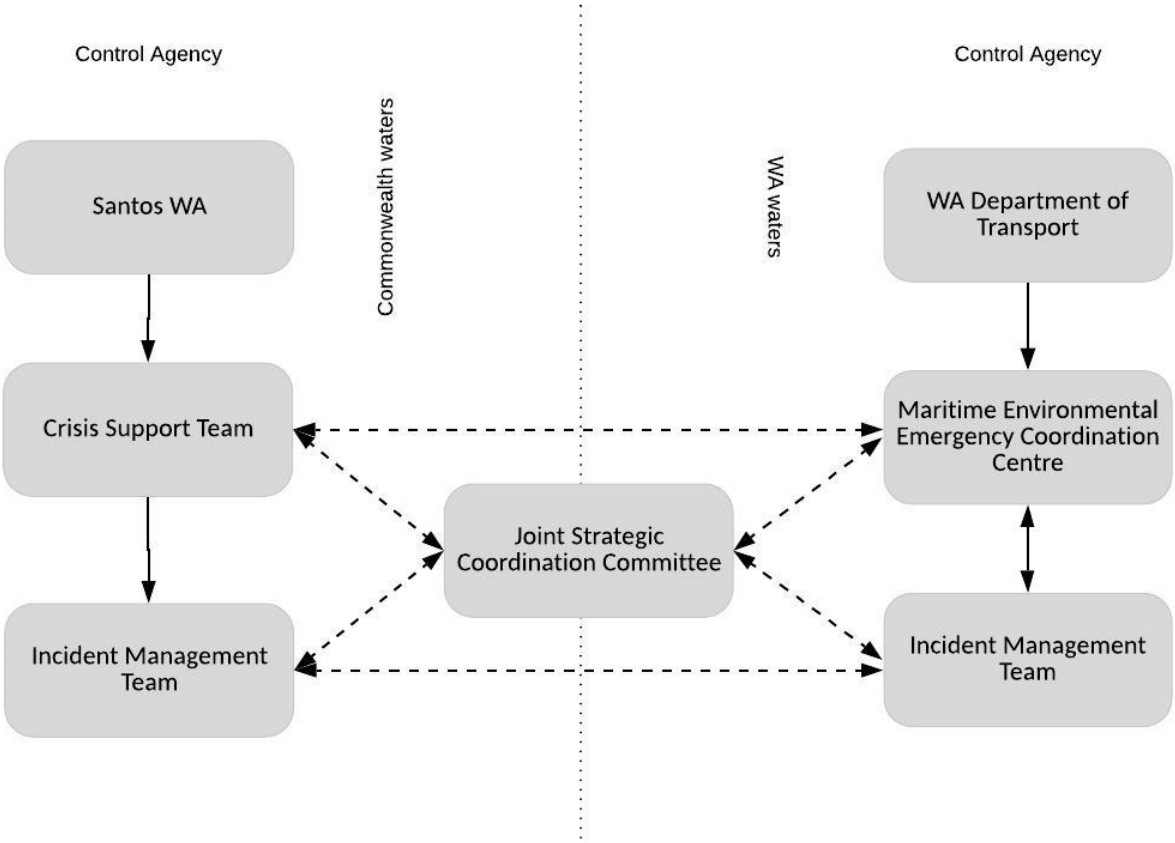


Figure 2-2: Santos WA incident management structure for Level 2/3 marine oil pollution incident within or entering State waters

2.4.4 WA Department of Biodiversity, Conservation and Attractions (DBCA)

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) has responsibilities associated with wildlife and activities in national parks, reserves and State marine parks. The *Wildlife Conservation Act 1950* (WA) is the legislation that provides DBCA with the responsibility and Statutory Authority to treat, protect and destroy wildlife. In State waters, DBCA is the Jurisdictional Authority for Oiled Wildlife Response (OWR), providing advice to the Control Agency (DoT) through an Oiled Wildlife Advisor (OWA). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) and regional sub-plans.

For a Level 2/3 petroleum spill that moves into State waters, DoT will be the Control Agency responsible for overall command of an oiled wildlife response. Santos WA will provide resources (equipment and personnel primarily through AMOSC membership) to DoT to facilitate this response.

For matters relating to environmental sensitivities and scientific advice in State waters, DBCA will provide an Environmental Scientific Coordinator (ESC) to support the State Maritime Environmental Emergency Coordinator and/or DoT Incident Controller.

This may include advice on priorities for environmental protection, appropriateness of proposed response strategies and the planning and coordination of scientific monitoring for impact and recovery assessment.

2.4.5 Oil Spill Response Limited (OSRL)

Through a direct international subscription, Santos WA has access to OSRL based in the UK with offices and equipment at Singapore and at other various locations around the world. In the event of a Level 3 response, Santos WA would access OSRL's international holding of Level 3 equipment and resources. Response equipment and personnel are allocated on a 50% of inventory basis.

OSRL is a member of the Global Response Network (GRN). Any short-fall in the allocation of equipment and resources will be addressed, under best efforts, through the GRN.

2.5 Interface with External Plans

Information from the following external documents have been used or referred to within this Plan:

+ AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - Details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
+ NatPlan - National Plan for Maritime Environmental Emergencies and National Marine Oil Spill Contingency Plan
  - Sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
+ Western Australia State Hazard Plan: Maritime Environmental Emergencies
  - Details the management arrangements for preparation and response to marine oil pollution in State waters.
+ DoT Oil Spill Contingency Plan
  - Defines the steps required for the management of marine oil pollution responses that are the responsibility of the DoT.
  - DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp)
+ Shipboard Oil Pollution Emergency Plans (SOPEP)
  - Under MARPOL Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
+ Western Australia Oiled Wildlife Response Plan (WAOWRP)
  - Defines the steps, personnel, equipment and infrastructure required for the management of wildlife in an oil pollution response. Each region has a Regional Oiled Wildlife Response Plan that gives further details on sensitivities and available resources. Both the Pilbara Region Oiled Wildlife Response Plan and the West Kimberley Region Oiled Wildlife Response Plan are relevant regional plans for OWR associated with worst case spills from Archer 3D MSS activities.
+ Western Australia State Hazard Plan: Hazardous Materials Emergencies (HAZMAT)
  - Details the emergency management arrangements for hazardous materials emergencies throughout the State of Western Australia (including State waters)
+ Oil Spill Response Limited (OSRL) Associate Agreement
  - Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
+ Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

2.6 Interface with Internal Documents

In addition to this OPEP, a number of other Santos WA documents provide guidance and instruction relevant to spill response, including:

- Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062);
- Incident Command & Management Manual (SO-00-ZF-00025);
- Archer 3D Marine Seismic Survey EP (SO-91-RI-20090);
- Incident Response Telephone Directory (SO-00-ZF-00025.2);
- Refuelling and Chemical Management Standard (SO-91-IQ-00098);
- Oil Pollution Waste Management Plan (SO-91-IF-10053);
- Oil Spill Response Health and Safety Manual (SO-91-RF-10016);
- Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
- Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
- Oil Spill Scientific Monitoring Baseline Data Review (SO-00-BI-20001); and
- Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

2.7 Cost Recovery

As required under Section 571(2) of the OPGGS Act 2006, Santos WA has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its Petroleum Activities, including major oil spills. This includes costs incurred by relevant Controlling Agencies (e.g. DoT) and third-party spill response service providers.

3. Identified Spill Risks and Protection Priorities

3.1 Spill Scenarios

Table 3-1 summarises the hydrocarbon spill risks that have been identified for the Archer 3D MSS.

Table 3-1: Hydrocarbon spill risks

Hydrocarbon Type	Source / Cause	Maximum Credible Volume Released (m^3)	Release duration	Spill modelling undertaken?
Hydraulic oil/lubricating fluids	Surface spill –due to handling spills or containment failure in vessel equipment	1 m^3	Instantaneous	No
Diesel (MDO/MGO)	Surface spill – Release from project vessel fuel tank (due to vessel collision)	1,065 m^3	30 minutes	Yes
	Surface spill – release of hydrocarbon during refuelling	37.5 m^3	15 minutes	No

3.2 Hydrocarbon Characteristics and Behaviour

Two types of hydrocarbons may be accidently spilt during the Petroleum Activity, namely marine diesel oil (MDO)/marine gas oil (MGO) and hydraulic lubricating oils.

3.2.1 MDO/MGO

In the marine environment, marine diesel oil will generally:

+ Spread rapidly in the direction of prevailing wind and current;
+ Evaporate rapidly from the sea surface (under calm conditions this will be the dominant process removing oil from the marine environment);
+ The evaporation rate of diesel will increase in warmer air and sea temperatures; and
+ As wind speed increases and breaking waves form, entrainment and dispersion of diesel under the sea surface, and biodegradation processes will increase.

GHD (2020) uses Marine Diesel (IKU) analogue from the SINTEF Oil Weathering Model to inform the hydrocarbon characteristics for the modelling. The characteristics of the Marine Diesel (IKU), selected as the analogue for the MDO/MGO release, are presented in **Table 3-2**. Further description of the selected hydrocarbon analogue can be found in Section 7.1.2 of the EP. Under moderate wind conditions (5 m/s), the initial surface slick is predicted to decrease to 1% after 72 hours (GHD, 2020).

Table 3-2: Characteristics of MDO/MGO

Oil Type	Initial density (g/cm^3) (20°C)	Viscosity (cP) (20°C)	Component	Volatiles (%)	Semi-volatiles (%)	Low Volatility (%)	Residual (%)	Aromatics (%)
			Boiling Points (°C)	<175	175-275	275-375	>375	Of whole oil <380 °C BP
				NON-PERSISTENT			PERSISTENT	
Marine Diesel (IKU) [SINTEF modelling analogue]	0.843	3.9	% of total	3	52	45	0	2.9

3.2.2 Hydraulic and lubricating oils

Hydraulic oils behave similarly to marine diesel when spilt to the marine environment. These are medium oils of light to moderate viscosity. They have a relatively rapid spreading rate and will dissipate quickly in ocean conditions. Similar to diesel, the spill will have a tendency to sit on the surface during calm conditions and will readily entrain during variable winds between 4-19 knots; readily returning to the surface when conditions return to calm. After several days up to 40% could be expected to evaporate and 15% decay (APASA 2013c).

Lubricating oils vary widely but in general are comprised primarily of long-carbon chain, persistent, hydrocarbons (APASA 2013c). These are reasonably viscous and so the spreading rate of a slick of these oils would be slow. These will not readily move into the water column, therefore are likely to remain on the water surface during calm to windy conditions. In the marine environment, approximately 90% residual of the total quantity of lubricating oil spilt is likely to remain after weathering (i.e. <6% due to evaporation and <8% due decay after several days). Lubricating oils also readily combine with sea-water to form a water-in-oil emulsion, taking up as much as 70% by volume as water (APASA 2013c).

3.3 Spill Trajectory Modelling

3.3.1 Stochastic Modelling

To inform the risk assessment process, spill modelling has been conducted to identify the spill trajectory area for the worst-case credible spill scenario:

+ 1,065 m^3 surface MDO/MGO release to the marine environment as a result of a vessel collision resulting in a ruptured fuel tank.

The modelling was performed on a near instantaneous (30 minute) release of 1,065 m^3 of MDO/MGO with 120 stochastic model simulations completed across all seasons at each modelling location. The model simulation period was 4 weeks, allowing sufficient duration for modelled hydrocarbon concentrations to drop below the minimum exposure values. Environmental impact exposure values are addressed in Section 7.1.2.3 of the EP.

Modelling was conducted for three release locations, at the north-eastern, south-eastern and south-western corners of the operational area. The selection of three release locations ensures the modelled spill trajectories determine the potential hydrocarbon oil exposure to environmental sensitivities from the diesel spill within the survey operational area.

In addition to the environmental impact exposure values, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These are shown in **Table 3-3**.

Table 3-3: Hydrocarbon Exposure Values for Response Planning

Oil concentration (g/m^2)	Description
>1	Minimum floating hydrocarbon concentration for initiating some scientific monitoring components (refer to **Section 14**)
>50	Estimated minimum floating hydrocarbon threshold for containment and recovery[1]
>100	Estimated floating hydrocarbon threshold for effective containment and recovery[1] Indicative concentration of shoreline accumulation targeted for shoreline clean-up
>1000	Shoreline accumulation concentration indicative of high clean-up effort

[1] NB: Containment and Recovery is not an applicable spill response strategy under this OPEP

Containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney and Caplis, 2017; NOAA, 2013). McKinney and Caplis (2017) tested the effectiveness of various oil skimmers at different oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was less than 50 g/m^2.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed through the use of spill response strategies) for the allocation and mobilisation of spill response resources, and therefore these are the results presented in this OPEP. **Table 3-4** presents the spill modelling results at Protection Priority locations.

Modelling results for dissolved and entrained oil have not been included given there are limited response strategies that will reduce subsurface impacts. Refer to Section 7.1.2.3 of the Archer 3D MSS EP for further description on selection of impact and operational thresholds.

The nature and scale of a 37.5 m^3 MDO/MGO release during refuelling fits well within the expected impact and extent for the MGO/MDO release associated with a vessel collision**.** Therefore, the sections below present the spill modelling results of the worst-case scenario only (1,065 m^3 of MDO/MGO spill due to a vessel collision).

Sea Surface Hydrocarbons

Surface oiling was assessed at three exposure values representing low exposure (1 g/m^2, visual/aesthetic impacts and minimum floating hydrocarbon concentration for initiating some scientific monitoring components), moderate exposure (10 g/m^2, lower limit for potential ecological impacts), and high exposure (50 g/m^2).

Surface oil above the low exposure value (1 g/m^2) was predicted to extend up to a maximum of approximately 380 km to the west and 230 km to the east from the release locations. The maximum spatial extent for the moderate (10 g/m^2) and high (50 g/m^2) exposure values were predicted to be 380 km to the west and 170 km to the east.

Key receptors predicted to be contacted by surface hydrocarbons above the low exposure value are outlined in **Table 3-4**.

Accumulated Hydrocarbons Ashore

Shoreline oiling was assessed at three contact thresholds representing low exposure (10 g/m^2, visual/aesthetic impacts), moderate exposure (100 g/m^2, generally requiring clean-up effort), and high exposure (1,000 g/m^2, requiring intensive clean-up effort).

Shoreline accumulation above the low exposure value (10 g/m^2) was predicted a maximum of 500 km from the Operational Area (at the Muiron Islands). Shorelines predicted to be receive shoreline oiling above the low exposure value are outlined in **Table 3-4**.

Table 3-4: Worst-case Spill Modelling Results for a Vessel Collision resulting in a Ruptured Fuel Tank (1,065 m^3)

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
North-eastern Release Location								
Clerke Reef Marine Park	NC	NC	8.3	6.3	0.8	7.3	1.9	4.2
Imperieuse Reef Marine Park	NC	NC	5	8.1	NC	NC	NC	NC
Rowley Shoals surrounds	1.7	4.7	NA	NA	NA	NA	NA	NA
Eighty Mile Beach AMP	1.7	5.1	NA	NA	NA	NA	NA	NA
Lacepede Islands	NC	NC	0.8	24.5	NC	NC	NC	NC
South-eastern Release Location								
Bedout Island	0.8	3.7	2.5	7.1	NC	NC	NC	NC
Clerke Reef Marine Park	NC	NC	1.7	7.3	0.8	7.3	2.6	7.1
Imperieuse Reef Marine Park	NC	NC	0.8	15	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Eighty Mile Beach	1.7	7.8	0.8	10.3	0.8	10.3	0.4	1.4
Eighty Mile Beach AMP	3.3	2.7	NA	NA	NA	NA	NA	NA
Broome North Coast	NC	NC	0.8	22.6	NC	NC	NC	NC
South-western Release Location								
Port Hedland-Eighty Mile Beach	3.3	3.8	1.7	4.8	1.7	7.8	31.8	1.4
Karratha-Port Hedland	0.8	7.9	1.7	7.1	1.7	7.1	10.8	7.1
Montebello Islands	NC	NC	8.3	6.3	NC	NC	NC	NC
Montebello AMP	1.7	5.9	NA	NA	NA	NA	NA	NA
Barrow Island	NC	NC	1.7	6.2	NC	NC	NC	NC
Bedout Island	0.8	5.6	1.7	8.6	0.8	8.6	0.3	1.4
Glomar Shoals	2.5	5	NA	NA	NA	NA	NA	NA

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Eighty Mile Beach	0.8	5.7	NC	NC	NC	NC	NC	NC
Eighty Mile Beach AMP	6.7	3.3	NA	NA	NA	NA	NA	NA
Muiron Islands	NC	NC	1.7	16.5	NC	NC	NC	NC
Offshore Ningaloo	0.8	3.3	NA	NA	NA	NA	NA	NA

NC = No Contact

NA = Not Applicable

3.3.2 Deterministic Modelling

In addition to the stochastic modelling, single-trajectory modelling (deterministic) was also undertaken at each release location to provide an example of the EMBA for a single spill and to characterise shoreline loading. The deterministic simulations are therefore representative of single spill events under certain wind and current conditions. The stochastic trajectories selected to run in deterministic mode were those with the largest predicted volume ashore from a single model run across all geographic receptors. The selected simulations from the north-eastern and south-eastern release locations resulted in a predicted accumulated oil mass above the moderate exposure value (100 g/m^2) of 1.9 tonnes and 2.6 tonnes at Clerke Reef Marine Park respectively, arriving after 7.3 days. A release at the south-western spill location resulted in a predicted accumulated oil mass above the moderate exposure value of 32 tonnes at Port Hedland-Eighty Mile Beach and 0.3 tonnes at Bedout Island, arriving after 7.3 days and 8.6 days respectively.

3.4 Identify Protection Priority Areas

Environmental and socio-economic response priorities are hierarchically presented below, from priority 1 to 4, to be consistent with the national framework:

1. Habitat, cultural resources;
2. Rare and/or endangered flora and fauna (including species listed as threatened or migratory);
3. Commercial resources; and
4. Amenities.

These resources would be prioritised in a spill response only after human health and safety needs have been met.

Protection priority areas, based on trajectory spill modelling, together with key sensitivities are included in **Table 3-5** below. Protection priority areas were selected from a subset of the High Environmental Value areas defined in Table 7-9 of the EP that could potentially receive floating oil, or accumulations of oil along shorelines, above the moderate exposure values outlined within Table 7-3 of the EP.

Table 3-5: Protection priority areas and key sensitivities

Protection Priority Area	Key Sensitivities	Relevant Key Periods
Eighty Mile Beach	• Turtle nesting – Flatback turtles nest locations along shoreline • Mangroves, saltmarsh and intertidal flats (RAMSAR wetland) • Coral and other subsea benthic primary producers • Seagrass • Seabird nesting, feeding and breeding area • Humpback whale migration • Migratory shorebirds	• Flatback turtle nesting: Dec-Jan • Birds: Sept-Feb • Humpback whale migration: Jun-Jul
Bedout Island	• Turtle –foraging and resting area for green, loggerhead and hawksbill turtles. • Coral and other subsea benthic primary producers • Seabird nesting*	• Green turtle nesting: Nov- to Apr. Peak period from Jan-Feb • Loggerhead turtle nesting: Dec-Jan • Hawksbill turtle nesting: Oct-Jan • See above
Clerke Reef – Rowley Shoals	• Turtle nesting –particularly hawksbill turtles • Coral and other subsea benthic primary producers • Seabird nesting • Migratory shorebirds • Humpback and pygmy blue whale migration	• Pygmy blue whale migration: Apr-Aug • Coral spawning: Mar-Apr and Oct-Nov • See above
Glomar Shoals	• Coral and other subsea benthic primary producers	• See above
Offshore Ningaloo	• Humpback whale migration	• Whale shark migration: Mar-Sep

	• Whale shark migration	• See above

Further detail on spill modelling conducted and potential impacts to environmental sensitivities from worst-case spill scenarios is presented in Section 7 of the EP.

3.5 Applicable response strategies for this OPEP

Oil spill response strategy applicability has been assessed based on the identified spill risks of the Activity below in **Table 3-6**. Considerations include, hydrocarbon properties (including weathering and characteristics), modelling of the worst-case spill scenarios and identified priorities within the EMBA.

Table 3-6: Summary of applicability of OSR strategies following initial NEBA assessment

OSR strategy	Activity	Acceptability /Applicability	Considerations for NEBA
Source control	Bunded areas around machinery and engines	□	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board the activity vessels. Bunded areas will minimise the volume of hydrocarbons escaping to marine waters.
	Securing cargo / trimming	□	In the event a vessel fuel tank is ruptured, cargo of the affected tank is to be secured via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will minimise the volume of fuel spilt. Specific actions applicable to the vessel for controlling a spill incident are outlined within the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP).
Monitor and evaluate / Surveillance	Aerial, Vessel, Tracking Buoys, Trajectory Modelling, Satellite imagery, WQ monitoring, shoreline and coastal habitat monitoring	□	Operational monitoring is a fundamental aspect of a spill response and used to gain situational awareness of the incident. Monitoring is used to assess the nature and scale of the spill, the current and projected movement of the spill, the physical and chemical properties of the spill over time and the actual and potential contact of the spill with sensitive receptors. Results of Operational Monitoring will be used to assist in escalating or deescalating response strategies as required.
Chemical dispersion	Chemical dispersant application to Enhance the dispersion rates of floating oil into marine waters	**X**	MDO/MGO are not persistent hydrocarbons with weathering modelling suggesting 99% of the MDO/MGO will evaporate and/or disperse within 72 hours (under moderate winds). This has been assessed through spill modelling of conservative worst-case scenarios. Dispersants are not considered effective when applied on thin surface films such as MDO/MGO, as the dispersant droplets tend to pass through the surface films without binding to the hydrocarbon. MDO/MGO slicks will break apart into wind rows with low surface thickness (rainbow and metallic sheens) given the very low viscosity of the hydrocarbon. Chemical dispersants have a window of opportunity, after which effectiveness decreases. This includes a workable area for dispersant application, adequate surface thickness and presence of dispersible components of oil. These characteristics typically exist in the initial hours following a release. Dispersant use is not considered to be effective on the spill scenarios given they are not continuous releases and slick characteristics amenable to dispersant operations will unlikely be present by the time dispersant operations are mobilised.

OSR strategy	Activity	Acceptability /Applicability	Considerations for NEBA
			This reasoning is consistent with ITOPF guidance (ITOPF, 2014) which advises against the use of dispersant on light products such as diesel given the high natural rates of evaporation/dissipation and rapid spreading.
Mechanical Dispersion	Vessel prop-washing	□	Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of mechanical dispersion is to reduce the concentration of oil floating at the surface which could potentially contact receptors at the sea surface (e.g. sea birds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Marine diesel is a light oil that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass ad macroalgae). This is most likely in shallow water of a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave induced entrained so is most beneficial in calm conditions) and the type, proximity and depth (as applicable) of sensitivities in the area. Mechanical dispersion will be considered for petroleum activity sourced spills at the discretion of the On-Scene Commander/IMT or by the relevant Control Agency. It is unlikely that vessels would be specifically allocated for mechanical dispersion but vessels undertaking primary strategies may be used opportunistically.
Containment and recovery	Booms and skimming	**X**	Given the fast spreading nature of diesel (MDO/MGO), and the expected moderate to high sea states of the area causing the slick to break up and disperse naturally, this response is not considered to be effective in reducing the net environmental impacts of a MDO/MGO release. This is consistent with spill response best practice. The ability to contain and recover these spreading oils (i.e. surface sheens) on the sea surface is extremely limited due the very low viscosity of the fuel. Low thickness of oil at sea surface, as shown by spill modelling confirms this.
Nearshore and shoreline protection and deflection	Deflection booms	□	Considered if spill is predicted to impact sensitive shorelines. Floating oil is predicted to contact shorelines > 10 g/m^2. Modelling indicates hydrocarbons may also accumulate on shorelines at concentrations above 10, 100 and 1000 g/m^2 exposure values.
In-situ burning	Controlled burning of released hydrocarbons.	**X**	Meteorological conditions and sea-state must allow the deployment of booms. Surface hydrocarbon would need to be corralled to a sufficient thickness to permit ignition and ongoing combustion. 99% of the hydrocarbon is expected to disperse and evaporate over the first 72 hours under moderate wind. Therefore, the surface hydrocarbons are not expected to be available at sufficient thickness for ignition.
Shoreline clean-up	Physical removal, surf washing, rock flushing,	□	Considered if operational monitoring shows or predicts contact to sensitive shorelines.

OSR strategy	Activity	Acceptability /Applicability	Considerations for NEBA
	bioremediation, natural dispersion		Diesel has low to no persistence in the environment and therefore prolonged loading of shorelines is not expected. Natural remediation and flushing may be preferred to more intrusive clean-up methods given the nature and low persistence of these hydrocarbons.
Oiled wildlife Response	Vessel-based hazing	□	Applicable for marine animals that come close to the spill when on the water. Care to be taken not to drive marine animals into spill or split up the pods, schools, and flocks.
	Capture and rehabilitation	□	Applicable for oiled marine animals. Difficult to do for large marine animals or poisonous animals such as sea snakes, however this response must always be assessed.
Scientific monitoring	Water quality, megafauna, pelagic fishes, etc.	□	The type and extent of scientific monitoring will depend upon the nature and scale of oil contact to sensitive receptor locations as determined through operational monitoring. Pre-defined initiation criteria exist for scientific monitoring plans associated with marine and coastal sensitivities.

4. Initial Response (First Strike Activations)

Initial response to an oil spill incident will be undertaken by the relevant Vessel Master. For vessel oil spill incidents, the Vessel Master will act in accordance with the relevant Shipboard Oil Pollution Emergency Plan (SOPEP) where applicable.

Following those initial actions undertaken by the Vessel Master to ensure the safety of personnel on the vessel, and to control the source of the spill, the Santos WA Company Site Representative will make an assessment of the situation based upon:

- What has caused the spill?
- Is the source under control?
- What type of hydrocarbon has been spilt?
- How much has been spilt?

For spills requiring, or potentially requiring external assistance (i.e. Level 2/3 spills), the Santos WA Company Site Representative notifies the Santos WA Duty Manager (refer **Table 4-1)** who will be responsible for notifying the Santos WA Incident Commander.

Table 4-1: Initial notifications following a spill

Position	Type of communication	Timeframe	To Whom
Santos WA Company Site Representative (CSR)	Verbal	Within 30 minutes of incident having been identified or as soon as additional resources are required	Incident Commander via Duty Manager

4.1.1 Level 1 Vessel Spills

Initial activations for a Level 1 spill are based on a spill incident that will not have an adverse effect on the public or the environment and can be controlled by the use of resources normally available at the vessel without the need to mobilise the IMT or other external assistance. It is considered that onsite response equipment and personnel are sufficient to mitigate the impacts of these spills and that the process is manageable under the relevant SOPEP for on-board incidents, plus the potential deployment of locally available vessels (surveillance/mechanical dispersion) and tracking buoys if required in the immediate area of the vessel (refer **Section 8.3**).

Spills that require this level of response may arise from blown hydraulic hoses, dropped or leaking drums of fuel or lubricant or minor refuelling accidents. The types of Level 1 spill scenarios that might occur during the activities are shown in **Table 4-2**.

While Level 1 spills are classified as those that can be managed with on-scene resources, AMSA, as the relevant Jurisdictional Authority and Control Agency, as well as the Santos WA IMT (Incident Commander), will be notified and kept up to date through situational awareness reporting to allow ease of elevating the level of response.

In the event that AMSA assumes control of the response as Control Agency, Santos WA will act under the direction of AMSA and provide all necessary resources as a Supporting Agency.

Table 4-2: First Strike Activations for Level 1 vessel spills

When	Activation	Who
Immediate	Manage the safety of personnel on the vessel and in operational area.	Vessel Master
Immediate	Control the source using resources available on the vessel as per the SOPEP. Refer **Source Control Plan** – go to **Section 7**	Vessel Master
30 minutes	Notify Incident Commander via Duty Manager	CSR

When	Activation	Who
30 minutes	Make initial notifications Activate the **Notifications Plan** – go to **Section 5.**	Vessel Master CSR Incident Commander (or delegate)
90 minutes	Monitor and evaluate the spill from the available vessels and initiate mobilisation of tracking buoy/s at request of CSR Go to **Section 8**	Vessel Master CSR
Ongoing	Provide updates and incident reporting in accordance with Notifications Plan – go to **Section 5.** Santos WA will act as Control Agency until such time that AMSA assumes the role of Control Agency in which case Santos WA will follow direction of AMSA and provide all necessary onsite resources.	Vessel Master Incident Commander (or delegate)

4.1.2 Level 2 Vessel Spills

Level 2 spills are those that require external assistance and resources to mitigate impacts from the spill and will involve response activation through the Perth-based IMT and CST. The worst-case vessel spill scenarios during the activities fall into this category (**Table 3-1**) which include a vessel refuelling incident and a fuel tank rupture incident.

Santos WA will be responsible for coordinating a first-strike response to a vessel based spill in Commonwealth water including activations as per **Table 4-3,** until such time as AMSA takes over the role as Control Agency in Commonwealth waters and/or or DoT takes over the role as Control Agency in State waters. At this time, Santos WA would provide all available resources as a Supporting Agency.

Table 4-3: First Strike Activations for Level 2 vessel spills response

When	Actions	Who
Immediate	Manage the safety of personnel on the vessel. Implement first-strike source control where possible as per vessel SOPEP.	Vessel Master
Immediate	Continue source control as required Activate the suitable **Source Control Plan** - go to **Section 7**. Control the source using available vessel resources. Refer to the **Source Control Plan** - go to **Section 7**.	Vessel Master
Within 30 minutes	Notify Incident Commander	CSR
As soon as practical	Make initial notifications Activate the **Notifications Plan** - go to **Section 5.** Including notifications to relevant Control Agency (DoT or AMSA)	Vessel Master CSR & Incident Commander (or delegate)
Within 90 minutes of notification	Gain situational awareness by initiating Operational Monitoring and initiate mobilisation of tracking buoy/s Activate the **Monitor and Evaluate Plan** – go to **Section 8**	CSR IMT Operations Team Leader IMT Logistics Team Leader IMT Environment Team Leader

When	Actions	Who
Day 1 (for applicable scenarios)	Reduce exposure of shorelines and wildlife to floating oil through **Mechanical Dispersion** - Go to **Section 9**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
If/when initiated	Prepare for initiation of **Shoreline Protection and Deflection** - go to **Section 9**	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation **Oiled Wildlife Response** as applicable – go to **Section 12**	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation of scientific monitoring as per **Scientific Monitoring Plans** where applicable – go to **Section 14**	IMT Environment Team Leader
If/when initiated	Prepare for initiation **Shoreline Clean-up Plan** - go to **Section 11**	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader
Day 1	Initiate the development of a Safety Management Plan/s to support activated strategies Refer Oil Spill Response Health and Safety Manual (SO-91-RF-10016)	IMT Safety Team Leader
Day 1	Initiate **Forward Operating Base** planning to support activated strategies **Section 15**	IMT Operations Team Leader IMT Logistics Team Leader
Ongoing	Following notification of a Level 2/3 spill, AMSA or DoT, as the legislated Control Agency, will assume control of the spill response and provide direction to those activities already commenced by Santos WA.	

5. Notification and Reporting

5.1 Regulatory Notification and Reporting

Santos WA will undertake reporting as detailed in **Table 5-1**. The Incident Commander is to delegate the following regulatory reporting requirements for spills in Commonwealth waters. Typical delegated parties will be the Safety Team Leader and the Environmental Team Leader.

Contact details for the Regulatory agencies outlined in **Table 5-1** are provided within the Incident Response Telephone Directory (SO-00-ZF-00025.020).

Table 5-1 outlines the external regulatory reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth and State jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using onsite resources as well as larger Level 2/3 spills.

State water notifications to WA DoT will apply to spills in State waters or spills originating in Commonwealth waters and moving to State waters.

Table 5-1 outlines Santos WA oil spill reporting requirements associated with carrying out a Petroleum Activity in State and Commonwealth waters. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and WA DoT (MEER unit).

Table 5-1: External Notification and Reporting Requirements (Commonwealth and State Water)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 2 hours Written report as soon as practicable, but no later than 3 days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009	A spill in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator) & DMIRS (WA Department of Mines, Industry Regulation and Safety)	Written report to NOPTA and DMIRS within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environmental Team Leader (or delegate)	Provide same written report as provided to NOPSEMA
AMSA and DoT spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within 2 hours of incident	Under the MoU between Santos WA and AMSA	Santos WA to notify AMSA of any marine pollution incident[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
WA Department of Transport (WA DoT)[2] (Maritime Environmental Emergency Response (MEER) Duty Officer)	• Verbal notification within 2 hours • Follow up with POLREP as soon as practicable after verbal notification • If requested, submit SITREP within 24 hours of request	Emergency Management Regulations 2006 State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos WA to notify of actual or impending Marine Pollution Incidents (MOP) that are in, or may impact, State waters. Emergency Management Regulations 2006 define MOP as an actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or	Notification by IMT Environmental Team Leader (or delegate)	WA DoT POLREP: https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf **Appendix A1** WA DoT SITREP: https://www.transport.wa.gov.au/mediaFiles/

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
			damage to the health of a person, property or the environment[1].		marine/MAC-F-SituationReport.pdf **Appendix A2**
Protected areas, fauna and fisheries reporting requirements					
Commonwealth Department of Agriculture, Water and the Environment (DAWE) (Director of monitoring and audit section)	Email notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	If matters of national environmental significance (MNES) are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (DBCA) (State Duty Officer)	Verbal notification within 2 hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Parks Australia 24-hour Marine Compliance Duty Officer	Verbal notification as soon as practicable. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be effected) • proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc.) • confirmation of providing access to	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
	relevant monitoring and evaluation reports when available; and • contact details for the response coordinator.				
Department of Primary Industry and Regional Development (DPIRD) - Fisheries	Verbal phone call .notification within 24 of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Australian Fisheries Management Authority	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

1- Santos WA will meet the requirement of reporting a marine oil pollution incident as outlined in **Section 8.1.2** of Archer 3D MSS EP.

2- Santos WA reporting requirements only listed. For oil spills from vessels, Vessel Masters also have obligations to report spills from their vessels to AMSA Rescue Coordination Centre (RCC) and, in State waters, WA DoT MEER.

5.2 Level 2/3 Spill Response Support Notifications

Table 5-2 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined within this plan. This list contains key response providers that have pre-established roles in assisting Santos WA in an oil spill response. It is not an exhaustive list of all providers that Santos WA may use for assisting an oil spill response. The Company Incident Response Telephone Directory (SO-00-ZF-00025.02) contains a more detailed list of contact numbers for incident response support and is updated every 6 months with up-to-date revisions available within the Company Incident Control room and online (intranet procedures and emergency response pages).

Table 5-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
AMOSC, AMOSC Duty Manager	As soon as possible but within 2 hours of incident having been identified	Verbal Service Contract	Santos WA is a Participating Company in AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos WA can also call upon mutual aid from other trained industry company personnel and response equipment AMOSC's stockpiles of equipment include dispersant, containment, recovery, cleaning, absorbent, oiled wildlife and communications equipment. Equipment is located in Geelong, Fremantle, Exmouth and Broome	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required – activate if spill response escalates in order to mobilise spill response resources consistent with the AMOSPlan **Step 3.** E-mail confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment, and callout authorities will be required to supply their credentials to AMOSC. A signed service contract must also be completed by a call out authority and returned to AMOSC prior to mobilisation	The IMT ETL (or delegate) will notify AMOSC (upon approval from Incident Commander
Oil Spill Response Limited (OSRL), OSRL Duty Manager	If spill requires additional resources or technical expertise	Verbal OSRL Notification Form OSRL Mobilisation Authorisation Form	Santos WA has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios. Further details available on the OSRL webpage.	**Step 1.** Contact OSRL Duty Manager in Singapore and request assistance from OSRL **Step 2.** Send notification to OSRL as soon as possible after verbal notification **Step 4.** Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby.	Designated call-out authorities (including Incident Commanders and CST Leaders)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
Babcock Helicopters	Within 2 hours of incident having been identified	Verbal	Helicopters/ pilots available for aerial surveillance. Contract in place.	**Phone call**	IMT Logistics Team Leader (or delegate)
RPS Group	As soon as possible but within 2 hours of incident having been identified	Verbal and written	Santos WA has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos WA, if required, as part of contracting arrangements with RPS Group	Contact RPS Group Duty Officer	IMT ETL (or delegate)
Exmouth Freight & Logistics	When equipment from movements are required in Exmouth and Dampier	Verbal	Assistance with mobilising equipment and loading vessels	**Phone call**	IMT Logistics Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
North West Alliance – Waste	When Shoreline Clean-up is activated (**Section 11**)	Verbal	Santos WA has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	Scientific Monitoring Plan initiation criteria are met (**Section 14**)	Verbal and written	Astron has been contracted by Santos WA to provide Standby Services for Scientific Monitoring Plans (SMPs) 1-11. This includes provision of personnel and equipment. Astron annually reviews the SMPs for continual improvement.	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring **Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email **Step 3.** Provide additional details as requested by the Astron Monitoring Coordinator on call-back **Step 4.** Astron initiates Scientific Monitoring Activation and Response Process	IMT Environment Team Leader (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 8.6**)	Verbal	Oil analysis including GC/MS fingerprinting	**Phone call**	IMT Environment Team Leader (or delegate)

6. Incident Action Plan (IAP)

Santos WA incident response personnel use the incident action planning process to develop incident action plans (IAPs). All stakeholders involved in the incident achieve unity of effort through application of the disciplined planning process.

The incident action planning process is built on the following phases:

1. Understand the situation;
2. Establish incident objectives;
3. Develop the plan;
4. Prepare and disseminate the plan; and
5. Execute, evaluate and revise the plan.

The Santos WA IMT will use the Incident Action Plan (IAP) process to determine and document the appropriate strategies as more information becomes available during an incident response. The IAP is to be used by the Control Agency IMT for each operational period following the initial first-strike assessments, notifications, and activations undertaken by Santos WA.

The Santos WA IAP process is built on the phases described in **Figure 6-1.**

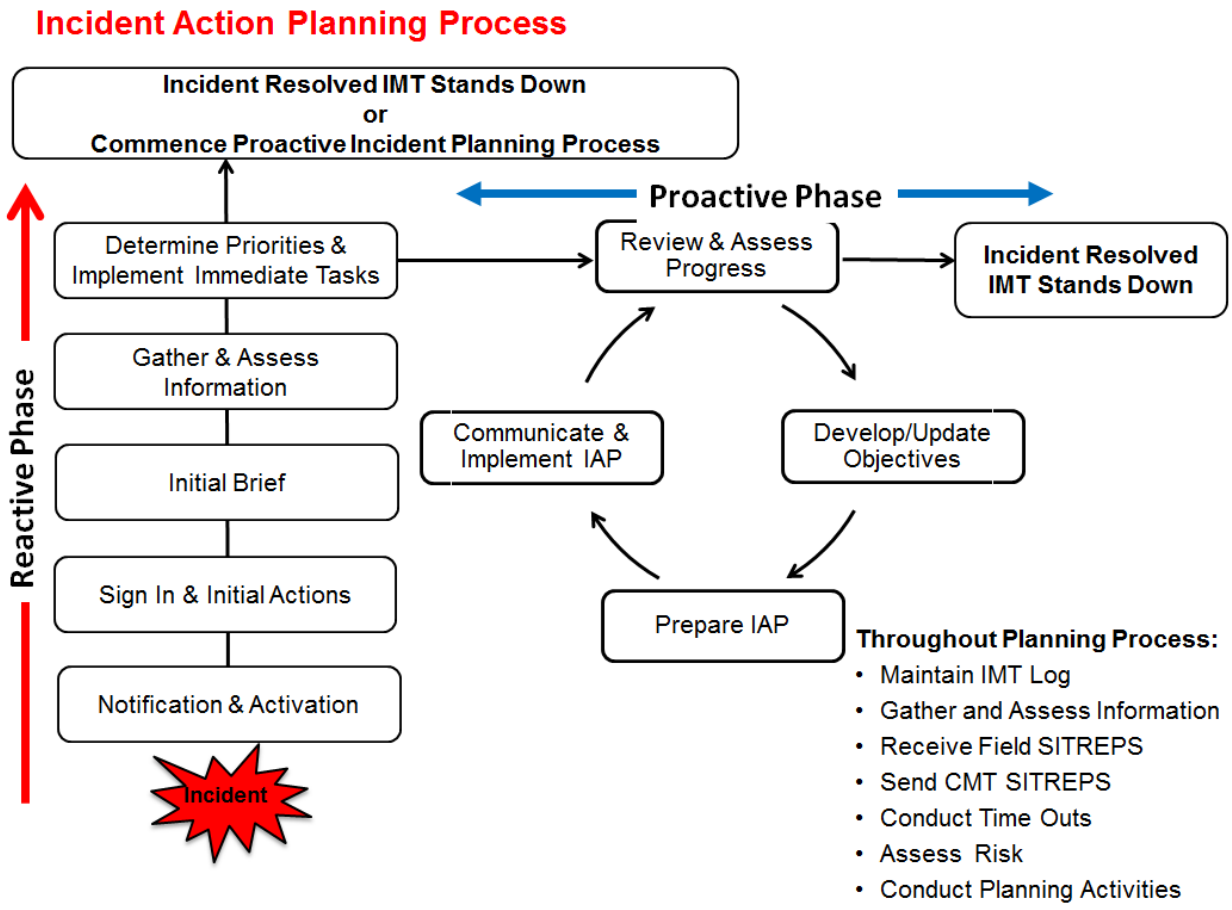


Figure 6-1: Incident Action Plan process

The IAP process facilitates the determination of appropriate strategies as more information becomes available during a spill event. The IAP is used for each operational period following the initial incident response actions defined in **Section 4**. An operational period is defined as the period scheduled for execution of actions specified in the IAP. The IAP is refreshed when conditions change. There can be multiple objectives and action plans occurring simultaneously within an IAP.

As IAPs and response strategies are implemented, their performance is monitored. The performance measurement results are fed back into the IMT to provide the IMT with greater situational awareness to enable the effective formulation of following IAPs. Those response strategies that are effective are continued or increased, while those strategies that are ineffective are scaled back or ceased.

The performance against the objectives of the IAP must be documented in the Incident Log by the IMT. This provides the IMT with information required to assist in formulating the following IAP and provides evidence of Santos WA's response to the incident for regulatory and legal investigations that will follow the termination of the incident.

IAP performance is monitored through IMT communication with in-field response personnel both verbally and through logs/reports/photos sent throughout the response (e.g. surveillance personnel, beach masters, team leaders, laboratory chemists, etc.) who report on the effectiveness of the response strategies.

Gain situational awareness

In order to review the applicability of the contingency response strategies contained within this OPEP to the actual and real incident characteristics, and assess the response strategies using NEBA to achieve impacts that are ALARP, the IMT must first gain situational awareness by obtaining answers to the following:

+ What type of hydrocarbon has been spilt?
+ What is the expected behaviour of the hydrocarbon that has been spilt?
+ How much has been spilt?
+ Is the source under control?
+ Where is the hydrocarbon going?
+ Is there anything in the path of the predicted hydrocarbon travel zones?
+ Can the hydrocarbon be approached or are there safety concerns?
+ Can the hydrocarbon be contained?
+ Can the hydrocarbon be dispersed?
+ Will shoreline impact occur and clean-up be required?
+ Can wildlife be affected and require response?

IAP forms and processes are documented in the Incident Command and Management Manual (SO-00-ZF-00025) and in the 'Emergency Response' folder sets at *L:\Resource\Emergency Response\Incident-Exercise Number-Name.*

6.1 Net Environmental Benefit Analysis (NEBA)

The Control Agency IMT will use the NEBA (also referred to as a spill impact mitigation assessment (SIMA)) process to inform the development and refinement of IAPs, so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed.

Within Santos WA's IMT, the Environmental Team Lead is responsible for reviewing the priority receptors identified within the Archer 3D MSS EP and this OPEP and apply NEBA to identify which response options are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

As a component of the incident action planning process, NEBA is conducted by the Control Agency with responsibility for the spill response activity. Where there are different activities controlled by different IMTs, as in a cross-jurisdictional response between Santos WA, AMSA and DoT, consultation will be required during the NEBA process such that there is consistency in the sensitivities prioritised for response across the Controlling Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to credible spills identified in this OPEP, with the benefit or potential impact to each sensitivity identified within the Environment that May Be Affected (EMBA) (refer Section 7.1.6 of the Archer 3D MSS EP).

In the event of a spill, NEBA is applied with supporting information from situational awareness and information collected as part of the Monitor and Evaluate Plan (**Section 8**) to achieve the following:

- Identify sensitivities within the area potentially affected by a spill at that time of the year;
- Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
- Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised, using the Operational NEBA Form (**Appendix A9**). To complete the NEBA:

- All ecological and socioeconomic sensitivities identified within the spill trajectory area are inserted;
- Potential effects of response strategies on each sensitivity are assessed and assigned a positive, negative or no change rating; and
- All persons involved and data inputs that have been considered for the analysis are included.

The Operational NEBA Form (**Appendix A9**) documents the decisions behind the recommendation to the IC on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The Operational NEBA provides guidance to the IAPs and is revisited each Operational Period. It should be possible to see how the NEBA evolves as new information and expertise comes to light.

7. Source Control Plan

The initial and highest priority response to an oil spill incident, following the safety of personnel, is to prevent or limit further oil loss into the marine environment; however, this will only be attempted if safe to do so.

7.1 Level 1 Vessel Releases

Level 1 releases are those that can be controlled through the use of onsite resources without external assistance. As a guide only, this includes spills up to an indicative 11 m^3. The most likely Level 1 incidents are minor spills of up to 1 m^3 from leaks and spills associated with hydrocarbon storage and handling on project vessels.

Minor Vessel Releases – Source Control		
Initiation criteria	Notification of a spill.	
Jurisdiction (Jurisdictional Authority)	AMSA	
Control Agency	AMSA is the designated Control Agency for vessel spills to Commonwealth waters. NB: Santos WA will coordinate response until AMSA assumes control.	
Objective	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Applicable hydrocarbons	MDO/MGO	Lube Oil/ Hydraulic Oil
	□	□
Resources	Shipboard Oil Pollution Emergency Plan (SOPEP), spill kits on vessels	
Termination criterion	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbon.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

In the event of a release of hydrocarbon onto the deck of a vessel, the vessel's SOPEP (if a SOPEP is required under MARPOL) will be implemented.

Notwithstanding specific requirements in procedures outlined above, source control measures applicable to minor vessels spills include:

- Isolation of damaged, leaking equipment;
- Where drainage is open to the marine environment, drainage is to be isolated as soon as practicable following the spill to prevent discharge to the ocean (the Vessel Master will confirm that the drainage network is closed on the vessel before washing down the deck after excess oil has been cleaned up);
- Use of onsite spill kit resources (i.e. sorbent material) to clean-up spills;
- Recovery of dropped object where practicable, if hydrocarbon containing equipment dropped to the marine environment;
- Disposal of contaminated waste to licensed waste contractor; and
- Repair of damaged, leaking equipment.

7.2 Refuelling spill

A Level 1/2 refuelling spill of up to 37.5 m^3 of MDO/MGO is considered possible due to bunkering activities.

Refuelling spill – Source Control		
Initiation criteria	Notification of a spill.	
Jurisdiction (Jurisdictional Authority)	Jurisdictional Authority and Control Agency for response to a spill from an Activity vessel in Commonwealth waters is AMSA. For any Level 2/3 spills reaching State waters the relevant Jurisdictional Authority and Control Agency for the response in State waters is DoT, regardless of the source of the spill. NB: Santos WA will act as Control Agency unless AMSA or DOT assumes control.	
Control Agency		
Objective	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	Release of hydrocarbon into the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

For refuelling activities, relevant procedural requirements as identified within the Archer 3D MSS EP shall apply to prevent or limit the volume of hydrocarbons released to the marine environment during a refueling spill.

In the event of a release during bunkering activities, the relevant SOPEP will be followed for actions to mitigate the impacts from the spill. Sorbent materials will be used from spill kits on-board the vessel to mop up the oil on deck. Soiled sorbent materials will be bagged and disposed to shore, following controlled/hazardous waste requirements as applicable.

Notwithstanding specific SOPEP/procedural requirements related to refuelling spills, source control measures will include:

+ Pumping operations to cease immediately following the spill;
+ Drainage networks closed as soon as practicable following the spill to prevent discharge to the ocean;
+ Recover hose and identify leaking pipe; and
+ Use spill kit resources (i.e. sorbent material) to clean-up spills.

7.3 Vessel Collision

A vessel collision may result in the release of all or part of a storage tank or fuel tank contents, releasing hydrocarbons to the marine environment (up to 1,065 m^3 of MDO/MGO).

Hydrocarbon fuel tank rupture – Source Control		
Initiation criteria	Level 2/3 incident (to be determined by On-Scene Commander).	
Jurisdiction (Jurisdictional Authority)	Jurisdictional Authority and Control Agency for the response to a spill from an Activity vessel in Commonwealth waters is AMSA. For any Level 2/3 spills reaching State waters the relevant Jurisdictional Authority and Control Agency for the response in State waters is DoT, regardless of the source of the spill. NB: Santos WA will coordinate response until AMSA or DOT assumes control.	
Control Agency		
Objective	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	The cargo in the ruptured fuel or storage tank is secured and release to the marine environment stopped.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

In a vessel impact situation, there is a likelihood of personnel injury, which will take priority over responses to reduce the hydrocarbon volume released to the marine environment. Where the vessel has a SOPEP or procedure for responding to a ruptured fuel tank, the SOPEP or procedure will be followed, as applicable.

Notwithstanding vessel specific procedures for source control, the following activities should be immediately evaluated for implementation providing safe to do so:

+ Reduce the head of cargo by dropping or pumping the tank contents into an empty or slack tank;
+ Consider pumping water into the leaking tank to create a water cushion to prevent further cargo loss;
+ If the affected tank is not easily identified, reduce the level of the cargo in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised;
+ Evaluate the transfer of cargo to other vessels;
+ Trimming or lightening the vessel to avoid further damage to intact tanks; and
+ Attempt repair and plugging of hole or rupture.

Through the implementation of these actions, the volume of hydrocarbons released to the marine environment may be reduced. However, there are several influencing factors that would result in delay or inability to implement controls, potentially resulting in a full discharge of a fuel tank compartment; such as a high sea state, a significantly large rupture, or injuries to personnel.

8. Monitor and Evaluate Plan (Operational Monitoring)

Understanding the behavior and likely trajectory of an oil spill is critical to evaluate the appropriate response strategy. Several methods can be used to monitor and evaluate:

- Vessel surveillance;
- Aerial surveillance;
- Tracking buoys;
- Spill fate modelling;
- Satellite imagery;
- Oil characterisation;
- Operational water quality monitoring; and
- Shoreline and coastal habitat assessments.

8.1 Vessel Surveillance

Direct observations from vessels can be used to assess the location and visible extent of an oil spill, which assists with the verification of modelling predictions and trajectories and informs response strategies. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea state conditions or where fresh hydrocarbons at surface poses safety risks (e.g. gas).

Vessel Surveillance		
Initiation criteria	Notification of a Level 2/3 spill - may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving into State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving into State waters) NB: Santos WA will undertake initial vessel surveillance and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	Vessel-based surveillance is undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable; or NEBA is no longer being achieved; or Notification of a Level 2/3 spill - may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

The CSR or Operations Team Lead will initiate available (undamaged) vessels and crew, or by vessels of opportunity that are working in the area. A request for vessel surveillance is made by the Operations Team Lead or CSR within 90 minutes upon notification.

First-strike actions to be initiated by Santos WA are as detailed below.

<table>
<tr><th colspan="4">Monitor and Evaluate: Vessel Surveillance</th></tr>
<tr><td colspan="2">Trigger</td><td colspan="2">Level 2/3 spills – may be deployed in a Level-1 incident (IMT)</td></tr>
<tr><td colspan="2">Activation time</td><td colspan="2">Within 90 minutes for available onsite vessels</td></tr>
<tr><td rowspan="8">Escalation and Ongoing Actions</td><td>No.</td><td>Action</td><td>By whom</td></tr>
<tr><td>1</td><td>Notify Vessel Master of available on-scene vessels to commence surveillance</td><td>CSR or Operations Team Lead</td></tr>
<tr><td>2</td><td>Identify all other vessels operating in the area and those under deployment for the incident response and request slick visual monitoring.</td><td>Logistics Team Leader
Operations Team Leader</td></tr>
<tr><td>3</td><td>Confirm surface slick location and extent, weather conditions, and marine fauna presence using vessel surveillance forms where possible (
Appendix A3)</td><td>Vessel Observers</td></tr>
<tr><td>4</td><td>Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick, to the IMT Operations and Planning Team Leads</td><td>Vessel Observers and/or CSR</td></tr>
<tr><td colspan="2">Resources</td><td>Location</td></tr>
<tr><td colspan="3">Equipment</td></tr>
<tr><td colspan="2">Vessels of Opportunity</td><td>Operational Area / Dampier/ Varanus Island</td></tr>
<tr><td colspan="3">Source of Personnel</td></tr>
<tr><td colspan="2">Vessel Crew</td><td>With vessel</td></tr>
</table>

Maintenance of response

This response will be maintained through Santos WA's existing contractual arrangements with vessel suppliers, which will ensure that sufficient surveillance can be maintained. The number of vessels required to undertake this surveillance are available to Santos WA and will be used on a continual basis until no longer required. Regular rotations of vessel crews and refuelling runs will be timed with other surveillance vessels to maintain the response.

8.2 Aerial Surveillance

Aerial surveillance is used to record the presence and characteristics of oil at the surface and other environmental observations including weather conditions, marine fauna and sensitive receptors in the area. Aerial surveillance provides superior coverage over vessel surveillance for estimating the spatial extent of a spill but is generally required only for larger Level 2/3 spills.

Aerial Surveillance		
Initiation criteria	Notification of a Level 2/3 spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial aerial surveillance and will control this activity until such time that AMSA and/or DoT takes control.	
Objectives	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable; or As directed by the relevant Control Agency.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

First-strike actions to be initiated by Santos WA are as detailed below.

Monitor and Evaluate: Aerial Surveillance			
Trigger		Notification of a Level 2 or 3 spill	
Activation time		Within 3 hours from notification	
Escalation and Ongoing Actions	**No.**	**Action**	**By whom**
	1	Source and mobilise initial aerial surveillance from closest location of available aircraft.	Logistics Team Leader Operations Team Leader
	2	Source available Santos WA Aerial Observers and deploy them to flight departure location following briefing Santos WA maintains a trained pool of Aerial Observers comprising both field staff and office staff. Aerial Observers based in Perth can be mobilised to the airbase the day following activation. In the absence of Aerial Observers, untrained observers (e.g. pilots) can perform initial surveillance of the spill to gain situational awareness.	Logistics Team Leader Operations Team Leader
	3	Develop flight plan (frequency and flight path) to meet IMT expectations	Operations Team Leader / Aviation Superintendent
	4	Aerial Observers to commence surveillance	Aerial Observer
	5	Determine the spill extent by completing Aerial Surveillance Surface Slick Monitoring Template (**Appendix** A5). Take photographic images of the slick.	Aerial Observer
	6	Complete Aerial Surveillance Observer Log (**Appendix** A4) and relay all surveillance records: logs, forms, photographic images, video footage to the IMT	Aerial Observer
	7	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix** A6)	Aerial Observer
	8	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT	Aerial Observer
	9	Using photographic images sent by Aerial Observers, conduct assessment of oil volume and distribution to validate Observers calculations or to conduct estimate if not done previously.	Planning Team Leader Operations Team Leader
	Resources		**Location**
	Equipment		
	Helicopters through Santos WA contracted suppliers		Exmouth and Karratha
	Source of Personnel		
	Santos WA Aerial Observers Industry Aerial Observers through AMOSPlan Mutual Aid, National Response Team State Response Team		Perth Office, NWS various

Maintenance of response

Aerial surveillance will be maintained through continual procurement of additional aircraft as required from Perth, the Pilbara regions and interstate. Trained aerial observers will be rotated on a roster throughout the response.

8.3 Tracking Buoys

Tracking Buoys		
Initiation criteria	Notification of a Level 2/3 spill. May be deployed for a Level 1 spill if deemed beneficial by the On-Scene Commander	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial deployment of tracker buoys and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or As directed by the relevant Control Agency.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

Santos WA maintains a minimum of 12 spill tracking buoys across their North West Shelf operations available for deployment in the event of a spill. These are located on Santos WA facilities. Each buoy acquires GPS data at 20 second intervals and transmits once every 30 minutes.

First-strike actions to be initiated by Santos WA as detailed below.

Monitor and Evaluate: Satellite Tracking Buoys			
Trigger		Notification of a Level 2/3 spill – may be deployed in a Level-1 incident (to be determined by CSR)	
Activation time		Deployment of onsite buoys occurs within 2 hours upon request from IMT or CSR (deployment time subject to vessel locations and weather conditions)	
Escalation and Ongoing Actions	**No.**	**Action**	**By whom**
	1	Request onsite vessel to deploy available buoys	CSR/ Operations Team Leader
	3	Deploy tracking buoy at leading edge of plume: • Remove buoy from packaging; • Remove On/Off magnet and place in safe location (back in the box); and • Deploy buoy into the water from height not greater than 10 m.	Vessel Master
	4	Monitor movement of tracking buoys: • Refer Emergency Response Intranet Page for login details	Planning Team Leader/GIS
	5	Relay information to spill fate modelling supplier for calibration of trajectory modelling	Planning Team Leader/GIS
	Resources		**Location**
	Tracking buoys (12)		Santos WA Facilities on NWS
	Santos WA contracted Vessel and crew		Operational Area, Santos WA facilities

Maintenance of response

Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations. If required mobilise additional tracking buoys from other Santos WA operations (Santos WA presently has 12 Tracker Buoys located on the NWS) or from AMOSC stockpiles.

8.4 Spill Fate Modelling

A spill modelling service provider will be used to provide forecast spill fate modelling to assess the direction, speed, and potential impacts of the spill. At the time of OPEP preparation, Santos WA has engaged RPS Group to provide forecast spill fate modelling. RPS Group use SIMAP and OILMAP modelling systems that comply with Australian Standards (*ASTM Standard F2067 "Standard Practice for Development and Use of Oil Spill Trajectory Models"*). RPS Group also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

Spill Fate Modelling		
Initiation criteria	Notification of a Level 2/3 spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial deployment of spill fate modelling and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic Oil
	□	X
Termination criterion	Spill fate modelling will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or until modelling is no longer beneficial to predict spill trajectory and concentrations; or As directed by the relevant Control Agency	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

The spill fate modelling service is to be initiated by the submission of the RPS Group trajectory modelling request form by the IMT (

Appendix A8). RPS Group is to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or if new information becomes available. Operational surveillance data (aerial, vessel, satellite imagery, tracker buoys) is to be provided to RPS Group to verify and adjust fate predictions of the spill and improve predictive accuracy.

First-strike actions to be initiated by Santos WA as detailed below.

<table>
<tr><th colspan="4">Monitor and Evaluate: Oil Spill Fate Modelling</th></tr>
<tr><td colspan="2">Trigger</td><td colspan="2">Notification of a Level 2 or 3 spill</td></tr>
<tr><td colspan="2">Activation time</td><td colspan="2">Oil Spill Fate Modelling provider will be contacted immediately upon notification of a Level 2/3 spill.
As per contractual agreements with the modelling service provider, upon activation and when requested by Santos WA, RPS Group will provide trajectory models with the following minimum delay (or otherwise agreed with Santos WA on a case-by-case basis);
• Within 2 hours for OILMAP model for offshore and open ocean
• Within 4 hours for OILMAP operation for near-shore</td></tr>
<tr><td rowspan="7">Escalation and Ongoing Actions</td><td>No.</td><td>Action</td><td>By whom</td></tr>
<tr><td>1</td><td>Initiate spill modelling by submission of a trajectory modelling request form (
Appendix A8) to RPS Group. Request for 3-day forecast trajectory modelling.</td><td>Environment Team Leader</td></tr>
<tr><td>2</td><td>Operational surveillance data (aerial, vessel, satellite imagery, tracker buoys) to be provided to RPS Group to verify and adjust fate predictions of the spill and improve predictive accuracy</td><td>Planning Team Leader/ GIS
Environmental Team Leader</td></tr>
<tr><td>3</td><td>Login to the RPS Group data sharing website and maintain connection. Download modelling results and report to GIS Support</td><td>Planning Team Leader/ GIS
Environment Team Leader</td></tr>
<tr><td>4</td><td>Upload modelling data onto Santos WA GIS.</td><td>GIS Support</td></tr>
<tr><td>5</td><td>Identify locations along the predicted oil trajectory that would be applicable to the different response strategies available. Assess strategies for applicability.</td><td>Planning Team Leader
Environment Team Leader</td></tr>
<tr><td>6</td><td>Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct NEBA on proposed response strategies.</td><td>Environment Team Leader
Planning Team Leader</td></tr>
<tr><td colspan="3">Resources</td><td>Location</td></tr>
<tr><td colspan="3">Spill fate modelling provider (RPS Group).</td><td>Perth</td></tr>
</table>

Maintenance of response.

This response will be maintained through contracts with suppliers to maintain spill trajectory modelling services to Santos WA.

8.5 Satellite Imagery

Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT.

Satellite Imagery		
Initiation criteria	Notification of a Level 2/3 spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters).	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters). NB: Santos WA will undertake initial activation of satellite imagery acquisition and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	Satellite monitoring will continue until no further benefit is achieved from continuing; or As advised by relevant Control Agency.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

Suitable imagery may be available from satellite imagery suppliers. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar (SAR) and visible imagery may both be of value.

Requests for satellite imagery through OSRL can be made by calling the OSRL Duty Manager and completing the OSRL Notification and Mobilisation forms (http://www.oilspillresponse.com/activate-us/activation-procedure/).

8.6 Initial Oil Characterisation

Initial Oil Characterisation		
Initiation criteria	Notification of a Level 2/3 spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial activation of oil characterisation and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	Oil sampling and analysis to terminate once enough data has been collected to profile the oil behaviour throughout weathering and to provide oil for toxicity testing; or As directed by the relevant Control Agency. NB: Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

Given MDO/MGO is a common fuel type, the general physical and chemical characteristics of these hydrocarbons are known and have been presented in **Section 3.2.1** and further described in Section 7.1.2 of the Archer 3D MSS EP. Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release, as well as providing information on the effect of natural weathering at sea on these properties over time.

Sampling and analysis will allow for forensic fingerprinting of the released hydrocarbon, potentially allowing contamination to be traced back to the source where this is otherwise unclear or in dispute.

Sampling of the released hydrocarbon may also provide samples suitable for use in ecotoxicology analysis allowing the toxicity of different concentrations of the hydrocarbon to marine organisms to be assessed experimentally.

Using onsite vessels of opportunity, oil samples are to be taken daily where possible from fresh oil, and from the weathered oil locations, nominally representing 24 hours old, 48 hours old and 72 hours old (as they occur), and dispatched to the laboratory for analysis.

Laboratory analysis is to include the chemical and physical properties of the recovered oil, including gas chromatography/ mass spectrometry (GC/ MS) for the purpose of fingerprinting the oil constituents.

In the event of a Level 2/3 spill provided sufficient quantities of the hydrocarbon can be collected, ecotoxicology assessment of the oil will also be conducted at an ecotoxicology laboratory following the Australian and New Zealand Water and Sediment Quality Guidelines (ANZECC/ARMCANZ 2000 Guidelines). A minimum of five species across four taxonomic groups are to be used as the basis of toxicity tests. The quantity of oil required for analysis will be confirmed by the laboratory but is expected to be in the order of 6-10 L of oil. Testing results will provide the concentrations at which toxicity endpoints consistent with ANZECC/ARMCANZ 2000 Guidelines are met for each test. Overall species protection concentrations, including 90%, 95% and 99% species protection trigger levels are then to be generated using a species sensitivity distribution (SSD) fitted to the data (e.g. by using the Burrlioz software program). These species protection trigger levels will be used to aid interpretation of spill trajectory modelling outputs and inform the NEBA process.

8.7 Operational Water Quality Monitoring

Operational sampling of oil and oil in water will be undertaken at discrete locations, providing visual observations dissolved oxygen readings and samples for laboratory analysis.

This monitoring is complimentary to scientific water quality monitoring (SMP1) delivered through the Oil Spill Scientific Monitoring Plan in terms of methodology and required skillset and can be provided through Santos WA's Scientific Monitoring arrangements (**Section 14**).

Key aspects of this monitoring program are provided below.

Operational Water Sampling and Analysis		
Initiation criteria	Notification of a Level 2/3 spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial activation of operational water sampling and analysis and will control this activity until such time that AMSA and/or DoT takes control.	
Objectives	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	Operational water sampling and analysis will continue for 24 hours following control of the source provided oil is no longer detectable; or As directed by the relevant Control Agency. NB: sampling will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.	
Scope of Work	The work scope for operational water quality monitoring will be driven by the IMT, defining objectives for each operational period. The sampling will occur within the predicted or observed position of the spill on surface or the underwater plume. The positioning of water quality locations will be informed by other operational monitoring inputs (for example spill fate modelling, aerial surveillance).	
Activation	Activation is to follow that for mobilising water quality sampling personnel and equipment for the Water Quality Scientific Monitoring Plan (SMP1).	
Survey design	The operational water sampling activities will be conducted by experienced environmental scientists and managed through the IMT Incident Action Planning (IAP) process. The exact nature of the sampling activities will depend upon the objectives for each operational period, however, the sampling design and methodology will consider the following points: • Sampling locations will be moved with the slick and/or plume based on the observed or predicted location and movement of oil on water and subsea plumes. This will be informed by vessel/aerial surveillance, satellite tracking buoys, satellite imagery and spill fate modelling • At each discrete location, sampling will be conducted along a depth profile which captures the three dimensional distribution of the oil. For a subsea release or where surface oil is present in shallow water (<5 m) this should involve a depth profile from the seabed to surface waters. Profiles should ensure that the full gradient of oil in water concentration can be determined • Oil and oil in water samples are to be collected using suitable pumping or sampling apparatus. For samples at depth a Niskin bottle(s) or similar device that allows remote closing and discrete sampling at depth is to be used. Alternatively, water samples can be pumped from defined depths using a hose suspended vertically using a suitable pump for water sampling (e.g. a peristaltic pump) • Samples are to be collected in clean, fully labelled glass jars, filled to the top and refrigerated/ kept cool and in darkness during storage and transport. Handling, storage and documentation requirements to be confirmed with laboratory but holding time <7 days is expected requirement	

Operational Water Sampling and Analysis	
	• Oil and oil in water samples will be replicated at each site to allow intra-site variability to be assessed • Concurrent with collection of water samples a conductivity-temperature-depth (CTD) meter shall be deployed at each site along the same depth profile from which water samples are collected. The CTD will require dissolved oxygen (DO) sensors as part of the sensor package to record the activity of hydrocarbon degrading bacteria (dissolved oxygen) • Water samples also to be provided to an independent NATA-accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons (PAHs)
Analysis and reporting	• All data collected on oil properties provided in spreadsheets (including GPS location, depth of sampling, timing, on water observations, in-situ readings and water sample label details) to IMT on an ongoing basis during spill response operations • Daily field reports of results provided to the IMT • Analysis of oil properties following laboratory evaluation • Final report detailing all data collected on oil properties throughout the monitoring program including relevant interpretation
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.	

8.8 Shoreline and Coastal Habitat Assessment

To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character (topography, complexity, exposure etc.), degree and distribution of oiling, if present, presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts. This information can be collected from on-ground assessments.

DoT are the designated Control Agency for shoreline response for all marine spills identified in this OPEP and will direct resources provided through Santos WA for the purposes of on-ground shoreline assessments and shoreline response activities. Santos WA will provide additional information on shoreline character and oiling collected as part of any aerial surveillance activities carried out under its control (refer **Section 8.2**).

Santos WA activated shoreline assessment teams will follow DoT's Shoreline Assessment Form unless directed otherwise:

https://www.transport.wa.gov.au/mediaFiles/marine/MAC_F_OS01_Shoreline_Assessment_Form.pdf

Shoreline and Coastal Habitat Assessment		
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Jurisdictional Authority	DoT	
Control Agency	DoT (Level 2/3 spills)	
Objective	Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	As directed by the relevant Control Agency	
Baseline	Existing information on shoreline character, distribution of habitats/fauna and access/ safety constraints can be obtained from the following sources: • Santos WA Energy GIS, including habitat/fauna distribution layers and aerial imagery; • TRPs (e.g. Eighty Mile Beach TRP, Clerke Reef and Imperieuse Reef TRPs) • Oil Spill Response Atlas (OSRA) Web Map Application (WMA); • Pilbara Region Oiled Wildlife Response Plan; and • WA Marine Oil Pollution Risk Assessment WMA, for rankings and general information on protection priorities (http://wamopra.navigatusconsulting.com/map and https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp).	
Analysis and reporting	Shoreline survey reports are to be submitted to the Controlling Agency IMT at completion of assessments. All raw data collected will be included as appendices to the report and provided in a geospatial format for subsequent use in GIS mapping software.	
Refer **to Section 17** for the Controls, Performance Outcomes, Standards and Measurement Criteria to meet this objective.		

9. Mechanical Dispersion Plan

In the event of thin oil sheens resulting from a vessel MDO/MGO spill following weathering, vessel based mechanical dispersion can be used to assist with the natural dispersion process, encouraging localised areas of an oil slick to mix and suspend within the water column where it can be more easily biodegraded. This is especially beneficial if patches of floating oil are in close proximity to sensitivities at risk from floating oil (e.g. birdlife). To do this, vessels are deployed to implement mechanical dispersion by way 'prop washing' through the slick.

Mechanical Dispersion		
Initiation criteria	Operational monitoring identifies thin oil patches at sea surface that are not naturally dissipating in sea surface and are posing a risk to wildlife by remaining on the surface.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving State waters) NB: Santos WA will undertake initial mechanical dispersion as required and will control this activity until such time that AMSA and/or DoT takes control.	
Objective	To reduce the concentration of surface hydrocarbons in the vicinity of sensitive receptors.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	There is no longer a noticeable reduction of surface oil resulting from the activity; or NEBA is no longer being achieved; or Unacceptable safety risks associated with gas and VOCs at the sea surface; or Agreement is reached with Jurisdictional Authorities to terminate the response.	
Refer to **Section 17** for the Performance Outcomes, Standards and Measurement Criteria to meet this objective.		

The Operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations. This activity is to be conducted during daylight only, and only once a safety plan has been developed. The safety plan will consider the potential for dangerous gasses and VOC's.

Assessment for the applicability of mechanical dispersion will continue throughout the spill response, and utilised when weather and sea conditions are not conducive to natural dispersion of thin oil sheens, and wildlife are under threat.

10. Shoreline Protection Plan

Protection of sensitive shorelines and deflection of hydrocarbons using booms is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike activations of protection and deflection resources and support the ongoing response. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline protection and deflection. Santos WA will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 8**).

Shoreline Protection Plan		
Initiation criteria	Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted; and Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy	
Jurisdictional Authority	DoT	
Control Agency	DoT (Level 2/3 spills)	
Objective	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s; and Agreement is reached with Jurisdictional Authorities to terminate the response strategy	
Refer to **Section 17** for the Controls, Performance Outcomes, Standards and Measurement Criteria to meet this objective.		

Information gathered during operational monitoring, including shoreline assessments, and assessed through an Operational NEBA will guide the selection of protection and deflection locations and techniques.

Shoreline protection and deflection techniques include:

- The utilisation of earthen booming and sandbags where needed to prevent ingress of oil into tidal creeks;
- Nearshore booming using vessel-based operations while the spill remains on a predicted shoreline impact trajectory; and
- Placement of shoreline boom around areas to protect and to deflect the oil back to ocean, or to less sensitive or easier locations for shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, current and wind conditions.

Santos WA has developed Tactical Response Plans for Eighty Mile Beach and the Rowley Shoals (Clerke and, Imperieuse Reefs) which detail specific locations, equipment and tactics for protection and deflection booming. These plans are available on the Santos WA Emergency Response Intranet Site and are also held by DoT.

Stochastic spill modelling is summarised in **Section 3.3.1** and predicts the potential for shoreline accumulation above the moderate exposure value (100 g/m^2) at the following locations:

- Port Hedland-Eighty Mile Beach (<2% probability, maximum accumulated load of 32 tonnes, minimum arrival time of 4.8 days and maximum oiled shoreline length was predicted of 1.4 km)
- Karratha-Port Hedland (<2% probability, maximum accumulated load of 11 tonnes, minimum arrival time of 7.1 days and maximum oiled shoreline length was predicted of 7.1 km)

- Bedout Island (<2% probability, maximum accumulated load of 0.3 tonnes, minimum arrival time of 8.6 days and maximum oiled shoreline length was predicted of 1.4 km)
- Clerke Reef Marine Park (<1% probability, maximum accumulated load of 2.6 tonnes, minimum arrival time of 7.3 days and maximum oiled shoreline length was predicted of 7.1 km);
- Eighty Mile Beach (<1% probability, maximum accumulated load of 0.4 tonnes, minimum arrival time of 10.3 days and maximum oiled shoreline length was predicted of 1.4 km)

Following deployment of protection and deflection booms, daily inspections and maintenance of the booms is to be undertaken by response personnel to ensure locations and formations are maintained so that they remain effective in achieving objectives.

The shoreline protection plan activation process is provided below.

<table>
<tr><th colspan="4">Shoreline Protection Plan</th></tr>
<tr><td colspan="2">Trigger</td><td colspan="2">Notification of a Level 2/3 spill</td></tr>
<tr><td colspan="2">Activation time</td><td colspan="2">Within 24 hours of request by IMT.</td></tr>
<tr><td rowspan="13">Escalation and Ongoing Actions</td><td>No.</td><td>Action</td><td>By whom</td></tr>
<tr><td>1</td><td>Assess the spill trajectory modelling and other surveillance data and identify protection priority areas</td><td>Environment Team Leader
GIS Team Leader</td></tr>
<tr><td>2</td><td>Identify resources for shoreline protection activities based on nominated deployment locations</td><td>Operations Team Leader</td></tr>
<tr><td>3</td><td>Mobilise resources to a designated port location for deployment</td><td>Logistics Team Leader</td></tr>
<tr><td>4</td><td>Deploy shoreline protection response teams to each shoreline location selected</td><td>Operations Team Leader</td></tr>
<tr><td>5</td><td>Deploy response teams to conduct daily inspections and maintenance of boom arrays</td><td>Operations Team Leader</td></tr>
<tr><td colspan="2">Resources</td><td>Location</td></tr>
<tr><td colspan="3">Tactical Response Plans (TRPs)</td></tr>
<tr><td colspan="2">Eighty Mile Beach TRP
Clerke Reef TRP
Imperieuse Reef TRP</td><td>Santos WA Emergency Response Intranet site
Also held by DoT</td></tr>
<tr><td colspan="3">Equipment</td></tr>
<tr><td colspan="2" rowspan="3">Sea Curtain, Near-shore, Beach Guard Booms and associated equipment
Skimming equipment
Temporary waste storage
PPE
(refer TRPs as applicable for equipment specifics)</td><td>Santos WA (Exmouth, VI)
Other Operators through AMOSC mutual aid</td></tr>
<tr><td>AMOSC (Geelong/ Fremantle/ Exmouth/ Broome)</td></tr>
<tr><td>AMSA (Darwin/ Dampier/ Fremantle)</td></tr>
<tr><td colspan="2">Vessels</td><td>Santos WA
Operational sites/ contracted vessel providers</td></tr>
<tr><td colspan="3">Source of Personnel</td></tr>
<tr><td colspan="2">Santos WA IRT and AMOSC Core Group Responders</td><td>Santos WA Operational sites</td></tr>
<tr><td colspan="2">AMOSC Core Group Responders</td><td>Mobilised through AMOSC</td></tr>
<tr><td colspan="2">National Response Team (NRT)</td><td>Mobilised through AMSA</td></tr>
<tr><td colspan="2">State Response Team (SRT)</td><td>Mobilised through DoT</td></tr>
<tr><td colspan="2">Santos WA Labour Hire (shoreline clean-up manual labour)</td><td>Santos WA labour hire arrangements</td></tr>
</table>

Maintenance of response

Shoreline protection efforts will be maintained through the forward staging areas set-up at mainland locations. Equipment will be installed and maintained by response crews who will be rotated on a roster basis from the forward operations centres, with new personnel procured on an as-need basis from existing human resource suppliers. The protection and auxiliary equipment (dinghy's, tools etc.) will be maintained and replaced if necessary through existing suppliers of this equipment or through supplies from existing stockpiles.

11. Shoreline Clean-up Plan

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike activations as triggered (refer below), until such time as DoT assume control. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline clean-up. Santos WA will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 8**).

Shoreline Clean-up Plan		
Initiation criteria	Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted; NEBA indicates shoreline clean-up will benefit receptors; and Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy	
Jurisdictional Authority	DoT	
Control Agency	DoT (Level 2/3 spills)	
Objective	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ hydraulic oil
	□	X
Termination criterion	As directed by DoT.	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

Spill modelling indicates MDO/ MGO from worst case releases could accumulate above 10 g/m^2 at multiple shoreline locations, with maximum total accumulation predicted to be 32 tonnes (at Port Hedland-Eighty Mile Beach). Given the light and volatile nature, MDO/ MGO is difficult to handle for removal; contaminated sands and debris are likely waste products. Stranded MDO/ MGO will continue to volatilise, remobilise and degrade and are not expected to have persistent residues.

Natural remediation and flushing may be preferred to more intrusive clean-up methods given the nature and low persistence of these hydrocarbons. The effectiveness of a clean-up technique will be weighed against the potential additional environmental impacts from implementing that technique as part of a Net Environmental Benefit Analysis (NEBA) for shoreline clean-up planning.

The shoreline clean-up plan activation process is provided below.

	No.	Action	By whom
Actions	1	Identify contacted shoreline locations and conduct NEBA to recommend clean-up techniques using guidance described in **Section 11.2.**	Planning Team Leader Environment Team Leader
	2	Identify resources for shoreline clean-up activities.	Operations Team Leader
	3	Mobilise resources to a designated port location for deployment, or directly to location via road transport.	Logistics Team Leader
	4	Deploy shoreline clean-up response teams to each shoreline location selected by DoT, as the relevant Control Agency, to begin operations (each team led by a AMOSC Core Group or NRT member).	Operations Team Leader
	5	Monitor progress of clean-up efforts and report back to Control Agency IMT.	Operations Team Leader
Resources			**Source/Location**
Eight Mile Beach TRP Clerke Reef TRP Imperieuse Reef TRP			Santos WA Emergency Response Intranet site Also held by DoT
Equipment			
Dozers, Diggers, Bobcats, Forklifts, Hiabs/Cranes, and ATV with trailers			Exmouth/ Dampier/ Karratha/ Fremantle
Shoreline Clean-up Equipment (Decontamination, Beach Wash Down and Beach Clean-up Kits) and temporary waste storage (as defined in **Appendix A10** and TRPs as applicable)			AMOSC / AMSA/ OSRL / Spot purchase from various suppliers
Waste skips and associated waste equipment (as defined in **Section 13**)			North West Alliance (Karratha/ State wide)
Beach Clean-up hardware (rakes, shovels, wheelbarrows, etc.) and PPE (**Appendix A10** and TRPs as applicable)			Perth Petroleum Services/ PPE specialists/ Hardware stores
Personnel			
Shoreline Clean-up specialists			AMOSC, NRT (AMSA), SRT (DoT), OSRL
Santos WA IRT Personnel			Santos WA Operations
Waste collection personnel			Through North West Alliance contract (Karratha/ State-wide)
Santos WA labour hire			Various (as per contract suppliers) Capability >2,000 personnel

11.1 Equipment and Personnel

Shoreline clean-up equipment available for use by Santos WA is a combination of Santos WA owned, AMOSC, AMSA and OSRL equipment as well as other industry resources available through the AMOSPlan mutual aid arrangements. Shoreline consumables are available through hardware, PPE and specialist oil/chemical spill suppliers and mobile plant is available through hire outlets in Perth, Karratha and other regional centres. Where vessel deployments are required Santos WA will leverage from existing contracted vessel providers.

Available shoreline clean-up personnel is a combination of Santos WA Incident Response Team members, AMOSC Core Group Responders (comprising AMOSC trained Santos WA and Industry personnel), State Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos WA's emergency response labour hire arrangements (Neutral Vendor contract).

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Deployment will be under the direction of DoT and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 8.8**) will provide information to guide the clean-up strategy and deployment of resources.

Tactical Response Plans have been developed by Santos WA for key protection priority areas including some relevant to an Archer 3D MSS spill response, including Eighty Mile Beach and Rowley Shoals (Clerke Reef and Imperieuse Reef).

11.2 Clean-Up Activities

Each shoreline location will be assessed for the most appropriate response activity or activities based on NEBA. Each clean-up team (OSRT) will be led by a Beach Master who will be an AMOSC Core Group Responder or a trained member of AMSA administered NRT (as per the MoU agreement between Santos WA and AMSA). The OSRT members are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. Clean-up teams and equipment will be deployed and positioned as per those observations by the OSRT in consultation with the DoT. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.

The Beach Master shall communicate daily reports to the IMT Operations Team Leader to inform of proposed shoreline response tactics and required resources. The IMT Operations Team Leader shall work with the Planning Team Leader to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through the Supply and Logistics Team Leaders.

11.2.1 Tactical Response Plans

Specific guidance on clean-up tactics and key protection priority locations, including Eighty Mile Beach and Rowley Shoals, (Clerke Reef and Imperieuse Reef) is provided within TRPs developed by Santos WA and located on the Emergency Response Intranet site. These TRPs are also held by DoT.

11.3 Shoreline Vessel Access

In the initial instance, shoreline clean-up assessment of remote shorelines can be conducted by using aerial reconnaissance operations, using the Shoreline Aerial Reconnaissance Log (**Appendix A7),** which are used to monitor the spill and undertake regular assessment of shorelines throughout the region.

Landing craft vessels are capable of grounding out; therefore, the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide.

Mechanical equipment and PPE are to be mobilised to the nominated marine operational base for onward movement to the affected locations.

11.4 Deployment Locations

Spill trajectory and surveillance information and NEBA will help identify and prioritise shoreline sites for clean-up operations. Shoreline sensitivity and mapping data provided in the following data sources will be used to assist in evaluation of protection priority areas:

+ Santos WA GIS;
+ DoT Oil Spill Response Atlas –Web Map Application (OSRA WMA);
+ Pilbara Region Oiled Wildlife Response Plan;
+ Spill trajectory modelling;
+ Aerial Surveillance and Shoreline Assessment records where available; and
+ the EP.

Santos WA GIS and the OSRA WMA, provides detailed information on shoreline features, sensitive receptors, and potential spill response equipment mobilisation locations in the North West Shelf region.

12. Oiled Wildlife Response Plan

The greatest potential for oiled wildlife will be for spills adjacent to, or moving towards areas with aggregations of wildlife, typically shallow water/shoreline areas in State waters.

DoT is the Control Agency for oiled wildlife response in State waters, and the Lead IMT for oiled wildlife response for spills moving from Commonwealth to State waters. In these instances, DBCA are the Statutory Authority for the protection of wildlife in State waters and will play a key role in the response (including provision of an Oiled Wildlife Advisor (OWA)).

Santos WA will provide all available resources to assist the relevant Control Agency in an oiled wildlife response, mainly, and initially, through its access to AMOSC oiled wildlife resources. Timely provision of equipment and personnel will be provided by AMOSC to the Control Agency/ Lead IMT through a combination of owned and operated equipment, call-off contracts with suppliers, and the management of industry OWR response personnel through an Industry Oiled Wildlife Advisor.

Oiled Wildlife Response Plan		
Initiation criteria	Operational monitoring shows wildlife are contacted or are predicted to be contacted by a spill.	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving into State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving into State waters) NB: Santos WA will initially undertake oiled wildlife response and will control this activity until such time that AMSA and/or DoT takes control. Under that scenario Control Agency responsibilities would be determined through agreement between AMSA and DoT. It is likely that DoT, under the advice of DBCA would control the oiled wildlife response as per the WA Oiled Wildlife Response Plan.	
Objective	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanase wildlife.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	Oiling of wildlife have not been observed over a 48-hour period; and Oiled wildlife have been successfully rehabilitated; and Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response	
Refer to **Section 17** for the Controls, Performance Objectives, Standards and Measurement Criteria to meet this objective.		

The key plan for oiled wildlife response (OWR) in WA is the WAOWRP.

The WAOWRP has been developed by AMOSC, on behalf of the petroleum industry, and DBCA to define the minimum standards for OWR in WA as a sub-plan to the SHP-MEE. The WAOWRP can also be used for guidance to OWR in Commonwealth waters adjacent to State waters, noting that OWR requirements in State waters are expected to be greater. The Pilbara Region OWRP, which sits under the WAOWRP provides operational guidance to respond to injured and oiled wildlife in the Pilbara region.

The sections below outline how resources will be activated by the Control Agency in responding to oiled wildlife as per the WAOWRP.

12.1 Activation Procedure

The Control Agency/Lead IMT will activate the WAOWRP when there is an oil spill incident that has potential to result in oiled wildlife. **Figure 12-1** details the WAOWRP activation process.

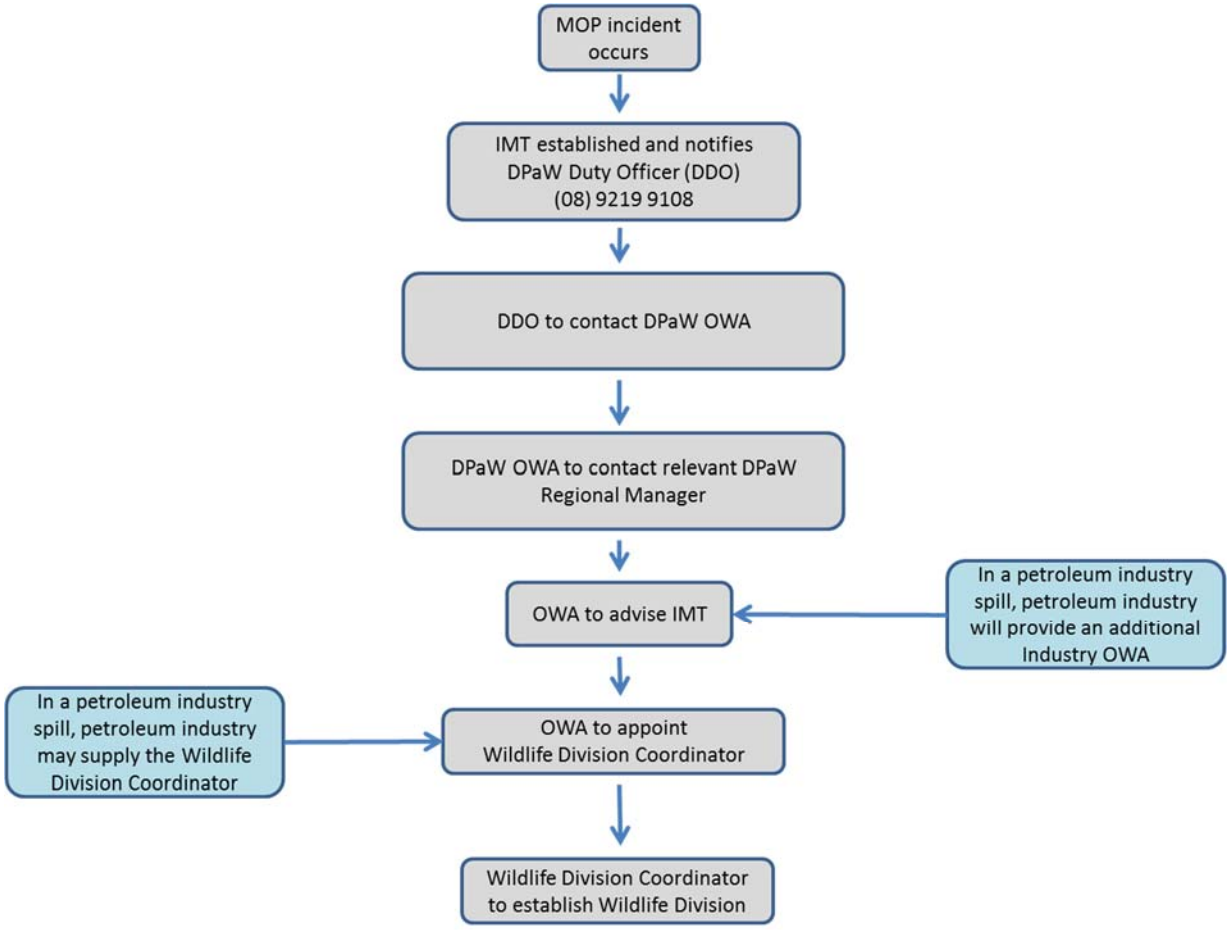


Figure 12-1: WAOWRP activation process

NB: DPaW is now referred to as DBCA

On occasions, a single oiled animal is found and the animal can be treated using local resources (veterinaries, wildlife carers or DBCA staff), no additional resources may be required and hence the OWR may not need to be escalated.

The level of escalation of the OWR is under the authority of the Incident Commander/Controller within the Control Agency IMT, and developed as a result of the incident specifics and advice given by Oiled Wildlife Advisors (DBCA and Industry as relevant) as per the protocols set out in the WAOWRP.

Where Santos WA is not the Control Agency for OWR, Santos WA will provide all relevant information with respect to oiled or at risk wildlife (location, access, number, species, and condition of oiled wildlife) as soon as possible. Santos WA will activate AMOSC for the provision of necessary resources to support the Control Agency.

12.2 Oiled Wildlife Response activities

Oiled Wildlife Response activities are described in detail in the WAOWRP and the Pilbara Region OWRP.

12.3 Oiled Wildlife Response Levels and Personnel Requirements

The WAOWRP nominates oiled wildlife response incident Levels based on the scale and severity of oiled wildlife impacts. **Table 12-1** provides the indicative level descriptions for Level 1 to Level 6 incidents.

The WAOWRP also nominates indicative personnel numbers and role requirements for each OWR Level as shown in **Table 12-2** and **Table 12-3**.

The number of personnel may change depending on the complexity of the response (spatial scale and variety of wildlife impacted). Additional personnel will be required as scribes/PAs for key functional positions. The skill level required is indicated as OWR 1-4, these correspond to competency based levels that ensure personnel have adequate knowledge to effectively perform the indicated roles / functions. In an incident, these tables are to be used as a guide; actual resourcing requirements will be guided by situational awareness on the complexity, scale and fauna types involved.

Table 12-1: WAOWRP indicative OWR levels

OWR level	Duration of OWR	Birds general	Birds OWR complex #	Turtles - hatchlings / juveniles / adults	Dolphins / Whales	Pinnipeds	Mammals terrestrial	Reptiles	Dugongs
Level 1	<3 days	1-2 birds per day or < 5 total	No complex birds	None	None	None	None	None	None
Level 2	4-14 days	1-5 birds per day or <20 total	No complex birds	< 20 hatchlings no Juveniles or adults	None	None	None	None	None
Level 3	4-14 days	5-10 birds per day or < 50 total	1-5 birds per day or <10 total	< 5 juv/adults, < 50 hatchlings	None	< 5 seals	< 5	< 5 - no crocodiles	None
Level 4	>14 days	5-10 birds per day or < 200 total	5-10 birds p/day	< 20 juv/adults < 500 hatchlings	< 5 or known habitats affected	5-50 seals	5-50 mammals	5-50 reptiles	Dugong habitat affected only
Level 5	>14 days	10-100 birds per day or > 200 total	10-50 birds per day	>20 juv/adults, > 500 hatchlings	>5 dolphins	> 50 seals	> 50 mammals	>50 reptiles	Dugongs oiled
Level 6	>14 days	>100 birds for day	10-50 birds per day	>20 juv/adults, > 500 hatchlings	>5 dolphins	> 50 seals	> 50 mammals	>50 reptiles	Dugongs oiled
# Threatened species, protected by treaty, or specialist feeders									

Table 12-2: WAOWRP indicative personnel numbers for Level 1 to 6 incidents

SKILL REQUIREMENT	OWR RESPONSE LEVEL & PERSONNEL NUMBERS					
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
OWR 4	1	1	3	2	2	2
OWR 3	2	0	4	4	4	4
OWR 2	4	9	15	17	18	18
OWR 1	0	14	33	47	84	90
Technicians (i.e Vets)	0	1	2	4	4	4
Other Specified Skills	0	0	2	3	4	4
Total	**7**	**25**	**59**	**77**	**116**	**122**

Table 12-3: WAOWRP indicative personnel requirements for Level 1 to 6 incidents

Category	Role	OWR Skill Level	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Strategic	Oiled Wildlife Advisor	OWR 4	1^{+1}	1^{+1}	1^{+1}	1^{+1}	1^{+1}	1^{+1}
	Wildlife Division Coordinator**	OWR 4	1	1	1	1	1	1
	Wildlife Operations Officer**	OWR 3			1	1	1	1
	Wildlife logistics Officer	OWR 3			1	1	1	1
	Wildlife Plannning Officer	OWR 3			1	1	1	1
	Wildlife Finance/Admin Officer	OWR 3			1	1	1	1
	Wildlife Communications Officer	OWR 2		1	1	1	1	1
	Wildlife Situation Officer	OWR 2			1	1	1	1
	Wildlife Supply/Resource Officer	OWR 2			1	1	1	1
	Wildlife Safety Officer	OWR2			1	1	1	1
	Wildlife Volunteer Coordinator	OWR 2			1	1	1	1
Staging Area / Facilities	Wildlife Staging Area Manager*	OWR 2	1	1	1	1	2	2
	Wildlife Staging Area / intake Team	OWR 1			3	3	6	8
	Wildlife Facilities Manager *	OWR 2			1	1	1	1
	Wildlife Trades assistants	Specified Skill			1	2	3	3
	Wildlife housekeeper	OWR 1			1	1	2	3
	Wildlife Security	Specified Skill			1	1	1	1
Re-connaissance	Wildlife Reconnaissance Officer	OWR 2	1	1	1	1	1	1
	Wildlife Aviation Supervisor	OWR 2				1	1	1
	Wildlife Vessel Supervisor	OWR 2			1	1	1	1
	Wildlife Shoreline Supervisor	OWR 2				1	1	1
	Wildlife Reconnaissance Team	OWR 1			2	4	6	8
	Wildlife Rescue Officer	OWR 2		1	1	1	1	1
Rescue	Wildlife Rescue Officer	OWR 2	2	1	1	1	1	1
	Wildlife Exposure Modification Officer	OWR 2		1	1	1	1	1
	Wildlife Field Collection Team	OWR 1		3	6	9	22	22
	Wildlife Transport Officer	OWR 2		1	1	1	1	1
Rehabilitation	Triage officer	OWR 2	2	1	1	1	1	1
	Triage team	OWR 1		1	4	5	5	6
	Wildlife Vetrinarian *	Specified Skill		1	1	3	3	3
	Wildlife Vetrinarian technician *	Specified Skill			1	1	1	1
	Wildlife Stabilisation Officer	OWR 2		1	1	1	1	1
	Wildlife Rehabilitation Officer	OWR 2		1	1	1	1	1
	Facilities Team	OWR 1		3	4	6	8	8
	washing/drying personnel ***	OWR 1		4	6	10	15	15
	Recovery/release personnel ***	OWR 1		3	8	10	20	20
Total number of personnel			**6**	**26**	**59**	**77**	**116**	**122**
NOTES	* 1 person per facility	*** Volunteers can be used to make up more numbers in this category where necessary						
	** May have deputy	Note: All Supervisor/coordinator positions should employ a scribe from level 4>						
	1^{+1} = In an industry spill there may be two oiled wildlife advisors (1 DPaW, 1 industry)							

12.4 Sources of Personnel and Equipment

In the event of a spill impacting wildlife, Santos WA will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the WAOWRP. An overview of sources of personnel is provided in **Table 12-4** and an overview of 'first-strike' equipment for initial deployment is provided in **Table 12-5.**

In the event of large-scale OWR further specialised OWR equipment and personnel will be provided by in-country and international organisations, as necessary, accessed through AMOSC (primary) and OSRL (secondary). Equipment and personnel required for the development and operation of staging areas/ treatment facilities can be provided locally (for example veterinary personnel and supplies). The Pilbara Region OWRP provide detail of local organisations and suppliers for personnel and equipment.

Further detail on OWR capacity accessed through AMOSC, OSRL/Sea Alarm and through Santos WA Workforce hire arrangements is provided in following sections.

Table 12-4: Sources of oiled wildlife response personnel

AMOSC / INDUSTRY RESPONDERS		**Activated through**	**Capability**
AMOSC Technical Advisor – Oiled Wildlife – assistant in IMT (as industry OWA if required)		AMOSC Duty Officer	1*
AMOSC OWR Industry Team– Level 2-4 responders (DBCA training)			18*
WA Petroleum industry personnel –Trained by individual petroleum industry companies – activated via mutual aid			~50*
AUSTRALIAN OWR EXPERTISE		**Activated through**	**Capability**
Blue Planet Marine (ACT and WA) – Oiled Wildlife Responders		AMOSC Duty Officer	10-20*
Phillip Island National Parks (VIC) – Oiled Wildlife Responders			~20-40*
NatPlan Mutual Aid			50-100*
Perth Zoo Duty Veterinarian	Wildlife care and rehabilitation advice, expertise and management	Personnel potentially available to petroleum industry (currently there is no formal arrangement)	
	Links to wildlife rehabilitation networks		
OWA Personnel		DBCA State Duty Officer –	1 per shift

DBCA staff with wildlife and emergency management skill set who currently operate in fire preparedness and response		
INTERNATIONAL OWR EXPERTISE	**Activated through**	**Capability**
DwyerTECH NZ - Facilities Management Personnel Call-off contract	AMOSC Duty Officer	2*
Wild base, Massey University (NZ) - Oiled Wildlife Responders		4-6*
International Bird Rescue (USA)- Oiled Wildlife Responders		4*
Sea Alarm (Belgium) – Expert assistance with organisational set-up and global OWR resourcing	OSRL Duty Officer	2/3** (OSRl /Sea Alarm) + additional OWR responders accessed through global network

* As per AMOSC Capacity Statement 25 June 2020 Feb 2019
** As per Sea Alarm/OSRL Service Level Agreement Statement

Table 12-5: First strike deployment-ready OWR equipment

AMOSC OWR Equipment*	**Activated through**	**Location**
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit	AMOSC Duty Officer	Fremantle
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit		Geelong
1 x AMOSC owned box kit		Exmouth
1 x AMOSC owned box kit		Broome
National Plan (NatPlan) OWR Equipment*	**Activated through**	**Location**
1 x NatPlan OWR container 1 x NatPlan/DBCA Box/trailer kit	AMSA RCC	Dampier
1 x NatPlan OWR container		Darwin
1 x NatPlan OWR container		Townsville
1 x NatPlan/OWR Container		Devonport
WA DBCA OWR Equipment*		
1 x DoT OWR container	**DoT Duty Officer**	Fremantle
DBCA OWR trailer kit		Karratha
DBCA OWR trailer kit		Kensington
NSW Maritime OWR Equipment*	**Activated through**	**Location**
1 x NSW Maritime OWR container	AMSA RCC	Sydney

OSRL OWR Equipment**	Activated through	Location
1 x Search and rescue response package 1 x Intake and triage response package 2 x Cleaning and rehabilitation response package	OSRL Duty Officer	UK
1 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Singapore
1 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Bahrain
1 x Wildlife Rehabilitation Unit		Fort Lauderdale, USA

* As per AMOSC Capacity Statement 25 June 2020

** As per OSRL SLA Equipment Report 4 May 2020

12.4.1 AMOSC OWR Arrangements

Santos WA's primary strategy for accessing in-country OWR personnel is to stand-up arrangements maintained by AMOSC through Santos WA's Participating Member contract. AMOSC supports Santos WA's commitment to providing OWR resources through a combination of owned and operated equipment, call-off contracts with suppliers, and the management of industry trained OWR personnel. AMOSC's arrangements include both Australian and International Oiled Wildlife Response Organisations as per **Table 12-4.** AMOSC will be requested to stand up an oiled wildlife response on behalf of Santos WA, sourcing personnel from this list. Oiled wildlife response equipment to be sourced through AMOSC is included in **Table 12-5**.

12.4.2 OSRL/Sea Alarm Foundation OWR Arrangements

In the event of a spill requiring a high level of OWR resourcing and/or a prolonged response, Santos WA can access global OWR resources through its membership with OSRL. OSRL provides OWR assistance through the availability of deployment ready OWR equipment packages, through OSRL internal staff with OWR expertise and through its relationship with Sea Alarm Foundation (Belgium).

Through the OSRL contract, Santos WA has access to 1-2 OSRL internal staff with OWR expertise and a OWR specialist from Sea Alarm. These personnel provide expert response advice (built on a knowledge gained from past global oiled wildlife incidents) and coordination of resources. A Sea Alarm Technical Advisor can be mobilised on-site during an incident, to act in a technical advisory role

During an actual oiled wildlife response a Sea Alarm Technical Advisor can be mobilised to help assess the situation, provide input on ways forward based on previous experience, coordinate joint stakeholder meetings or decision-making processes, and activate international assistance where appropriate.

A major benefit to Santos WA from this relationship is access to global expert personnel and response equipment through OSRL and Sea Alarm's global network.

12.4.3 Santos WA OWR Arrangements

In addition to OWR providers mobilised through AMOSC and OSRL/Sea Alarm Santos WA maintains access to the workforce marketplace during an emergency response. This arrangement provides for the rapid on-boarding of personnel from the marketplace through multiple recruitment agencies. Level 1 oiled wildlife responders, of which the WAOWRP indicates 90+ could be required for a Level 6+ event, could be provided through Santos WA's workforce hire arrangements. On the job training requirements for Level 1 responders could be provided by DBCA, AMOSC or Sea Alarm personnel. Skilled but ubiquitous roles required for manning and maintaining facilities and staging areas, such as trades, technicians and vets, could also be filled through workforce hire arrangements. The Pilbara Region OWRP provide contact details for local trade personnel, vets and wildlife specialists that could be employed for manning/maintenance of forward response wildlife response facilities.

12.5 Wildlife Holding Facility

In the event that handling and rehabilitation of oiled wildlife is required (e.g. birdlife), local facilities will be used in conjunction with mobile oiled wildlife response equipment provided through spill response providers. The Pilbara Region Oiled Wildlife Response Plan details potentially applicable facilities to be used for oiled wildlife

response. Based on the potential area of the response and the likely use of Dampier as the closest port for vessel based operations, facilities in the Dampier/Karratha region would be the primary options.

12.6 Termination Procedure

Once the decision has been made to terminate operations, the IC, under advice from relevant Statutory Authorities, will stand down individual participating and supporting agencies when parties agree that the incident/emergency has been satisfactorily controlled and their input is no longer required. This is likely to involve the progressive stand down of different sections of the response teams as some may need resourcing for longer than others.

In the event of a spill that impacts on wildlife, ongoing resourcing may be required to complete the rehabilitation of some affected animals and to conduct monitoring programs after their release. Demobilisation of the wildlife response will be guided by parameters established by DBCA at the beginning of operations.

13. Waste Management Plan

Collection of oily waste associated with the spill response may be from nearshore/ shoreline operations in State waters (e.g. protection booming and shoreline clean-up). Due to the nature of the MDO, offshore containment and recovery of oil was not considered an applicable strategy reducing collection from this method. Nearshore/shoreline operations will be under the control of DoT.

Waste management will also apply to any other response activities that generate oily water and oil contaminated material requiring disposal (e.g. cleaning of oiled wildlife and contaminated equipment, disposal of oiled consumables and PPE).

Shoreline contact and loading is expected to be moderately low based on predicted worst-case loadings. Shoreline clean-up techniques may favor non-intrusive techniques given the hydrocarbons are light and non-persistent. Collection of oily waste from shorelines is therefore expected to be limited.

This Waste Management Plan outlines measures to ensure the appropriate handling, storage and disposal of wastes generated during response and recovery operations.

Waste Management Plan		
Initiation criteria	Response activities that will be generating waste have been initiated	
Jurisdictional Authority	AMSA (Commonwealth waters) or DoT (spills moving into State waters)	
Control Agency	AMSA (Commonwealth waters) or DoT (spills moving into State waters) NB: Santos WA will initially coordinate waste management through its waste service provider and will continue to do so until such time that control of waste management is taken over by AMSA and/or DoT.	
Objective	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible.	
Applicable hydrocarbons	MDO/MGO	Lube oil/ Hydraulic oil
	□	X
Termination criterion	All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements; and Agreement is reached with Jurisdictional Authorities to terminate the response	
Refer to **Section 17** for the Controls, Performance Outcomes, Standards and Measurement Criteria to meet this objective.		

Where Santos WA is the Control Agency for spill response waste management, or at the request of the designated Control Agency, Santos WA will engage its contracted Waste Service Provider (WSP) to manage oily waste collection, transport and disposal. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to the final disposal points.

The current Santos WA contracted WSP is North West Alliance (NWA). Detailed guidance on NWA responsibilities for spill response waste management is provided within the Santos WA Oil Pollution Waste Management Plan (SO-91-IF-10053). This plan provides capability for a response commensurate to a worst case spill across all existing and planned activities undertaken by Santos WA across its facilities and permit areas, including operations, drilling campaigns and project work.

Key aspects of oil spill response waste management services to be provided by Santos WA's WSP are outlined below.

13.1 Legislative Requirements

State Government Legislation
Environmental Protection Act 1986
Environmental Protection Regulations 1987
Environmental Protection (Rural Landfill) Regulations 2002
Environmental Protection (Unauthorised Discharges) Regulations 2004
Environmental Protection (Controlled Waste) Regulations 2004
Pollution of Waters by Oil and Noxious Substances Act, 1987
Waste Avoidance and Resource Recovery Act 2007
Dangerous Goods Safety Act 2004 and regulations
Soil and Land Conservation Act 1945
Contaminated Sites Act 2003 and regulations
National Environmental Protection (Movement of Controlled Waste between States and Territories) Measures as Varied December 2004
Occupational Safety and Health Act 1984 and regulations
Road Transport Act 1985
Emergency Management Act 2005
Commonwealth Legislation
Protection of the Sea (Prevention of Pollution from Ships) Act 1983

13.2 Codes and Standards

Other codes or standards that may be relevant include:

+ AS/NZS ISO 9001:2000 – Quality Management Systems – Requirements;
+ AS/NZS ISO 14001:2016 – Environmental Management Systems;
+ AS/NZS ISO 45001:2018 – Occupational Health and Safety Management Systems;
+ AS/NZS ISO 31000:2009 – Risk Management – Principles and Guidelines;
+ AS/NZS 4452:1997 – The storage and handling of toxic substances;
+ AS/NZS 5667.10:1998 – Water Quality – Sampling – Guidance on sampling of waste waters;
+ AS/NZS 3833: 2007 - The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers;
+ AS 1692-2006: Tanks for flammable and combustible liquids;
+ AS 1940:2017 The storage and handling of flammable and combustible liquids;
+ APPEA, 2008: Code of Environmental Practice;
+ DWER, 1996 (as amended 2018): Landfill Waste Classifications and Waste Definitions;
+ Australian Government, 2018: National Waste Policy: Less Waste – More Resources; and
+ DNV 2.7-1 Offshore Containers.

13.3 Regulatory Approvals

Regulatory approval will be required for temporary storage, transport, disposal and treatment of waste. Under the SHP-MEE, the WA Department of Water and Environmental Regulation (DWER) is the relevant Regulatory Authority and Support Agency to DoT for waste management approvals. The standing up of an Operational Area Support Group (OASG), as defined in the MEE, provides a mechanisms for DoT to consult with, and request support from relevant WA Government Agencies, including DWER, during a State waters/onshore spill response.

13.4 WSP Responsibilities

Santos WA's WSP has the capacity to receive and deliver all waste material from oil spill response activities to predetermined disposal points.

Key capabilities include:

+ The WSP will maintain emergency response standby preparedness arrangements:
+ Have access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos WA's worse case spill and waste requirements;
+ Provide primary and secondary contact details for activation of spill response waste management services;
+ Have suitably trained personnel for completing critical tasks in spill response waste management; and
+ Participate in exercising undertaken by Santos WA.
+ Ability to assist in the Control Agency's IAP and Waste Management Sub-plan process as required;
+ Mobilise resources to waste collection identifies by the Control Agency;
+ Ensure waste handling, transport and disposal practices meet legislative requirements;
+ Keep auditable records of waste streams from collection points to final disposal points;
+ Provide regular progress reporting to the Control Agency IMT and a final report relating to quantities and destinations of collected waste;
+ Provide a project manager responsible for the rollout of spill response resources to meet spill response waste management objectives; and
+ Provide location specific Operations Supervisor/s to handle on-site operational aspects (management of personnel and equipment, reporting, liaison with relevant field based spill responders).

13.5 WSP Waste Management Services

13.5.1 Waste Collection

Waste collection points will be determined by the Control Agency. If required, the WSP will provide waste receptacles at collection points and arrange for transporting of waste from collection points to final disposal locations (via staging areas as appropriate). Segregation of oily waste by the Control Agency should occur prior to collection by the WSP to reduce inefficiencies in transport and reduce potential for delays associated with classification of waste types. The WSP will arrange for sampling and analysis of collected waste for the purpose of controlled waste/ landfill site classification as required. Controlled wastes are waste materials which are considered hazardous and are subject to controls regarding their transport, storage, treatment and disposal. Oiled waste is considered controlled waste if;

+ The oiled waste is in liquid form (e.g. emulsions, recovered oil, oily water); and
+ The oiled waste cannot be disposed of at a Class I, II or III landfill site (e.g. oiled debris, oiled sorbents and waste that has been immobilised or encapsulated after treatment with solidifying or gelling compounds).

The type of transport and receptacle provide will depend upon the type and quantity of waste, regulatory requirements, haulage distance and access constraints to the collection site.

13.5.2 Waste Transport

Waste material collected from forward operations areas or port locations by the WSP will be directed to an approved and licensed waste facility. The WSP will comply with the Environmental Protection (Controlled Waste) Regulations 2004 in terms of transportation requirements.

The regulations are designed to ensure the safe transportation of controlled waste, by suitably licenced personnel to an approved location and to monitor and track controlled waste to prevent unauthorized discharge into the environment.

The ability to track the movement of controlled waste is a requirement under the regulations and the controlled waste tracking system (CWTS) provides the DWER with suitable tools to carry out this function. The information from the tracking system is collated by DWER to provide data on priority waste management issues within the state. Only wastes that are transported on gazetted roads will be tracked by this system, once they have been transferred to shore.

13.5.3 Waste Treatment and Disposal

Where possible, waste will be segregated, recycled and reused. The WSP will make available licenced waste handling and transfer facilities to consolidate and recycle waste prior to transport to final disposal and treatment sites.

NWA as Santos WA's current WSP has a DWER licensed liquid and solids waste treatment facility in Karratha with the following capabilities:

+ Liquid and Hazardous Waste Management;
+ Solid Waste Management including the supply of onshore and offshore receptacles;
+ Solid Waste Recycling – materials recovery facility, shredding, baling, etc.;
+ Industrial Services – tank cleaning, marine services, vacuum loading, asset maintenance; and
+ Quarantine Decontamination.

The options for waste treatment and final disposal will depend upon the type and classification of the waste. Oily water can potentially be treated (dewatered) at specialised facilities. NWA as Santos WA's current WSP has options to treat water at Veolia Water and Western Resource Recovery.

Solid wastes will generally be disposed at landfill with the disposal site depending upon the classification of waste. Analysis of solid waste will be undertaken by the WSP to determine which classification the waste belongs to, as per the DWER Landfill Waste Classification and Waste Definitions 1996 (as amended 2018). Most oiled waste will go to Class III or IV landfill. There are multiple Class III facilities in WA but currently only one Class IV facility at Red Hill Landfill, operated by the Eastern Metropolitan Regional Council.

13.6 Waste Equipment Requirements

Santos WA's WSP will provide all waste storage and transportation equipment required to store and move oily waste from collection points to final destination points. **Table 13-1** provides oily waste storage and transportation equipment commensurate to a worst case spill, and resultant worst case waste generation, across all Santos WA operations. Santos WA's WSP can provide for the equipment requirements detailed in **Table 13-1.**

Table 13-1: WSP indicative vehicle and equipment availability

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (t)
Waste removal					
Skip Lift Truck	12	Lift up to 15 Tonnes	Servicing of skip bins	7	630
Front Lift Trucks	10	28 m^3 Body	Servicing of front lift bins	7	784
Side Loading Truck	10	18 m^3 Body	Servicing of Mobile Garbage Bins (MGB's)	7	504
Hook Lift Truck	5	70 Tonne rated	Servicing of hook lift bins	7	980
Flat Bed Truck	16	15 pallet spaces	Servicing of bins	7	840
Waste storage					
MGB's	500	240 litres	Mobile bins	2	48
Offshore 8 pack Lifting Cradle (MGB's)	2	16 x 240 litre MGB'S	Able to remove 16 x 240L MGB'S simultaneously	continuous	
Lidded Bins	6	1,100 litres	Contain various waste streams	2	13
Front Lift Bins	50	3 m^3	Various waste streams	2	300
Front Lift Bins	25	4.5 m^3	Various waste streams	2	225
Offshore Rated Front Load Bins	100	3 m^3	Various waste streams	2	600
Offshore Rated Bins	45	7 m^3	Various waste streams	2	630
Marrell Skip Bins	60	6-9 m^3	Various waste streams	2	960
Hook Lift Bins	12	15-30 m^3	Various waste streams	25	6900
Forklift	4	4 tonne Forklift	All areas	continuous	

14. Scientific Monitoring Plan

Oil spill scientific monitoring is the principal tool for detecting and quantifying the level of environmental impact to sensitive receptors from an oil spill and the subsequent level of post- spill recovery. Santos WA is required to have oil spill scientific monitoring plans and in place for Petroleum activities in State and Commonwealth waters, and arrangements in place to implement the scientific monitoring.

In the event of a spill entering into State waters, DoT as the relevant Control Agency may assume responsibilities for coordinating scientific monitoring under advice from the State Environmental Science Coordinator (ESC) provided through DBCA. If this occurs, Santos WA will provide all necessary resources to aid DoT in planning and implementation of scientific monitoring.

14.1 Objectives

The overarching objective of Santos WA's Scientific Monitoring Plans (SMPs) is to provide guidance to staff, consultants and contractors in developing a monitoring program for detecting impacts and recovery to environmentally sensitive receptors contacted by a spill.

Receptor-specific SMPs have different objectives as outlined in

Appendix B1.

Refer to **Section 17** for the Controls, Performance Outcomes, Standards and Measurement Criteria to meet this objective.

14.2 Industry Guidelines

The NOPSEMA *Information Paper: Operational and Scientific Monitoring Programs (OSMPs)* sets out general principles and practical advice to assist operators in their planning for, and application of, fit-for-purpose SMPs.

14.3 Monitoring Background

Scientific monitoring activities have different objectives to Operational Monitoring, (refer to **Section 8**), which significantly influences the monitoring methods likely to be used, the degree of scientific rigour required to meet the monitoring objectives, and the scope of studies.

Operational monitoring (**Section 8**) is monitoring undertaken to obtain information which will provide situational awareness and assist in the planning and execution of the oil spill response. In contrast, scientific monitoring is undertaken to provide indicative or quantitative data for short term and longer term environmental effects assessment. **Table 14-1** provides the characteristics of each of the monitoring types.

Table 14-1: Characterisation summary of spill monitoring types

Monitoring Classification	Character or Criteria
Operational	• Results generally required rapidly • Lower requirement for statistical strength • Lower requirement for the identification of control sites or to demonstrate baseline conditions • Concentration on key habitats or species that are indicators of biological community health, are of particular 'value', or have slow recovery times • Includes monitoring to help predict environmental effects or define the sensitivity of resources to guide spill response actions
Scientific	• Need for high statistical strength (e.g. potentially large number of samples or sample sites) • Need for high quality 'control' areas where practicable

14.4 Scientific Monitoring Plans

Santos WA has developed receptor-specific scientific monitoring plans (SMPs) relevant for worst case spills across all of its operations. Key elements of the SMPs, including objectives, initiation/termination criteria, methodologies and analysis/reporting requirements are provided in

Appendix B1, with the full detail and supporting information provided in the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099).

The relevance of SMPs to a spill incident will be informed through operational monitoring of the spill and the potential contact of sensitive receptors. Specific initiation criteria for each SMP are detailed in

Appendix B1.

On the basis of spill trajectory modelling for worst case spill scenarios associated with the Activity, the SMPs most applicable to worst case spills associated with the Activity are outlined in **Table 14-2**, however, the actual SMPs will only be known at the time of a spill.

Table 14-2: SMPs most applicable to worst case spills outlined in this OPEP

Study	Title
SMP1	Water Quality
SMP2	Sediment Quality
SMP3	Sandy Beaches and rocky shores
SMP4	Mangroves
SMP5	Intertidal mudflats
SMP6	Benthic Habitats
SMP7	Seabirds and Shorebirds
SMP8	Marine Megafauna
SMP9	Marine Reptiles
SMP10	Seafood Quality
SMP11	Fish, Fisheries and Aquaculture

14.5 Scientific Monitoring Service Providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos WA by Monitoring Service Providers (MSPs). Astron Environmental Services (Astron) is currently Santos WA's primary MSP for the implementation of SMPs.

Santos WA holds a contract with Astron for the provision of standby monitoring services. For SMPs where Astron requires the technical support of additional MSPs, Astron will sub-contract as required. This is considered normal practice for MSPs given the limited ability of any single provider to provide all expertise and equipment across the multitude of marine and coastal scientific disciplines.

As per the Santos WA Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162), Astron provides the following scientific monitoring services to Santos WA:

- 24/7 monitoring support accessed through 24 hr call out number;
- Provision of a suitably trained Monitoring Coordination Team including a Monitoring Coordinator, Monitoring Operations Officer, Planning and Logistics Officer and Safety Officer;
- Provision of Technical Advisors and Field Teams (staff and contractors) for first strike deployments;
- Maintenance of standby monitoring equipment;
- Monthly personnel capability reports;
- Provision and review of Scientific Monitoring Sub-plans;

- Provision and review of Standby Service Manual (EA-00-RI-10162) and associated response activation forms; and
- Participation in drills and exercise.

Astron's capability (as of October 2020) for provision of resources to implement SMPs is provided in **Appendix B3**. Capability Statements are provided monthly and available to Santos WA IMT Environment Team Leaders through the Emergency Response Intranet Page.

14.6 Activation

In the event that one or more SMPs are activated, as per the initiation criteria for each SMP (

Appendix B1), the Activation Process outlined in

Appendix B2 will be followed, including the completion of an Activation Form.

The Santos WA IMT Environment Team Leader (ETL) with support from IMT Environment Team members is responsible for activating Astron as the primary MSP. The Santos WA Environment Team will assist the Astron MCT and relevant Technical Advisors in defining the monitoring study design, monitoring locations and field methodologies based on Operational Monitoring information (e.g. spill modelling and aerial surveillance information), relative location of sensitive receptors to the spill and the timing of the spill with respect to seasonality of sensitive receptors.

This process will identify monitoring operational objectives and resourcing/ mobilisation requirements which the Environment Team Leader will feed back to the IMT for approval.

In the event that a designated Control Agency takes command of scientific monitoring, Santos WA will follow the direction of the Control Agency providing planning and resourcing support through its MSPs as required.

15. Forward Operations Plan

The IMT and CST operate from Perth within the Santos WA IMT and CST rooms. These rooms are equipped and subject to reviews and updates as detailed in the Incident Command and Management Manual (SO-00-ZF-00025).

15.1 Forward Operating Base (FOB)

For a significant Level 2/3 response requiring coordination of resources deployed to the field, Santos WA will set up a FOB. For a level 2/3 spill crossing from Commonwealth to State waters (cross-jurisdictional spills) DoT will establish a FOB. **Sections 2.3.1** and **2.4.3** detail requirements for Santos WA providing personnel to a DoT FOB.

Depending upon the scale of the incident, Santos WA's Dampier facilities leased from Toll Energy may be used. These facilities are located in Toll Energy's Yard 1 and Yard 2 on Streckfuus Road Dampier; the facilities consist of a conference room and multiple offices that could be used as break-out rooms.

The Toll Energy Dampier facilities are connected to the Santos WA internet and telephone system. These facilities are also available to the DoT to establish a FOB for State based response.

15.2 Staging Areas

Staging areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Control Agency for shoreline response activities.

15.3 Freight Movement

The transportation of all equipment and services, as required, will be through Santos WA's third party logistics providers.

15.4 Transport

Transportation on shoreline locations will be supported by 4x4 vehicles and all-terrain vehicles. These can be supplied by locally and nationally through hire/purchase 3rd parties.

15.5 Decontamination

Decontamination areas (HDPE lining provided through the provider of PPE) will be constructed for maintaining the integrity of the 'Zones' at shoreline Staging Areas, location and terrain permitting and as directed by the DoT as Control Agency for the shoreline response. Contaminated water from the decontamination areas will be regularly pumped out. All contaminated wastewater will be decanted into suitable transportable medium provided by Santos WA's WSP for removal.

15.6 Ablutions

Staging Areas may be supported by toilet / ablution solutions; these solutions will be dictated by the location and terrain of the clean-up operations. Available facilities include:

+ Portable Toilets;
+ Trailer Mounted Toilets; and
+ Transportable Toilets.

These solutions are chemical and fresh water based, and supported by weekly / fortnightly flushing servicing. The requirement of the situation will dictate if this service is supplied out of Karratha or Perth. Santos WA's WSP can provide disposal as required of wastewater from ablutions.

15.7 Security

To ensure that Staging Areas are secure, Santos WA can provide temporary fencing to contain operations / equipment during the clean-up; suppliers of temporary fencing are available in Karratha, or larger quantities may need to be sourced from Perth. If required the specialist services of security providers will be engaged.

15.8 Messing

Messing and catering facilities can be provided through one of Santos WA's current service providers, under local arrangements as determined by capacity and facilities geographically available.

15.9 Cleaning and Repair

Cleaning and repair of booms and other operational equipment this can be carried out in bunded areas at the supply base facilities.

15.10 Suppliers

All material, associated equipment and services will be sourced, where possible, through existing Santos WA suppliers. Service Orders will be raised if other/new suppliers are to be engaged to provide services etc. in the event of an oil spill.

15.11 Accommodation

Accommodation options for field responders and FOB personnel will be dictated by proximity to their respective activity areas, to ensure maximum utilisation of the shift time available.

Mainland accommodation is available at Dampier/ Karratha, Onslow and Exmouth. Santos WA's Devil Creek accommodation close to Karratha may also be used.

Where possible local facilities will be utilised to accommodate response personnel, however transportable accommodation and messing facilities can be supplied through contract suppliers if required.

Santos WA has access to transportable accommodation and messing facilities supplied through Santos WA contracted service provider and its subcontractors.

Where additional support and remote accommodation is required, Santos WA would engage the market for provision of a complete service for remote messing and accommodation; inclusive of transportation, laundry, potable water etc**.**

Transportation to respective work sites would be facilitated via modal and multimodal transport solutions, dictated by the geographical constraints of each site. Under current contractual arrangements, Santos WA has access to transportation providers for Land, Air and Marine operations. In general, from accommodation locations to operational areas transport would be via road using the services of a third party supplier. Should additional services be required to meet the demand, this would be engaged under a Service Agreement as determined and authorised by the IMT.

15.12 Providoring

Providoring arrangements when utilising local facilities would be covered under Service Orders / Purchase Order Terms and Conditions. Santos WA has existing contracts with local supplies in Karratha who could be used for additional support for providoring. These supplies would be transported to the respective spill response staging area by one of Santos WA's third party logistics providers.

For transportable and remote messing, the providoring requirements would be provided directly through accommodation provider including the transportation thereof.

15.13 PPE

Santos WA would utilise the services of specialist providers of PPE for response operations. All PPE would be sourced in Perth and transported by one of Santos WA's third-party logistics providers to the forward operating centres.

The disposal of contaminated PPE is provided by Santos WA's WSP.

PPE requirements for spill responders is detailed in the Santos WA Oil Spill Response Health and Safety Manual (SO-91-RF-10016).

15.14 Response Personnel Clean-up Crew

Santos WA can provide an initial clean-up workforce from existing Santos WA and AMOSC staff and contractors. This could provide up to 150 personnel immediately from Varanus Island, Dampier Supply Base, Karratha and Perth office, and AMOSC core group responders from around Australia.

Santos WA has an arrangement in place with a number of service providers its day-to-day operations which would be utilised for providing spill response personnel. Additionally, Santos WA would access labour hire arrangements for untrained work force required for low skill labour intensive operations, including shoreline clean-up and roles within an oiled wildlife facility. On the job training and inductions would be provided to enable personnel to perform their functions safely and effectively.

15.15 Radio communications

Santos WA would utilise the services of a specialist communication provider, mutual aid arrangements, or control agency arrangements to access hand-held and vehicle mounted UHF radios to support response and clean-up personnel. Portable deployed repeater stations (battery or mains powered) can be positioned along the shoreline to provide a 'voting' system for transmitting and receiving during the clean-up operation.

16. Spill Response Termination

The decision to terminate the spill response is made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role (e.g. DBCA). This decision will be made with consideration of the following factors:

- The efficacy and benefit of current response options;
- Any potential for additional pollution;
- Any potential for additional environmental damage caused by further spill response efforts; and
- An assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.

A NEBA will be conducted to inform the decision making process. Termination criteria are defined within each section of contingency response activities defined within the OPEP.

Upon conclusion of the spill response activity, Santos WA will complete the following tasks:

- Prepare detailed reports and collate all documents;
- Report on the performance objectives of each individual spill response that was mobilised;
- Undertake an inventory of consumables and prepare accounts;
- Arrange for the return of equipment;
- Arrange for the refurbishment of consumed equipment;
- Conduct an investigation into the cause of the incident and report to relevant authorities; and
- Assess long-term environmental monitoring requirements.

17. Performance Outcomes and Performance Standards

The provision of Environmental Performance Outcomes, Performance Standards and Measurement Criteria for control measures used to prevent or mitigate environmental impacts is a requirement for Environment Plans (including an Oil Pollution Emergency Plan) under the OPGGS (E) Regulations. Sections below outline the Performance Outcomes, Controls, Performance Standards and Measurement Criteria for spill response measures that will be used to mitigate a hydrocarbon spill from activities covered by the EP/OPEP.

Table 17-1 through to **Table 17-** list the Environmental Performance Outcomes, Controls, Performance Standards and Measurement Criteria required for each spill response under this OPEP.

Table 17-1: Source Control: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Source control	**Response Preparedness**		
	Vessel Spill Response Plan (SOPEP/SMPEP)	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records Inspection records
		Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP	Inspection records
	Response Implementation		
Source control - vessel collision	As per the vessel SOPEP	Actions to control spill associated with a vessel incident followed in accordance with SOPEP	Vessel logs

Table 17-2: Monitor and Evaluate: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Monitor and Evaluate	**Surveillance**	**Response Preparedness**	
	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	MSA with aircraft supplier	Master Services Agreement (MSA) in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos WA trained Aerial Observers	Santos WA maintains a pool of trained aerial observers	Exercise Records Training Records
	AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Access to certified Unmanned Aerial Vehicles (UAV) providers	Maintenance of contract for access to UAV providers	Contract with service provider
	Surveillance	**Response Implementation**	
	Vessel surveillance	Vessel Surveillance strategy initiated within 90 minutes following request from IMT (i.e. begin to source vessels for surveillance)	Incident log
		Daily observation reports submitted to IMT until termination criteria is met	Incident log

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Vessels and aircraft compliant with Santos WA's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos WA's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	Completed vessel statement of conformance
		Aircraft comply with Santos WA's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos WA's Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance	Aerial Surveillance initiated within 3 hours following request from IMT	Incident log
		Following initiation two passes per day of spill area by observation aircraft provided	Incident log
		Trained Aerial Observers supplied from Day 2 of response	Incident log
		Flight schedules are maintained throughout response	Incident Action Plan
		Observers completed aerial surveillance observer log following completion of flight	Aerial Observer Logs
	Tracking Buoys	**Response Preparedness**	

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Tracking buoys available	Maintenance of 12 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests
		Response Implementation	
		Tracking buoys mobilisation within 2 hours of request from On-Scene Commander or Operations Team Leader	Incident log
	Oil Spill Modelling	**Response Preparedness**	
	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract
	Oil Spill Modelling	**Response Implementation**	
	Oil spill modelling available	Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill	Incident Log
		Modelling delivered to IMT within 2 hours of request to service provider	Incident Log
	Satellite Imagery	**Response Preparedness**	
	Satellite imagery	Contract in place with third party provider to enable access and analysis of satellite imagery	Contract with service provider
	Satellite Imagery	**Response Implementation**	

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Satellite imagery	Data incorporated into common operating picture and provided to spill modelling provider	Incident Log and Incident Action Plan
	Oil and Oil in Water Monitoring	**Response Preparedness**	
	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Oil and Oil in Water Monitoring	**Response Implementation**	
	Initial Oil Characterisation	Oil samples sent to laboratory for initial fingerprinting	Laboratory Sample Chain of Custody Record
		Oil samples to be sent for laboratory ecotoxicity testing of oil	Laboratory Sample Chain of Custody Record
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum 5 species' tests) within 24 hours of receiving all results	Ecotoxicity report
	Operational Oil and Oil in Water Monitoring	Identify if water quality monitoring is required within 2 hours of receiving spill and receptor information	Incident Log
		Operational water sampling and analysis surveys mobilised within 72 hours of monitoring action plan approval	Incident Log
		Daily operational water sampling provided to IMT	Incident Log

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Shoreline Assessment	**Response Preparedness**	
	AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	AMOSC Participating Member Contract
	Shoreline Assessment	**Response Implementation**	
	Shoreline assessment	Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA	Incident Action Plan
		Santos WA will make available AMOSC Core Group Responders for shoreline and coastal habitat assessment positions to the Control Agency	Incident Log
		Shoreline assessment reports provided to the IMT daily detailing the assessed areas to maximise effective utilisation of resources	Shoreline Assessment Reports
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met

Environmental Performance Outcome	*Implementation of monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are mapped out in sensitive habitat areas.	IAP or Field Task Assignment demonstrates demarcation is provided to field team.
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met.

Table 17-3: Mechanical Dispersion: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Mechanical Dispersion	**Response Implementation**		
	Mechanical Dispersion Plan Safety Plan Operational NEBA	Mechanical dispersion is to be conducted during daylight only, once the safety plan has been developed and Operational NEBA confirms suitability and environmental benefit	Incident Log IAP

Table 17-4: Shoreline Clean-up: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Response Implementation		
	Shoreline Clean-Up Plan	Santos WA IMT to confirm protection priorities in consultation with DoT	IAP Incident Log
		Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit, if not otherwise done by DoT	Dated operational NEBA indicates completion prior to shoreline clean-up activities commencing
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination, if not otherwise done by DoT	NEBA Template
		IAP Shoreline Clean-up Sub-plan developed to provide oversight and management of shoreline clean-up operation, if not otherwise done by DoT	Dated Shoreline Clean-up Sub-plan indicates preparation prior to shoreline clean-up operations commencing
		Clean-up strategies will be implemented under the direction of DoT as the HMA	DoT Incident Action Plan

Environmental Performance Outcome	*Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Santos WA will make available AMOSC Core Group Responders for shoreline clean-up team positions to the Control Agency	Incident Log
		Santos WA will make available to the Control Agency equipment from Santos WA, AMOSC and OSRL stockpiles	Incident Log
		NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan	Dated NEBA and IAP
	Prioritise use of existing roads and tracks	Unless directed otherwise by the designated Control Agency (i.e. DoT) access plans for shoreline operations will prioritise use of existing roads and tracks	IAP demonstrates requirement is met.
	Soil profile assessment prior to earthworks	Unless directed otherwise by the designated Control Agency (i.e. DoT) a soil profile assessment is conducted prior to earthworks	Documented in IAP and Incident Log.
	Pre-cleaning and inspection of equipment (quarantine)	Vehicles and equipment provided by Santos WA are verified as clean and invasive species free prior to deployment to offshore islands	Documented in IAP and Incident Log.
	Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Unless directed otherwise by the designated Control Agency (i.e. DoT) a Heritage Advisor is consulted if shoreline operations overlap with areas of cultural significance	Documented in IAP and Incident Log.
	Select temporary base camps in consultation with DoT and DBCA	Any establishment of forward staging areas at shoreline areas done under direction or in consultation with DoT and DBCA	Documented in IAP and Incident Log.

Environmental Performance Outcome	*Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are mapped out in sensitive habitat areas.	IAP demonstrates requirement is met.
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met.
	Stakeholder consultation	Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas	Consultation records

Table 17-5: Oiled Wildlife Response: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	***Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanase wildlife.***		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Oiled Wildlife Response	**Response preparedness**		
	Maintenance of access to oiled wildlife response equipment and personnel	Maintenance of access to oiled wildlife response equipment and personnel through AMOSC, AMSA National Plan and Oil spill Response Limited (OSRL) throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Response Implementation		
	OWR managed in accordance with the WAOWRP	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Wildlife Response Sub-plan developed to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

Table 17-6: Waste Management: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible.*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Waste Management	**Response preparedness**		
	Maintain access to waste management equipment, personnel, transport and disposal facilities	Maintain access to waste management equipment, personnel, transport and disposal facilities throughout activity	Contract with Waste Service Provider for emergency response services
	Response Implementation		
	Implement Oil Pollution Waste Management Plan (SO-91-IF-10053)	Waste Service Provider to appoint a Project Manager within 24 hours of activation	Incident Log
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination.	Incident Log IAP
		Waste Service Provider shall track all wastes from point of generation to final destination	Waste tracking records
		Waste Service Provider to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports

Table 17-7: Scientific Monitoring: Environmental Performance Outcomes, Control Measures, Performance Standards and Measurement Criteria

Environmental Performance Outcome	*Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response*		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Scientific Monitoring	**Response preparedness**		
	Maintenance of Monitoring Service Provider contract for scientific monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Conduct periodical review of existing baseline data sources across the Santos WA combined EMBA	Undertake a review of the status, availability and suitability of existing baseline data sources every 2 years	Baseline data review report
	Response implementation		
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAPs and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log
		Monitoring Service Provider shall commence activation process within 30 mins of initial notification form being received from Santos WA	Monitoring Service Provider records
		Santos WA personnel to support Monitoring Service Provider through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident Log and Monitoring Service Provider records

18. Training, Exercise and Audit

18.1 IMT Training

Training requirements for Santos WA Perth based IMT and CST members are provided within the Santos WA Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) and summarised in **Table 18-1.** The complete list of required oils spill response competency and training qualifications for each IMT role is described in the Incident Command and Manual (Planning) SO-00-ZF-00025)

Table 18-1: Training and exercise requirements for IMT/CST positions

IMT Role	Exercises	Skill Maintenance
Incident Management Team (IMT)	1x Level 2 (Operational) Exercise OR 3 x Level 2 (Operational) Desktop Exercises	Critical Skill Workshops
Crisis Management Team (CST)	1x Level 3 (Strategic) Exercise OR 2 x Level 3 (Strategic) Desktop Exercises	

18.2 Oil Spill Responders

Santos WA has an internal capability of trained oil spill responders that are utilised in a spill response, and has access to external trained spill responder resources (Refer **Table 18-2)**.

Table 18-2: Spill responder personnel resources

Responder	Role	Training	Available Number
Santos WA AMOSC Core Group Responders	Santos WA personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT in the initial response and capable of leading response teams.	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course	12
Santos WA Facility Incident Response Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents	Internal Santos WA training and exercises as defined in each facility's Incident Response Plan On-scene commander to have AMOSC – Oil Spill Response Familiarisation Training.	One IR team per operational facility per shift.
Santos WA Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually).	6
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos WA under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course	As defined in Core Group Member Reports Min.84 Max. 140 (incl. Santos WA).

Responder	Role	Training	Available Number
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos WA-OSRL contract.	As per OSRL training and competency matrix.	18
AMOSC Oil Spill Response Specialists	Professionals, providing technical, incident management and operational advice and assistance available under Santos WA-AMOSC contract.	As per AMOSC training and competency matrix.	8
Oiled Wildlife Response Roles (Level 2-4)	Refer **Section 12.4**		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	Monitoring Coordination Team (MCT) SMP Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports. MCT – 5 personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision	No previous training required - on the job training provided	Nominally over 1,000
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

In addition to **Table 18-2**, the following resources are available to Santos WA:

- National Plan: National Response Team (NRT) – Trained oil spill response specialists including aerial observers, containment and recovery crews deployed under the direction of AMSA and IMT in a response. The NRT is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2014);
- SHP-MEE: State Response Team (SRT) and NW Regional Response Team (RRT) - Oil pollution response teams available to assist under the jurisdiction of the DoT. SRT and RRT members remain trained and accredited in line with SHP-MEE requirements; and
- In the event of a spill the trained spill responders outlined in **Table 18-2** would be required to undertake various roles in key spill response operations including operational monitoring, shoreline protection, shoreline clean-up, oiled wildlife response and scientific monitoring.

18.3 Testing Arrangements

Following acceptance of an OPEP, the arrangements of the plan are tested through a communications test to all external agencies and companies with roles defined within the plan. The Communications Tests are repeated annually for activities that extend longer than 1 year.

CST and IMT members undertake Workshops and Exercises as outlined within the Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) to clarify and familiarise themselves with their respective roles and responsibilities within OPEPs and other Emergency Plans. Learning aids are also introduced through these workshops to assist improvement of capability for the personnel to perform the

functions of their role. Santos WA conducts scenario-based IMT/CST workshops and desktop and activation exercises each year as per the Incident and Crisis Management Exercise and Training Plan (SO-92-HG-10001). Oil spill scenarios are included as part of the annual schedule which build competency of IMT/CST roles. Once IMT/CST exercise are completed, participation records are entered into the Santos WA Training and Induction Database (Learning Management System).

Testing of key response provider arrangements are done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider is assessed against the performance requirement.

Field deployment tests are undertaken by Santos WA as a sole responder and through Santos WA's involvement in multi-operator response deployment exercises.

Key actions arising from exercises are recorded and tracked through the Santos WA Action Tracking System.

Progress of training, exercise and workshop completion against the schedule is tracked and reported against on a monthly basis

18.4 Audits

Oil spill response audits will follow the Santos Assurance Management Standard SMS-MS15.1 and are scheduled as per the annual Assurance Schedule. Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit any opportunities for improvement and /or corrective actions required (non-conformances) will be formally noted and discussed with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong and Fremantle is audited every two years under the direction of AMOSC's participating members. The intent of this audit is to provide assurances to Santos WA and associated members of AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in Oil Pollution Emergency Plans and AMOSC's Service Level Statement.

The deployment readiness and capability of OSRL's oil spill response equipment and personnel in Singapore is audited every two years. The intent of this audit is to provide assurances to Santos WA's of OSRLs ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos WA's Oil Pollution Emergency Plans and OSRL's Service Level Agreement.

The objectives and frequency of oil spill response testing and auditing relevant to Archer 3D MSS oil spill response is summarised in **Table 18-3.**

Table 18-3: Oil spill response testing arrangements

Exercise	Objective	Frequency	Recording and review
Communication Test	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP.	Required for every approved OPEP. When response arrangements have changed. At least annually.	Any results of the test are recorded in a Test Report. Corrections are updated within the Incident Response Telephone Directory (SO-00-ZF-00025.2)
IMT/CST Workshops	To refresh IMT & CST roles and responsibilities and provide familiarisation with OPEP processes and arrangements.	Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) Typically 3-4 per Quarter are run	All workshops undertaken are recorded in Santos WA's Learning Management System.
OPEP Exercise	To familiarise IMT with functions and process in response to a simulated oil spill scenario To activate IMT/CST roles in response to oil spill scenario and test arrangements contained within OPEP	As per Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) One or more per year.	All exercises undertaken are recorded in Santos WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System.
Response arrangement tests	Tests of third party response arrangements outlined within the OPEP either as part of OPEP exercise or as standalone desktop tests	As per Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)	Test reports are recorded Any recommendations are recorded are tracked in Santos WA's Action Tracking System.
Equipment deployment exercises/ tests	To focus on Santos WA's deployment capability. To inspect and maintain the condition of the Santos WA oil spill response equipment. To maintain training of field response personnel.	When new response equipment is added. As per Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001) The following Santos WA-owned equipment is inspected and/or tested Tracker buoys Offshore boom/ nearshore boom Power packs Vessel dispersant spray systems	Reports are generated for exercises and recorded in Santos WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System. Tracker Buoy tests are recorded.
AMOSC audit	To test deployment readiness and capability of AMOSC.	Every 2 years.	Undertaken by two of AMOSC's participating members and the audit report made available to members.
OSRL Audit	To test deployment readiness and capability of OSRL in Singapore.	Every 2 years.	Undertaken by Santos WA or other member company in consultation with Santos WA

19. Stakeholder Engagement

In preparing this OPEP a number of parties were identified to provide spill response services and actions to support the OPEP. Santos WA's OPEP stakeholders are identified through evaluation of the Activity and spill potential.

Where required, specific agreements or contracts have been put into place with agencies and organisations so that roles, responsibilities and service requirements are understood. However, some services provided by organisations nominated in this OPEP are business as usual services (for example helicopter and vessel support) that support Santos WA' ongoing offshore activities.

Stakeholders providing a regulatory function or support service in a spill response for the Archer 3D MSS Activity are outlined in **Table 19-1**. These stakeholders are relevant to spill response arrangements supporting other Santos WA activities, including ongoing operations which are continual throughout the year. For that reason engagement with these stakeholders is continual and is largely achieved through Santos WA's ongoing spill response testing, exercising and assurance activities as detailed in **Section 18**. However, where noted in **Table 19-1**, consultation specific to the revision of this document has been undertaken.

Santos WA seeks to establish and maintain two-way lines of communication between itself and all potential relevant persons throughout the life of all activities across the North West Shelf. Consultation is continuous and ongoing to maintain best practice in the field of oil spill response. The OPEP will continue to be reviewed, and updated as required, considering any identified improvement opportunities or changes in a stakeholder's position.

Table 19-1: Stakeholder Consultation

Engaged with		Assessment of Consultation Undertaken
Function	**Stakeholder**	
Australian Marine Oil Spill Centre (AMOSC)		Historically, AMOSC reviewed oil spill contingency plans and OPEPs and has been satisfied with the description of their support. AMOSC now requests to only view OPEPs once they are accepted by the regulator and before the Activity commences. Roles and responsibilities defined in the OPEP reflect the arrangements established under contract conditions as a Participating Member of AMOSC under the AMOSPlan, a cooperative arrangement for response to oil spills by Australian oil and associated industries. Continuous consultation with AMOSC occurs through the implementation and participation in Santos WA's exercise and training program and through industry engagement events throughout the year, including AMOSC member forums.
Oil Spill Response Limited (OSRL)		OSRL operates under contract conditions with Santos WA. All arrangements defined in the OPEP nominating OSRL reflect contracted services. Continuous consultation with OSRL occurs through the implementation of Santos WA's exercise and training program and through industry engagement events throughout the year.
Australian Marine Safety Authority (AMSA)		Historically AMSA reviewed OPEPs and are satisfied with the description of their support. AMSA now request to only view OPEPs once they are accepted by the regulator and before the Activity commences Roles and responsibilities defined in the OPEP reflect the arrangements established within a Memorandum of Understanding between AMSA and Santos WA.
Logistics providers		Santos WA maintains local logistics and global freight forwarding service under contract conditions. All arrangements defined in

Engaged with		Assessment of Consultation Undertaken
Function	Stakeholder	
		the OPEP reflecting freight forwarding services reflect contracted services. These services are business as usual services, however arrangements specific to supporting spill response are tested and exercised as part of Santos WA training and exercise schedule.
Vessel providers		Vessel providers operate under contract conditions to provide day to day services to Santos WA's offshore operations. These arrangements will be used to support spill response activities included in this OPEP. Specific engagement, training and testing related to spill response operations is included in Santos WA training and exercise schedule.
Aircraft providers		Aircraft providers operate under contract conditions to provide day to day services to Santos WA's offshore operations. These arrangements will be used to support spill response activities included in this OPEP. Specific engagement, training and testing related to spill response operations is included in Santos WA training and exercise schedule.
Waste contractor		A waste service provider operates specific contract conditions with Santos WA for oil spill response waste service provision. All arrangements defined in the OPEP nominating waste services reflect contracted services. Engagement and testing of this service is included in Santos WA training and exercise schedule.
Spill Modelling and Scientific Monitoring Providers		Santos WA maintains standby contracts for technical spill modelling and scientific monitoring services. The providers are regularly engaged through Santos WA's exercise program.
Department of Water and Environmental Regulation (DWER) (Waste Management Branch)		The DWER Waste Management Division, has reviewed and has had input into defining the Waste Management Plan contained in Santos WA oil spill contingency plans or OPEPs. The waste management processes do not change between OPEPs, so the original consultation is sufficient for the OPEP.
Department of Biodiversity, Conservation and Attractions (DBCA)		DBCA were contributors to development of the WA Oiled Wildlife Response Plan (OWRP) defined in the OPEP. Descriptions of the Santos WA interface with the WAOWRP contained within the OPEP are consistent with the intent of DBCA (and AMOSC) for oiled wildlife response. Santos WA will continue to consult with DBCA on scientific monitoring as its scientific monitoring plan and associated arrangements are updated. DBCA was provided the Archer 3D MSS Stakeholder Consultation package via email on 22 September 2020. DBCA responded on 23 September 2020 confirming that based on the information provided, DBCA has no comments to provide in relation to its responsibilities under the Biodiversity

Engaged with		Assessment of Consultation Undertaken
Function	Stakeholder	
		Conservation Act 2016 and the Conservation and Land Management Act 1984. Santos WA responded 1 October 2020 acknowledging response.
Department of Primary Industries and Regional Development – Fisheries (DPIRD Fisheries)		DPIRD was provided the Archer 3D MSS Stakeholder Consultation package from Santos WA via email on 22 September 2020. A follow up email was sent on 28 October 2020. There has been no response from DPIRD to date, and in the past there has been no specific response related to oil spill arrangements or OPEP. Santos WA will continue to consult with DPIRD.
Director of National Parks (DNP)		The Director of National Parks (DNP) was provided the Archer 3D MSS Stakeholder Consultation package via email on 22 September 2020. DNP responded on 22 October 2020 which included the following relevant information to the OPEP: In the case of an emergency response, the DNP should be made aware of oil/gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. Notification should be provided to the 24-hour Marine Compliance Duty Officer. The notification should include: + titleholder details + time and location of the incident (including name of marine park likely to be effected) + proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc.) + confirmation of providing access to relevant monitoring and evaluation reports when available; and + contact details for the response coordinator. Santos WA responded on 22 October 2020 acknowledging the DNP comments and advising Santos WA has followed the NOPSEMA guidance note in preparation of the EP. In addition, the Oil Pollution Emergency Plan (OPEP) for the activity includes DNPs notification requirements. These can be found in **Section 5** of this OPEP. Notification requirements to the 24-hour Marine Compliance Duty Officer in the event of oil pollution incidences which occur within a marine park or are likely to impact on a marine park, have been included in **Section 5** of this OPEP.
Department of Transport (Hazard Management Authority)		All roles and responsibilities defined within the OPEP for DoT reflect the arrangements defined by the DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements (July 2020)

Engaged with		Assessment of Consultation Undertaken
Function	Stakeholder	
		These arrangements are exercised during Santos WA's exercise and training program, most recently in November 2020. DoT were provided the Archer 3D MSS Stakeholder Consultation package via email on 22 September 2020. DoT responded on 21 October 2020 advising if there is a risk of a spill impacting State waters from the proposed activities, please ensure that the Department is consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020). Santos WA responded on 22 October 2020 and advised that as required in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020), Santos WA will provide the department a copy of the Archer 3D Marine Seismic Survey OPEP upon submission to NOPSEMA, and a copy of the Archer 3D Marine Seismic Survey OPEP DoT Consultation Package. DOT responded on 27 October 2020 and acknowledged Santos WA' notification.
Town of Port Hedland Shire		Consultation with the Town of Port Hedland Shire has been conducted. Town of Port Hedland Shire will be notified and included in the spill response planning in the event locations in their jurisdiction are contacted by oil.

20. OPEP Administration

20.1 Document Review and Revision

The document may be reviewed and revised, if required, in accordance with the Santos WA Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

- When major changes have occurred which affect Oil Spill Response coordination or capabilities;
- Changes to the Environment Plan that affect Oil Spill Response coordination or capabilities (e.g. a significant increase in spill risk);
- Following routine testing of the OPEP if improvements are identified; or
- After a Level 2/3 spill incident.

The extent of changes made to the OPEP and resultant requirements for regulatory resubmission will be informed by the relevant State and Commonwealth regulations, i.e. the OPGGS (E) Regulations, P(SL)(E) Regulations and PP(E) Regulations.

20.2 OPEP Custodian

The custodian of the OPEP is Santos WA Senior Oil Spill Response Coordinator:

Position:	Senior Oil Spill Coordinator
Location	Santos WA Perth Office

21. References

AMSA (2015). Technical guidelines for preparing contingency plans for marine and coastal facilities. Prepared by the Australian Maritime Safety Authority, January 2015.

Department of Transport (Sep 2020) State Hazard Plan - Maritime Environmental Emergencies (MEE)

DoT (2015) Western Australia Oil Spill Contingency Plan. https://www.transport.wa.gov.au/mediaFiles/marine/MAC-P-OSCP-OilSpillContingencyPlan2015.pdf

GHD Pty Ltd (GHD). (2020). Archer 3D Seismic Survey. Diesel Spill Modelling. October 2020. Report to Santos WA Energy Ltd.

ITOPF (2014). Use of dispersants to treat oil spills. Technical information paper 4. 6 pp.

McKinney, K. and Caplis, J. (2017) Evaluation of oleophilic skimmer performance in diminishing oil slick thicknesses. International Oil Spill Conference Proceedings. 2017. 1366-1381. 10.7901/2169-3358-2017.1.1366.

NOAA (2013). Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments. https://response.restoration.noaa.gov/sites/default/files/Characteristics_Response_Strategies.pdf

Appendix A1: Marine Pollution Report (POLREP)

Department of **Transport**

Marine Pollution Report (POLREP)

BEFORE completing this form please contact the MEER duty officer on (08) 9480 9924 (24hrs). Immediate reporting will enable a rapid response.

Return completed form to:
Maritime Environmental Emergency Response
Department of Transport
Email: marine.pollution@transport.wa.gov.au and rccaus@amsa.gov.au
Phone (08) 9480 9924
Fax: 1300 905 866

INCIDENT DETAILS

Date of Incident: _____ Time of Incident *(24 hr format)*: _____

Location name/description: _____

Incident Coordinates Latitude of spill _____ Longitude of spill _____

Format of coordinates used *(select one)* ☐ *Degrees & decimal degrees* ☐ *Degrees, minutes & decimal minutes* ☐ *Degrees, minutes & seconds*

Description of Incident: _____

POLLUTION SOURCE

☐ Vessel ☐ Land *(Specify)* _____ ☐ Other *(Specify)* _____ ☐ Unknown

Vessel type *(if known)* ☐ Tanker ☐ Container ☐ Bulk ☐ Cargo
☐ Fishing ☐ Defence ☐ Recreational ☐ Other *(Specify)* _____

Vessel name: _____ Flag State / Callsign: _____ Australian vessel? ☐ Yes ☐ No

POLLUTANT

☐ **Oil** *(type)* ☐ Bilge ☐ Diesel ☐ HFO bunker ☐ Crude ☐ Unknown ☐ Other *(Specify)* _____

☐ **Chemical** Name: _____ MARPOL cat / UN Nos: _____

☐ **Garbage** Details/description: _____

☐ **Packaged** Details/description: _____

☐ **Sewage** Details/description: _____

☐ **Other** Details/description: _____

EXTENT

Size of spill *(length & width in metres):* _____

Amount of pollutant, if known *(litres):* _____

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

Weather conditions at site: _____

☐ **Photos taken** Details: _____ held by: _____

☐ **Video taken** Details: _____ held by: _____

☐ **Samples taken** Description: _____ held by: _____

☐ **Items retrieved** Description: _____ held by: _____

ADDITIONAL INFORMATION

Response action undertaken? ☐ Yes ☐ No If yes, provide details below, please include any environmental impact.

Equipment used? ☐ AMSA ☐ State / NT ☐ Industry

Is assistance for an investigation required from DoT ☐ Yes ☐ No

ORIGINAL REPORT SOURCE

Name:_____ Position: _____ Phone: _____

Combat agency:_____ Statutory agency: _____

SENDER DETAILS

Name:_____ Agency: _____ Date:_____

Phone: _____ Fax: _____ Email:_____

PRIVACY STATEMENT

The Department of Transport is collecting the information on this form to enable it to carry out its role as Jurisdictional Authority as per WestPlan - Marine Oil Pollution. The Department of Transport and/or AMSA may give some or all of this information to other government bodies, non-government organisations who have responsibilities under the National Plan, and law enforcement agencies.

Appendix A2: Marine Pollution Situation Report (SITREP)

Marine Pollution Situation Report (SITREP)

Send completed form to:
Maritime Environmental Emergency Response
Department of Transport
PO Box 402 Fremantle , 6159
Email: marine.pollution@transport.wa.gov.au
and rccaus@amsa.gov.au
Fax: 1300 905 866

MARINE POLLUTION SITUATION REPORT (SITREP)

This is advice from the Control Agency of the current status of the incident and the response.

This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

Incident Name:_____ **Ref. No.** _____

Priority ☐ Urgent ☐ Immediate ☐ Standard

Final SITREP? ☐ Yes ☐ No Next SITREP on: _____

Date:_____ **Time:**_____

POLREP Reference: _____

Incident location Latitude_____ Longitude_____

Brief description of incident and impact:

Overall weather conditions:

Summary of response actions to date:

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

SITREP **Prepared By**	Name:	
	Agency:	
	Role:	
	Contact	Telephone
		Fax
		Mobile
	No of Pages Attached:	

Appendix A3: Vessel Surveillance Observer Log

Vessel Surveillance Observer Log – Oil Spill

Survey Details			
Date	Start time:	End Time:	Observers:
Incident:			Area of Survey:
Vessel:			Master:

Weather Conditions	
Wind speed (knots):	Wind direction:
Time high water and height (LAT):	Current direction:
Time low water and height (LAT):	Current speed (nM):
Tide during observations:	Sea state:
Stage of tide during observations (incoming/falling):	Other weather observations:

Slick Details									
Slick grid parameters by lat/long:				Slick grid parameters (vessel speed)		Slick grid dimensions: N/A			
Length Axis:		Width Axis:		Length Axis: N/A		Width Axis	Length		nm
Start Latitude		Start Latitude		Time (seconds)		Time (seconds)	Width		nm
Start Longitude		Start Longitude					Length		nm
End Latitude		End Latitude		Speed (knots)		Speed (knots)	Width		nm
End Longitude		End Longitude					Grid area		km^2

Code	Colour	%age cover observed	Total grid area		Area per oil code		Factor	Oil volume	
1	Silver			km^2		km^2	40-300 L/ km^2		L
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L

Timeline of observations:

Time	Description

Appendix A4: Aerial Surveillance Observer log – Oil Spill

Aerial Surveillance Observer Log – Oil Spill

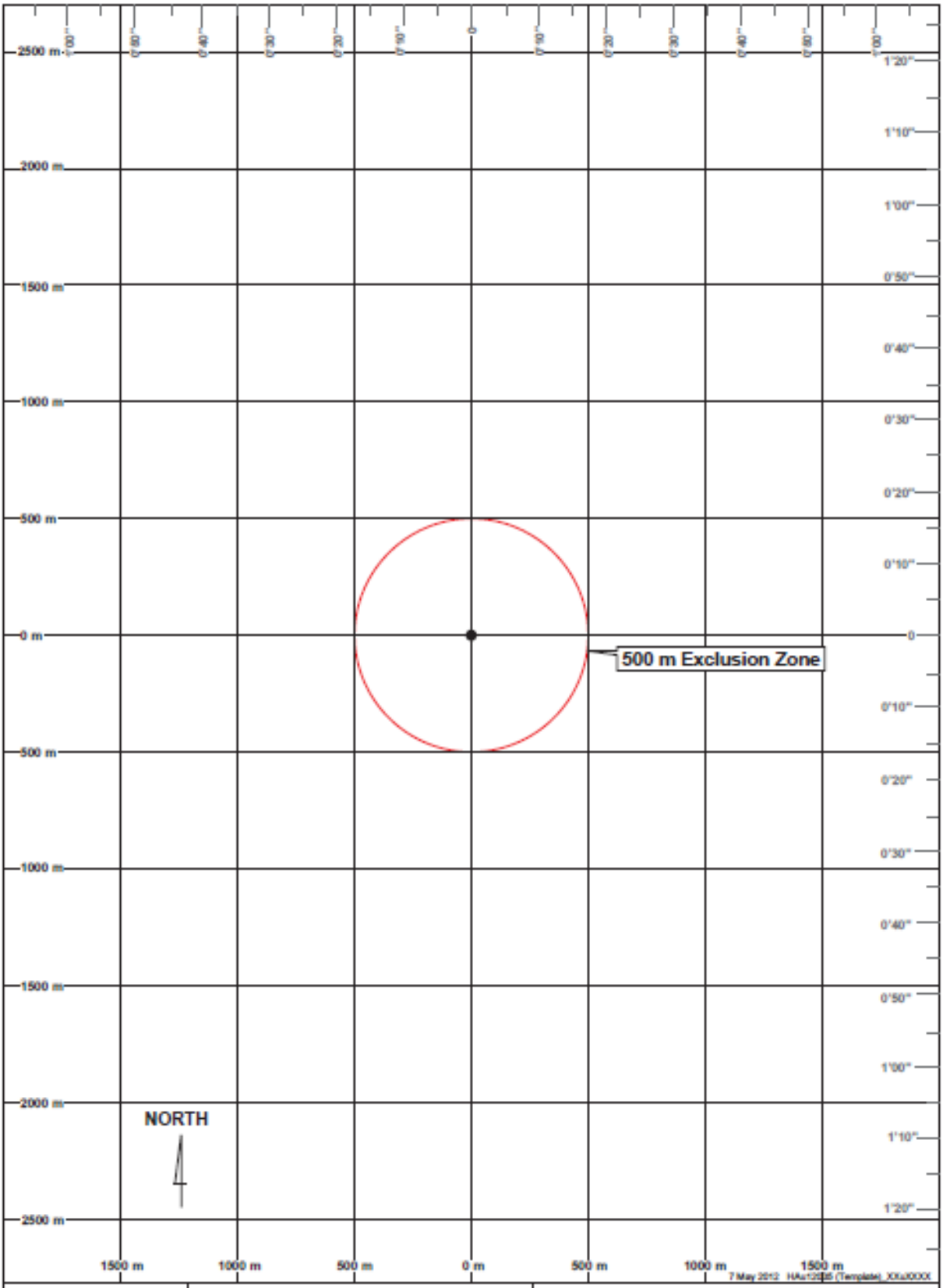
Survey Details					
Date	Start time	End Time	Observers		
Incident			Area of Survey		
Aircraft type	Call sign		Average Altitude	Remote sensing used	

Weather Conditions	
Wind speed (knots)	Wind direction
Cloud base (feet)	Visibility
Time high water	Current direction
Time low water	Current speed (nM)

Slick Details											
Slick grid parameters by lat/long				Slick grid parameters (air speed)			Slick grid dimensions				
Length Axis		Width Axis		Length Axis			Width Axis	Length		nm	
Start Latitude		Start Latitude		Time (seconds)			Time (seconds)	Width		nm	
Start Longitude		Start Longitude						Length		nm	
End Latitude		End Latitude		Air Speed (knots)			Air Speed (knots)	Width		nm	
End Longitude		End Longitude						Grid area		km^2	
Code	Colour	%age cover observed	Total grid area		Area per oil code		Factor	Oil volume			
1	Silver			km^2		km^2	40-300 L/ km^2		L		
2	Iridescent (rainbow)			km^2		km^2	300-5,000 L/ km^2		L		
3	Discontinuous true oil colour (Brown to black)			km^2		km^2	5,000-50,000L/ km^2		L		
4	Continuous true oil colour (Brown to black)			km^2		km^2	50,000 – 200,000 L/ km^2		L		
5	Brown / orange			km^2		km^2	>200,000 L/ km^2		L		

Appendix A5: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



	NAME:	VESSEL / AIRCRAFT:
	DATE / HOUR:	OTHER REFERENCE:

Appendix A6: Aerial Surveillance Marine Fauna Sighting Record Sheet

AERIAL SURVIELLANCE MARINE FAUNA SIGHTING RECORD SHEET

Resource	Type/species	Number	Location	Behaviour / Comments
Cetaceans				
Turtles				
Dugongs				
Sharks				
Sea snakes				
Seabirds				
Vessels				
Other Details for each observation location				

Ambient conditions at each location	Date	Photographic record	Date and Time of each
	Time		Photo/video clip number
	Weather Conditions		Brief description
	Visibility (atmospheric)		
	Water turbidity		

Appendix A7: Shoreline Aerial Reconnaissance Log

Shoreline Aerial Reconnaissance Log – Oil Spill

Survey Details				
Incident	Date	Start time	End Time	Observers

Area of Survey			
Start GPS: LAT _____deg._____LONG_____deg. _____min		End GPS: LAT_____deg. _____LONG_____deg._____min	
Aircraft type	Call sign	Average Altitude	Remote sensing used (if any)

Weather Conditions		
Sun/Cloud/Rain/Windy	Visibility	Tide Height L/M/H
Time high water	Time low water	Other

Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present					
	Rocky Cliffs		Boulder and cobble beaches		Sheltered tidal flats
	Exposed artificial structures		Riprap		Mixed sand and gravel beaches
	Inter-tidal platforms		Exposed tidal flats		Fine-Medium sand grained beaches
	Mangroves		Sheltered rocky shores		Other
	Wetlands		Sheltered artificial structures		

Operational Features (tick appropriate box)					
	Direct backshore access		Alongshore access		Suitable backshore staging
Other					

Appendix A8: RPS GROUP – Oil Spill Trajectory Modelling Request

PROCEDURE FOR INITIATING SPILL MODELLING – FOR OIL SPILLS

Step 1. Complete the form with all details – provide estimates and details of uncertainties.
Step 2. Call the RPS Response duty officer on (**0408 477186**) to alert them of the requirement for spill modelling, explaining the general details and seeking clarification as required.
Step 3. Send the form to **RPSresponse@rpsgroup.com** (save form as pdf, then click on the email address (in this step), attach your saved form and your attachments (listed below), to your email and send).

Incident Exercise

Date and time of this notification:

Contact details

Name of company	
Name of contact person	
Contact number (include country/area codes)	
Email address for return communications	

Details of spilled material (include oil assay if available)

Oil name			
Type or description			
Latitude of source	Degrees:	Minutes:	Seconds:
Longitude of source	Degrees:	Minutes:	Seconds:
Date and time spill started			
Time zone (+ or - from UTC)			
If slicks have been observed from an unknown source, **provide** map information to define the bounds (attach to email).			
Do you want: Forecasting forward in time from this location or back-track to an unknown source, or both?	Forward from slick area		Geographic bounds of slick area(s) and time of observation must be supplied
	Back-track from slick area		
	Forward and back-track		

Depth, type of discharge

Depth of release	Surface	Subsurface – specify the depth (m)
If from subsurface, describe the discharge energy	Low turbulence e.g. low-pressure leak	
	Medium turbulence e.g. intermediate-pressure leak	
	High turbulence e.g. well blow out, ruptured pipeline	

Volume or rate of release

Short spills that have ended	Volume:	Units:	Duration (hours):
Ongoing spills	Rate:	Units:	per hour

Notes (describe special details of the incident, special concerns, landmarks, doubts about information, etc.)

Documents attached

Oil Assay sheet	Safety data sheet	Local wind measurements
Spill site photos	Aerial surveillance maps	Line drawings showing oil distribution

Others (specify):

PROCEDURE FOR REQUESTING UPDATED OIL SPILL MODELLING

Step 1. Revise the input form for any changes.

Step 2. If surveillance is available to define the observed location of slicks, this information should be provided to the duty officer in a format that can be translated to define the spatial distribution and relative thickness of the oil. Formats that would be useful include:

a. A GIS (.shp) file defining the oil distribution (including the datum format)

b. Satellite imagery that includes spatial references

c. Photographs with location references

d. A line drawing marked with estimated centre and edge locations, length and width dimensions, and relative thickness contours (use the space below, making sure to provide spatial references)

e. Location of tracking buoys (first confirm that these are marking the slick location).

Step 3. Call the RPS Response duty officer on (**0408 477186**) to request an update to the spill modelling for changed details, explaining what has changed and seeking clarification as required.

Step 4. Send the form and any files to **RPSresponse@rpsgroup.com** (click on email address).

Appendix A9: Operational NEBA Form

Department of Transport

INSTRUCTIONS - How to use NEBA/SIMA Tool

Introduction

What is NEBA/SIMA: Net environmental benefit analysis (NEBA) or Spill Impact Mitigation Assessment (SIMA) is a structured approach used by the response community and stakeholders during oil spill preparedness, planning and response to compare the environmental benefit of potential response tools and develop a response strategy that will reduce the impact of an oil spill on the environment (IPEICA 2015).

Depending on the scenario, environment may need to include the broader 'environment' including socio-economic and cultural costs and benefits.

Remember- the dynamic nature of the incident is such that undue delays could result in both the NEBA/SIMA's conclusion and the resulting strategic decisions having little practical value (IPEICA 2017). You want as much information as possible across all aspects - but only if timely data is available. Where possible, classify broadly to save time.

Process

The NEBA/SIMA process can be summarised in four stages (which are detailed in the tabs in this excel workbook) (IPEICA 2017):

Stage 1

Compile and evaluate data (situational awareness) to identify an exposure scenario, potential response options, resources at risk and to understand the potential impacts of that spill scenario.

Consider:

• Oil type, seasonality of resources at risk (ecological and socio-economic and cultural where applicable), certainty around modelled predictions etc.

• When ranking the priorities of the resources at risk consider importance, vulnerability, sensitivity, ability to recover, conservation status, amenity value, cultural heritage value, condition etc. Remember, a resource may be sensitive to oil impacts, but not vulnerable (consider exposure pathways).

• Where can you gather your information from? This could be from formal databases, local knowledge, existing OSCP/OPEP/EPs etc.

• Who needs to be involved in the NEBA/SIMA decision making process, and the final approval process (relevant stakeholders, ESC etc)? During an incident the NEBA/SIMA process will be undertaken through the existing emergency management structure and will consider stakeholder and community concerns to the extent practicable (IPEICA 2017).

• Logistic constraints on response options.

Stage 2

Using the information from Stage 1, predict outcomes/impacts for the 'no response' option, to determine which techniques are effective and feasible.

Stage 3

Balance trade-offs by weighing and comparing the benefits and drawbacks associated with each feasible response option, including no intervention.

Stage 4

Select the best response option for the given scenario to form the strategy for the response. Once this has been done, complete tab 4 and make a summary of the outcomes of the NEBA/SIMA. Save. Print tabs Stage '1, 2 & 3, 4', staple with tab '4. Summarise Outcomes' tab at the front, and gain the appropriate approvals/signatures.

Stage 5

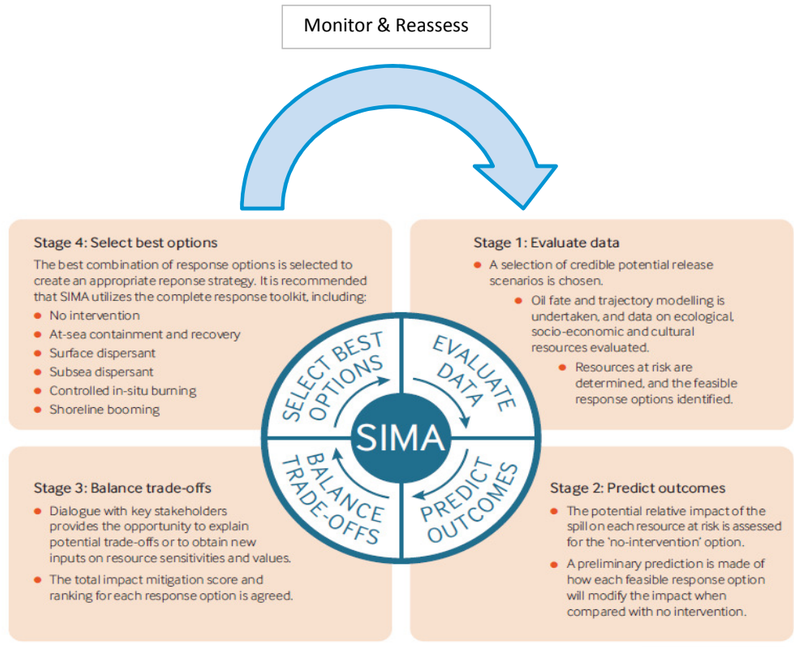
Monitor the situation. Has the response strategy implemented worked? You will need to continually monitor and reassess/update/revise the NEBA/SIMA where required to ensure an adequate response is obtained. Where a response option is not achieving the desired result, it may need to be reconsidered.

Use existing data where available, for example, for response to incidents where a scenario is covered by an OSCP/OPEP/EP that incorporates a NEBA/SIMA the following process can be used:

a. Select the planning scenario that most closely matches the incident circumstances, along with its associated response strategy, as a starting point.

b. Validate or adjust as needed the assumptions and considerations used in the planning (strategic) NEBA/SIMA for actual (operational) incident conditions.

c. Confirm the applicability of the pre-determined response strategy or adjust as necessary.



IPEICA 2017

Records
Complete a new NEBA/SIMA Tool for each revision of the NEBA/SIMA that is done. Ensure that each one is saved with the incident name, date and time. This is to ensure records are maintained for each operational period.

References - if you need more information use the following
IPIECA (2015). Response strategy development using net environmental benefit analysis (NEBA) - Good practice guidelines for incident management and emergency response personnel. http://www.ipieca.org/resources/good-practice/response-strategy-development-using-net-environmental-benefit-analysis-neba/ IPIECA (2017). Guidelines on implementing spill impact mitigation assessment (SIMA) - A technical support document to accompany the IPIECA-IOGP guidance on net environmental benefit analysis (NEBA). http://www.ipieca.org/resources/awareness-briefing/guidelines-on-implementing-spill-impact-mitigation-assessment-sima/

Database Links
• OSRA https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp • NatureMap Search https://naturemap.dpaw.wa.gov.au/ • EPBC Map Protected Matters Search http://www.environment.gov.au/epbc/protected-matters-search-tool • SPRAT Database http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl • National Conservation Values Atlas http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf • North West Shelf Atlas http://northwestatlas.org/nwa/about-us • Ningaloo Atlas http://ningaloo-atlas.org.au/

STAGE 1 - Compile & Evaluate Data

Define Scenario (remember that the NEBA/SIMA is only specific to this scenario)

NV flowline rupture, approx 160 m ^{3} Coniston/ Novara/ Van Gogh Crude. Oil spill direction to the South

Questions of Spill Assessment

What is it?	
Oil name	*Consiron Novara Van Gogh Blend*
Oil type	*Crude*
Oil properties	
Specific gravity	
Viscosity	*at 40C 149.7 cSt*
Pour point	
Asphphaltines	
Wax content	
Boiling point	
Toxicity	
Where is it?	
Latitude/longitude of spill source	
Distance of spread	
Bearing	
How big is it?	
Area	20km2
Volume	*160 m3*
What is in the way (resources at risk - list below)?	**Details**
Water Quality	*contamination*
Marine Fauna (whale sighted in the area)	*contcat with oil*
When will it get there?	
Weather conditions	
Currents	
Tides	
Time of impact	
What's happening to it?	
Weathering process (evaporation, natural dispersion, emulsification)	

Potential response options	Yes	No	N/A
Monitor & evaluate			
Surface dispersant			
Contain & recover			
Mechanical dispersion			
In-situ burning			
Protection & deflection			
Shoreline cleanup			
Oiled wildlife response			
Subsea dispersant			
Other (list below)			

Please indicate which sources were interrogated for gathering of input data into the NEBA

Source	Yes	No	N/A
Relevant OSCP/OPEP			
Relevant EP			
WAMOPRA Database (DoT)			
NatureMap Search Database (DBCA)			
EPBC Map Protected Matters Search Database (DoEE)			
SPRAT Database (DoEE)			
National Conservation Values Atlas Database (DoEE)			
OSRA Database (DoT)			
North West Shelf Atlas (AIMS & PTTEP)			
Ningaloo Atlas (AIMS & BHP)			
All other (please specify below)?			

STAGE 2 & 3 - Predict Outcomes and Balance Trade-offs

Instructions:
a) Determine Priority Rank and Impact Score for the baseline case (what would happen if no response was taken (taking into account natural weathering and attenuation)). Priority is ranked from 1 (low) to 4 (very high). Impact is scored from 1 (low) to 3 (high). Add more line items for 'Resources' if required. Some guidance on ranking is provided in the 'Reference' tab.
b) Determine all potential Response Options (add more columns if required, or delete if not required).
c) Determine the Impact Score for each Response Option (i.e. does that Response Option decrease or increase the impact from the Baseline Case).
d) The spreadsheet will automatically populate the Net Benefit (which is calculated by the Baseline Case Impact Score - Response Option Impact Score).
e) The spreadhseet will automatically populate the Weighted Net Benefit (which is calculated by the Response Option Net Benefit * Priority Rank).
f) The spreadsheet will automatically colour in the Weighted Net Benefit cells according to their rank (red = negative benefit from Response Option, green = positive benefit from Response Option) (colour legend under matrix below).

RESOURCES	DETAILS	a) Baseline Case Monitor & Evaluate Only - No Response		b) Response Options																			
		Priority	Impact	Surface Dispersant			Contain & Recover			Mechanical Dispersion			In Situ Burning			Protection & Deflection			Shoreline Cleanup			Oiled Wildlife Response			Subsea Dispersant			***Considerations/justification for decision made.*** ***Consider - importance of resource, vulnerability, sensitivity, ability to recover (also consider indirect impacts of the response option e.g. biosecurity)***
		Priority Rank	Impact Score	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	c) Impact Score	d) Net Benefit	e & f) Weighted Net Benefit	
Water Surface																											
Water as habitat																											
Birds		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		Dispersant application within 8 hours preferential, reduced efficacy after 8 hours EXCEPT Finasol
Wildlife contact surfaces																											
Seabird feeding		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		
Waterbird feeding		1	2	2	2		1	1	1	2	2		2	2		2	2		2	2		2	2		2	2		
Marine mammals		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		
Marine reptiles (e.g turtles, seasnakes)		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		
Marine megafauna (e.g. whale sharks)		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		
Commercial waterway																											
Shipping channels		1	1	1	1		2	-1	-1	1	1		1	1		1	1		1	1		1	1		1	1		May interfere with shipping?
Food organisms and water for human consumption																											
Commercial fisheries		1	1	1	1		1	0	0	1	1		1	1		1	1		1	1		1	1		1	1		
Amenity and/or safety of water																											
Recreation/Tourism		2	2	2	4		1	1	2	2	4		2	4		2	4		2	4		2	4		2	4		
Extraction of water for industrial use																											
Industrial cooling		3	2	2	6		1	1	3	2	6		2	6		1	1	3	2	6		2	6		2	6		
Shoreline	Exepected after 7 days - Preparation for repsonse																										
Shoreline as habitat/ecosystem																											
Salt marshes and mangroves		3		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		
Sheltered tidal flats		3		0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		
Sheltered rocky/rubble coasts				0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		
Exposed tidal flats				0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		
Gravel beaches				0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0		

Mixed sand and gravel beaches			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coarse grain sand beaches			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fine-medium grain sand			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exposed wave/cut platform			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exposed rocky shores			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Terrestrial flora (and habitats)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wildlife contact surfaces																		
Marine reptiles (e.g turtles, seasnakes)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seal colonies			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shorebird feeding, roosting, nesting			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water bird roosting, nesting			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seabird roosting, nesting			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Terrestrial fauna			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cultural and historic value																		
Archaeological sites			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heritage sites			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geological sites			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food organisms and water for human consumption																		
Intertidal harvesting			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amenity and/or safety of water																		
Public amenity beach			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Boat ramps			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial use of shoreline/infrastructure																		
Commercial facilities (ports etc.)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water column																		
Water as habitat																		
Fish spawning/nursery areas			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine mammals (seals/dolphins/whales)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine megafauna (e.g. whale sharks)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine reptiles (e.g turtles, seasnakes)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benthic systems (reef, coral, seagrass etc.)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estuaries			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine Parks/Sanctuartes			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wildlife contact surfaces																		
Seabird feeding			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marine mammals			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Food organisms and water for human consumption																		
Commercial Fisheries			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Commercial water intakes			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aquaculture lease			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Amenity and/or safety of water																		
Amenity swimming beaches			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Recreational fisheries			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Air																		
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Weighted Net Benefit legend
Positive impact
Neutral impact
Negative impact

STAGE 4 - Summarise Outcomes of NEBA/SIMA

Incident name	NV Flowline Rupture
Date of analysis	21/11/2019
Time of analysis	2pm
Prepared by	Sonja Mavrick/ Emily Gifford/Anpa S
Role	Environment
Function	Environment
Contact number	6216 7154

Resources at risk (listed from highest priority to lowest)

Resource	Why prioritise (detail broadly)
Marine Fauna	Protected matters, environment senisitivytr, reduce impacts eg oiled wildlife
Commercial fisheries	Reduce economic impacts
Shipping Channels	Reduce economic impacts
Cooling Water Intake	Reduce economic impacts

Response options for each location (considered for use (listed from most effective to list))

Response Option	Location
Source Control	Pipeline rupture
Containment and Recovery	Where oil is thickest according to surveillance
Vessel based dispersant application (Finasol only)	Where oil is thickest according to surveillance. Vessel based applictaion recommended over aerial to allow containment and recover operations can proceed
Protect and Deflect	Watching Brief if spill direction changes - Around infrastructure (FPSO) specifically the water intakes
Not to be used	
Aerial Dispersant	Due to low efficacy after 8 hours, assumes instantaneous release
In situ burning	Crude not amenable

Comments

Vessel based dispersant application of Finasol only - is possible but not recommended given potental logistic constraints	There is limited window of opportunity for dispersant application, within 8 hours preferential However if Finsaol can be mobilised and applied by vessel within 48 hours, may have some efficacy - reduce with time 25% or less after 8 hours. UPDATE: No finasol available, although perhaps not as effective trial SLikgone (AMOSC recommendation). Vesel and equipment to be mobilised to spill to test efficacy

ESC Signature

Name	*Signature*

IC Signature

Name	*Signature*

Department of Transport

REFERENCES

Prioritising Resources

Prioritising resources helps to identify where limited means of combat should be directed for the best effect. The greatest challenge for resource prioristion is that everyone prioritises resources differently. Ideally, the priority ranking of a resource would reflect the value of the resource to the community or society as a whole. In practice, the value of a resource is difficult to determine so indirect methods must be used to assign priority.
Prioritisation of resources should be done independently of their sensitivity, potential impact or recovery time, because i) these factors will vary with hazard type and exposure and ii) they will be considered later when assessing impact (*National Plan NEBA Guidance Draft Outline v6.05*).

Guideline for assigning priority rank of resources

	Low (1)	Medium (2)	High (3)	Very High (4)
Plant and animal habitats	Important site for non-classified species (e.g. breeding colony) or known habitat for endemic species	Important sites for endemic species or known area for species in decline	Important sites for species in decline (but not listed) or known habitat for endangered or vulnerable species	Important sites for listed threatened species, or part of a known range for nationally critical species, or important sites for nationally critical species (e.g. breeding colony)
Protected sites	Identified sites of importance but no protected status	Scenic reserve or wildlife management reserves	Marine mammal sanctuary, nature reserve, wildlife refuge	Marine National Park, Sanctuary, Ramsar sites, World Heritage sites
Economic/commercial	Very low economic significance for the region (<$150k per km of coast)	Low economic significance for the region (<$150k-$500k per km of coast)	Some economic significance for the region, but not nationally ($500k-$1.5 million per 1 km of coast)	High regional or national significance (>$1.5 million per 1 km of coast)
Cultural and heritage	No special cultural importance	Some importance to local community	Important historical or cultural heritage site	High state or national historical or cultural heritage site
Social, amenity and recreation	Low to moderate local recreational use, community or amenity values	Regionally significant seasonal recreational use, community or amenity values	Regionally significant year-round recreational use, community or amenity values	Nationally significant seasonal and year-round recreational use, community or amenity values

**Adapted from the National Plan Guidance Draft Outline v6.05 and Maritime NZ NEBA Planning Process (Vorwerk 2012).*

Assigning Impact Scores

Impact degree and extent should consider the size of the impact (extent) and its duration (recovery time). Size of the impact should also consider the sensitivity of the resource to the spill and the degree of exposure (e.g. geographic coverage, concentration and duration of exposure).

		Recovery period			
		Rapid →			Slow
Guideline for assigning impact score		**<1 year**	**1-3 years**	**3-5 years**	**>5 years**
Impact degree and extent	**Low**	Low (1)	Low (1)	Low (1)	Medium (2)
	Medium	Low (1)	Medium (2)	Medium (2)	High (3)
	High	Medium (2)	High (3)	High (3)	High (3)

**Adapted from the National Plan Guidance Draft Outline v6.05 and the Guidelines on implementing spill impact mitigation assessment (SIMA) (IPIECA 2017).*

Version No.	Date	Prepared by	Revision or issue description	Issued to
0	31/10/2018	J. Herwig (Department of Transport)	Issued for use	Public

Appendix A10: Shoreline Clean-up Equipment Lists

Equipment List for an Initial deployment of a 6 person Manual Clean Up Team

On Shore Clean-up Tools		Quantity
	Disposal Bag Labelled, 140 cm x50cm x 100um	1000
	Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100um	50
	Polyethylene Safety Shovel 247mm z 978mm	2
	Steel Shovel	4
	Steel Rake	2
	Landscapers Rake	2
	Barrier Tape – "Caution Spill Area"	10
	Pool scoop with extendable handle – flat solid	2
	Poly Mop Handle	2
	Safety Retractable Blade Knife	2
	Poly Rope 20m	6
	Star Pickets	24
	Star Picket driver	1
	Hand Cleaner	1
	Cable ties – general use	1000
	Wheel Barrow	2
	Galvanised Bucket	4
	Pruning secateurs	2
	Hedge Shears	1
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Respirator dust/mist/fume and valve	40
	Disposable box light nitrile gloves (100bx)	2
	Alpha Tec gloves (assort size)	24
	Ear Plugs (200bx)	1
	Safety Glasses	18
	Safety Goggles non vented	6
	Gum Boots (assort size)	18
	Rigger Gloves (assort size)	18
	Day/Night Vest	6
Storage Equipment		
	Collapsible Bund 1.6m x 1.2m	2
	Collapsible bund 4m x 2.4m	1
	Misc sizes of ground sheets/tarps	6
Absorbents		
	Absorbent Roll 'oil and fuel only' 40m x 9m	6
	Absorbent Pad "oil and fuel only" 45cm x 45cm	400
	Poly Mops (snags)	150
	Poly Absorbent Wipes	10
Additional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	
Optional Items		

	Inflatable Tent 9 square metres	1

Equipment list for a decontamination unit for Beach Clean Up Team

Shore Clean-up Tools		**Quantity**
	Inflatable Decon Tent	1
	Inflatable Tent 9 square metres – Modesty or Control tent	1
	Misc sizes of ground sheets/tarps	4
	Collapsible Bund 1.6m x 1.2m (two stages)	2
	2 stools in each bund	
	Collapsible Bund 4m x 2.4m (for used PPE and clothing into DB's)	1
	Long Handled Scrub brush	2
	Scrub Brush	2
	Simple Green 20 ltr	2
	Poly Absorbent Wipes	10
	Wet Wipe Canister	6
	Disposal Bag for Clothing, 140cm x 50cm x 100um	100
	Bath towel	6
	Liquid soap in push dispenser (citrus based)	1
	Track mat – Absorbent for Corridor/walkway	1
	Star pickets	16
	Star picket driver	1
	Barrier tape to create corridors	4
	Safety Goggles non vented (used during decon)	6
Optional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	

Equipment list for deployment of a 6-person team for flushing or recovery

Flushing Equipment		**Quantity**
	Diesel self prime semi trash pump, 25-35 psi, 4.8hp	1
	Perforated 2" lay flat hose, 20 mtr sections	2
	Section Hose 2", 20m sections	5
	Hose End Strainer	1
Recovery Equipment		
	Tidal Boom (shoreline boom) 25m lengths	2 (50m)
	Tidal Boom Accessories pack	1
	Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	2 (50m)
	Towing Bridle	2
	Danforth Sand Anchor Kit, 30m lines, 15m trip lines	3
	Diesel Powered pump with hose	1
	Manta Ray skimmer	1
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Respirator dust/mist/fume and valve	40
	Disposable box light nitrile gloves (100bx)	2
	Ear Plugs (200bx)	1
	Safety Glasses	18
	Gum Boots (assort size)	18
	Hyflex Oil Restraint Gloves (assort size)	18
	Day/Night Vest	6
Storage Equipment		
	Collapsible Bund 1.6m x1.2m	1
	Misc sizes of ground sheets/tarps	6
	Collapsible Tank 5000 litres	2
Absorbents		
	Absorbent Boom 'oil and fuel only' 3 or 6m x 180mm	200mtrs
	Absorbent Roll 'oil and fuel only' 40m x 9m	10
	Absorbent Pad "oil and fuel only" 45cm x 45cm	1000
	Poly Absorbent Wipes	10
Additional Items		
	Folding Deck Chair	6
	Folding Table	1
	Shelter open side	1
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6
	Boxes, Bin and Lid Storage/transport assorted	
	Inflatable Tent 9 square metres	1

Equipment list for a 6 person team for near shore clean up

Absorbents		
	Absorbent Roll 'oil and fuel only' 40m x 9m	20
	Absorbent Pad "oil and fuel only" 45cm x 45cm	2000
	Absorbent Boom "oil and fuel only" 3or6m z 180mm	200mtrs
	Poly Mops (snags)	150
	Poly Absorbent Wipes	20
Recovery Equipment		
	Tidal Boom (shoreline boom) 25m lengths	4 (100m)
	Tidal Boom Accessories pack	2
	Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	8 (200m)
	Towing Bridle	2
	Danforth Sand Anchor Kit 15kg 30m lines, 15m trip lines	10
	Weir Skimmer 30T hr	1
	Trash Screen for above	1
	Diesel Powered pump with hose	1
	Manta Ray skimmer	1
Shore Clean-up Tools		**Quantity**
	Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100um	200
	Pool scoop with extendable handle – flat solid	2
	Poly Mop Handle	2
	Poly Rope 20m	10
	Star Pickets	24
	Star Picket driver	1
	Intrinsic Safe Torch	6
	Hand Cleaner	1
	Cable ties (to add extra join to absorbent booms)	150
Personal Protection Equipment (PPE) Team of 6		
	Spill Crew Hazguard water resistant coveralls (assort sizes)	36
	Disposable box light nitrile gloves (100bx)	2
	Alpha Tec gloves (assort size)	24
	Ear Plugs (200bx)	1
	Safety Glasses – with head strap	18
	Gum Boots (worn extra large or as advised by skipper)	18
	Steel cap waders	2
	Personal Flotation Device	6
	Rigger Gloves (assort size)	18
Storage Equipment		
	Collapsible Bund 1.6m x 1.2m	2
	Collapsible bund 4m x 2.4m	1
	Collapsible Tank 5000 litres	2
	Alum box, Bin & lid Storage/transport cases	10
	Misc sizes of ground sheets/tarps	6
Optional Items		
	6 Person first aid kit	1
	Wide Brim Hat with cord	6
	Sunburn Cream 1 litre pump bottle	1
	Personal Eyewash bottle 500mls	6
	Personal Drink bottle 750mls	6

Appendix B1: Scientific Monitoring Plans

1 Scientific Monitoring Principles

1.1 Monitoring Design

In the event of an oil spill the monitoring design will depend upon the nature of the spill, the availability of baseline data in relation to the spill extent and expert opinion. In order to ensure the application of robust designs and sampling approaches which have the highest likelihood of detecting an environmental impact while allowing suitable flexibility, this plan provides a set of Guiding Principles for monitoring design and sampling (Table 1). A structured decision making framework for allocating monitoring effort in both time and space is described in Figure 1.

Table 1: Guiding principles for oil spill monitoring design and methodologies.

Principle	Explanation	Key guiding references
Match baseline	Designs and methodologies should follow those used in appropriate baseline studies wherever possible.	N/A
Comprehensive sampling	Sampling methods should seek to sample the full range of taxa within each assemblage. This may require the use of several complimentary techniques (the exception is if indicator taxa are employed; see below).	N/A
Reliable indicator taxa	If indicator taxa are targeted then the choice of indicator should be defensible, and a link to the response of the broader assemblage demonstrated. Indicators of ecosystem function should also be considered.	Hilty and Merenlender (2000)
Appropriate sample area or volume	Size of sampling unit should be determined based on the level of clustering of individuals and whether the goal is to quantify this clustering, or establish low inter-sample variability (probably more the latter for oil spill studies).	Kenkel et al. (1989)
Reduce within sample variation over time	Wherever possible repeated measures are carried out on the same sample space in order to reduce within treatment variation.	N/A
Compositing of samples	Appropriate compositing to increase statistical power should be considered.	Carey and Keough (2002)
Account for environmental gradients and partition variations	Sources of variation are considered and compartmentalised to best reduce within treatment variation, and thereby maximise power to detect an impact. This is managed through several means: 1. Environmental covariates are considered in sampling design recorded and incorporated statistically. 2. A hierarchical or stratified sampling design is used to address variation at multiple scales 3. Design is standardized, by sampling equivalent strata (e.g., level of exposure, depth etc.).	English et al. (1997), Snedecor and Cochran (1989)
Assess statistical power	Where null-hypothesis tests are planned, statistical power of the design is assessed prior to execution.	Gerrodette (1987) Legg and Nagy (2006) Toft and Shea (1982)

Principle	Explanation	Key guiding references
Appropriate sampling extent	Sample the range of hydrocarbon concentration (and at least the upper end).	Skalski (1995)
Independence amongst samples	Site selection should aim for independence amongst samples and potential spatial or temporal autocorrelation should be considered.	Hurlbert (1984)
Reduce observation error	Observer bias and amongst observer variation should be considered.	Thompson and Mapstone (1997)
Appropriate spatial replication	Sites are replicated. A limitation is that there is only one spill, but control sites should be replicated and spatially Interspersed. Ideally, the design should be able to detect an impact at several possible scales.	Underwood (Underwood 1991, 1992, 1994)
Appropriate temporal replication	Sampling should account for natural temporal variation.	Underwood (Underwood 1991, 1992, 1994)

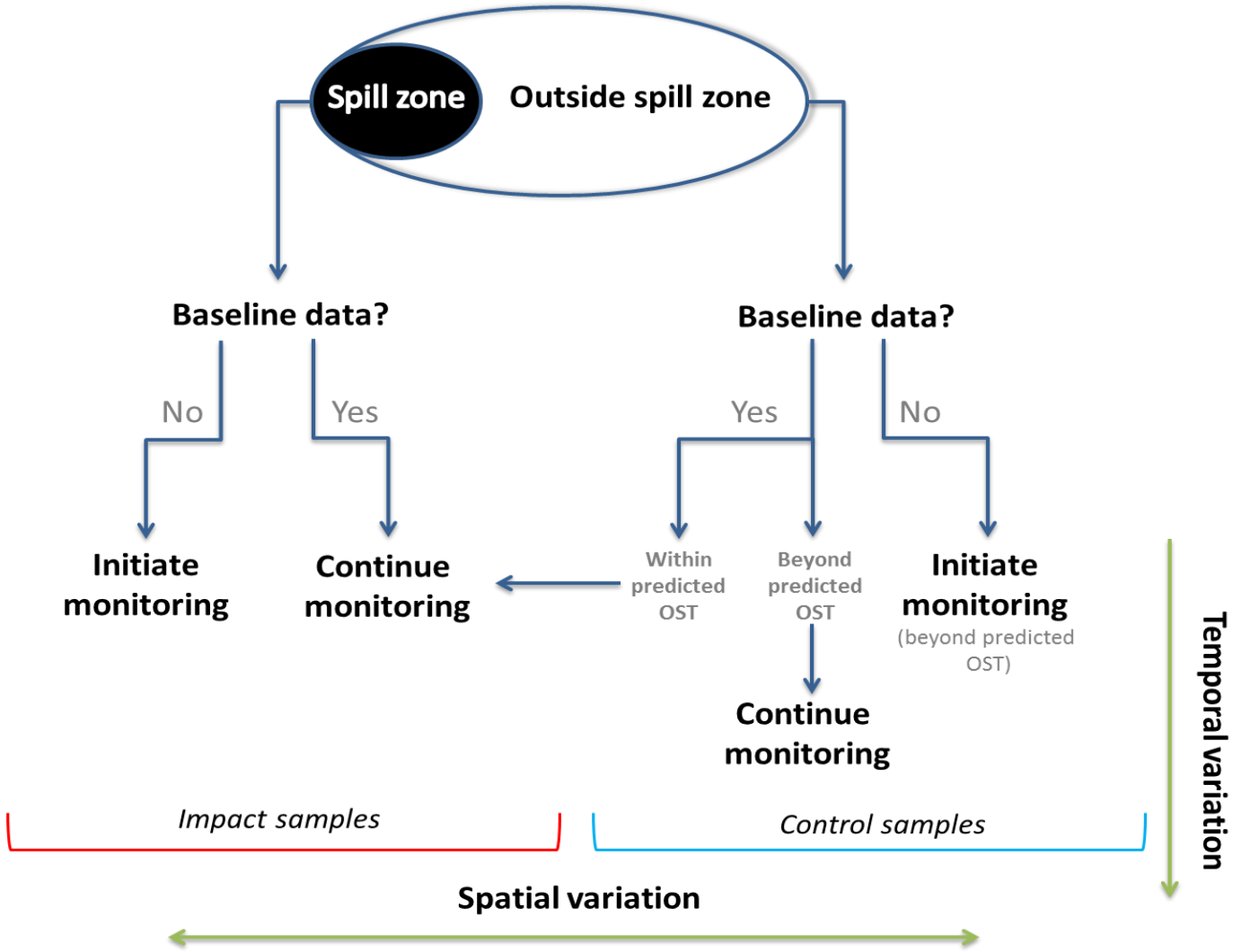


Figure 1: Structured decision making process based on Gregory et al. (2012) in reference to monitoring programs, the availability of baseline data, and oil spill trajectory. In an ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

The most important approaches to statistical analysis and related sampling design are summarised in Table 2 (below).

Table 2: Summary of data analysis techniques.

Analysis type		Description	Strengths	Limitations	Addressing limitations
Gradient analysis		Impact is quantified in terms of distance from spill.	Can be established post-spill.	Doesn't account for inherent spatial patterns present prior to spill.	Include spatial covariates in model. Incorporate a temporal component.
Control chart	Univariate	Single variable is monitored and plotted over time, and breaching of control limits tested.	Control sites are not required. Takes account of natural variation in system.	Control limits do not necessarily have biological meaning. Doesn't control for broader spatial scale temporal variation.	Include control charts for control sites which incorporate broad scale temporal variation.
	Multivariate	Multiple variables are combined, monitored and plotted over time, and breaching of control limits tested.	Ability to combine suite of data (e.g. community composition) into one variable. Sites plots not required.	Individual responses are masked. Control limits do not necessarily have biological meaning. Significant control limits challenging to define. Direction of change is undefined.	Compliment with graphical approaches to identify direction of change and individual species responses.
	Reference	Control limits are based on knowledge of biological system (e.g. minimum viable population size, toxicity).	Control limits have recognised biological meaning or consequence.	Control limits may be considered arbitrary.	Use established standards for control limits.
BACI		Quantifies state before and after potential impact, and also at impacted and control sites. Impact is tested by statistical interaction of terms.	Controls for natural variation, by incorporating control sites.	Limited power to detect significant impact. Requires appropriate matching of control (non-impacted) sites. Requires pre-impact data.	Increase power by increasing temporal component. Choose indicators with low natural variability.

2 Scientific Monitoring Plans by Receptor

2.1 SMP1 Marine Water Quality

SMP1 – Marine Water Quality	
Rationale	The release of hydrocarbons at sea will pollute marine waters via floating, entrained or dissolved aromatic hydrocarbons. The water quality SMP may also be used in conjunction with Monitor and Evaluate, to inform the sampling design of other SMPs where objectives are to evaluate impact and recovery of sensitive receptors, in relation to hydrocarbon contamination.
Aim	To monitor changes in water quality following an oil spill and associated response activities for the purpose of detecting a potential impact and recovery and for informing other scientific monitoring studies.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the Industry-Government Environmental Metadatabase (IGEM) (Santos is subscribed to) will be reviewed for applicable marine water quality baseline data. In the absence of baseline data for hydrocarbons, data from appropriate reference sites will be used in place of the baseline values.
Initiation criteria	Upon notification of a Level 2 or 3 incident -(a level 2 or 3 incident includes those which may have an adverse effect on the environment. This may be informed by operational water quality monitoring)
Termination criteria	Concentrations of hydrocarbon contaminants, attributable to the released hydrocarbon, are not significantly higher than baseline data or similar non-impacted sites data. In the absence of baseline or similar non-impact sites data, concentrations of hydrocarbon contaminants, attributable to the released hydrocarbon, are below the relevant hydrocarbon contaminant trigger level within the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower and values are not significantly different to reference sites. Forensic fingerprinting of the released hydrocarbon and water quality sample analysis by way of gas chromatography/mass spectrometry (GC/MS) may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impacts to specific receptors from hydrocarbons within marine waters are described in individual SMPs.

SMP1 – Marine Water Quality	
Methodological approach	Overall sampling design approach will be enacted according to the availability of baseline data guided by the structured decision-making process based on Gregory et al. (2012): 4. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 5. If insufficient long-term baseline data is available, where appropriately matched baseline data sites are impacted and non-impacted, a before-after-control-impact (BACI) approach to monitoring will be applied; 6. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See Figure 1 for detailed description of these approaches. The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling. Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design. <u>Water profiles</u> A water quality probe will be used to measure conductivity (to derive salinity), temperature and depth (CTD), dissolved oxygen (% and mg/L), turbidity, total dissolved solids and fluorometry along a depth profile. Sampling methods will be aligned with the recommended standard operating procedures for the use of sensors for oil spill monitoring found in Appendix F of the Oil Spill Monitoring Handbook (Hook et al. 2016). <u>Water quality</u> Water quality samples will be taken along a similar depth profile as the CTD measures using a Niskin bottle, Van Dorn water sampler, rosette sampler or equivalent instrument. The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sample. Water samples shall be analysed for key contaminants of concern including polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene, xylene), and nutrients, metals and chlorophyll-a. At each site, replicate water samples (at least three samples) will be collected to allow appropriate statistical analyses to be made including samples for quality assurance and quality control (QA/QC) purposes (i.e. split sample, triplicate sample, field blanks, transport blanks). Water sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al., 2016), specifically the following sections: • Appendix A & B hydrocarbon analysis; • Appendix C Volatile Organic Compounds Analysis; and • Appendix D Surface Oil Analysis. Environmental DNA (eDNA) will also be collected to detect for the presence of marine species in the water column. Water samples will be collected in Nalgene bottles and sent to an appropriate laboratory for analysis. Sample processing will depend on holding times required (<8 hours ideal) and may involve filtering and freezing of each sample (Grochowsi and Stat 2017).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.

SMP1 – Marine Water Quality	
Implementation	Service provider able to mobilise within 72 hours of the SoW following approval by Santos (this time allows for costing, preparation of equipment and disposables and travel time to site).
Analysis and reporting	Chemical analysis will be carried out by NATA-accredited laboratories. A government endorsed laboratory for forensic fingerprinting (GS/MS) will be used. Data will be entered to spatially explicit database. Data will be analysed appropriately in order to determine if there was a statistical difference in water quality before and after a hydrocarbon impact. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.2 SMP2 Sediment Quality

SMP2 - Sediment Quality	
Rationale	Hydrocarbons released during a spill scenario may contact, settle and/or accumulate in marine sediments. Toxic substances found in accumulated hydrocarbons may lead to impacts to ecosystem processes associated with this primary producer habitat. Sediments and marine infauna will be sampled concurrently in order to establish potential correlations amongst the two parameters.
Aim	To monitor the fate and persistence of hydrocarbons in marine sediments following an oil spill and associated response activities. To monitor marine benthic infauna assemblages as an indicator of sediment quality, in relation to an oil spill and associated response activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM will be reviewed for applicable marine baseline sediment quality and infauna data. In the absence of baseline sediment quality data, hydrocarbon contaminant trigger values for marine sediments as listed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018) will be used as a proxy for baseline levels. Where other regulatory site-specific trigger levels exist, the lower of these levels and the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Governments 2018) levels will be used as proxy baseline levels.
Initiation criteria	Operational Monitoring or SMP1 indicates that contacted sediment or sediment predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP2 - Sediment Quality	
Termination criteria	Concentrations of hydrocarbons in marine benthic and shoreline sediments, attributable to the released hydrocarbon, are not significantly higher than baseline or similar non-impact sites. In the absence of baseline or similar non-impact sites data, concentrations are below marine sediment quality interim guideline levels within the ANZG (2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower. For infauna assemblages, abundance and species diversity/richness/composition are not significantly different from baseline (where baseline data exists) or are not statistically significantly different from comparable non-impacted benthic infauna assemblages. Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in: • Taxonomic diversity • Assemblage composition • Abundance of indicator species. Other pressures to these states are: • Discharge of other toxicants • Physical disturbance including dredging • Sedimentation • Introduction of marine pests • Shading from marine infrastructure • Climate change

SMP2 - Sediment Quality	
Methodological approach	Overall sampling design approach will be enacted according to the availability of baseline data guided by the structured decision-making process based on Gregory et al. (2012): 7. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 8. If insufficient long-term baseline data is available, where appropriately matched baseline data sites are impacted and non-impacted, a before-after-control-impact (BACI) approach to monitoring will be applied; 9. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See Figure 1 for detailed description of these approaches. The selection of potentially impacted and non-impacted sites will be informed by Operational Monitoring, including operational water quality monitoring and spill trajectory modelling. Sampling frequency will be dictated by the spatial extent of the spill, the number and location of sampling sites and the philosophy of the sampling design <u>Sediment quality</u> Operational Monitoring (including spill trajectory modelling) and the results of SMP1 Marine Water Quality monitoring will be used to inform the location of potentially impacted sediment sites. Sediment monitoring sites in nearshore and shoreline locations will also consider and align where practicable, with sites selected for habitat monitoring (i.e. SMP3, 4, 5 and 6). Sampling frequency will be dictated by the spatial extend of the spill, the number and location of sampling sites and the philosophy of the sampling design. At each site, replicate sediment samples will be taken including those for QA/QC purposes. Sediment grab (i.e. Van Veen or Box corer) or coring equipment will be selected based on water depth (offshore, inshore or shoreline) and sample size requirements. Sediment sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al. 2016), specifically the following sections according to sampling equipment utilised: • Appendix G hydrocarbon analysis (Grab samplers) • Appendix H hydrocarbon analysis (Ship borne corer) • Appendix H Manual push corer, and • Appendix O Sediment infauna. The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sediment sample. Sediment samples shall be analysed for key contaminants of concern including metals, hydrocarbons, nutrients, particle size distribution, and nutrients. <u>Infauna samples</u> A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of infauna to lowest taxonomic resolution possible. eDNA will also be collected to detect for the presence of marine infauna species in sediments. Sediment will be removed from the surface of a subset of the sediment sample and sent to an appropriate laboratory for analysis.

SMP2 - Sediment Quality	
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Implementation	Service provider to be capable of mobilising within 72 hours of the SoW having been approved by Santos. Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Sediment samples analysed by NATA-accredited laboratories for presence and concentrations of hydrocarbons associated with the spill including full suite PAHs and total organic carbon. A government endorsed laboratory for forensic fingerprinting (GC/MS) will be used. Infauna samples sorted and identified by qualified marine invertebrate specialist to acceptable taxonomic groups. Data will be entered to spatially explicit database and analysed statistically in order to detect significant differences among sites. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.3 SMP3 Sandy Beaches and Rocky Shores

SMP3 - Sandy Beaches and Rocky Shores	
Rationale	Contact of entrained oil and stranded floating oil of shoreline habitats may occur on sandy beaches and rocky shores. Rocky and sandy shores provide habitat for a variety of intertidal organisms, which in turn provide food for shorebirds. Large tides tend to create a large degree of horizontal zonation amongst taxa. Rocky and sandy shores are included within the one receptor as they are often spatially mixed and both represent high energy regions.
Aim	To monitor changes in biota of sandy and rocky shoreline habitats in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall be reviewed for applicable rocky shoreline and sandy beach biota baseline data. Minimal baseline data currently exists for rocky shorelines and sandy beaches.
Initiation criteria	Operational monitoring, SMP1 or SMP2 indicates that rocky and/or sandy shorelines are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP3 - Sandy Beaches and Rocky Shores	
Termination criteria	Shoreline assemblage structure, and hydrocarbon concentration levels in representative invertebrate species, are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages; AND SMP2 Sediment Quality monitoring at the site has been terminated AND Shoreline clean-up at the site has been completed.
Receptor impact	Impact to shoreline invertebrates from pressures including hydrocarbons is measured through change in: • Species diversity • Assemblage composition • Abundance of indicator taxa. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Litter/waste • Introduction of marine pests • Over-collection • Nutrification • Climate change.

SMP3 - Sandy Beaches and Rocky Shores	
Methodological approach	Monitoring will be designed as follows: • Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied. Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority where no baseline data exists. If this opportunity is not available, a gradient approach to monitoring will be applied. Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design. Rocky shoreline intertidal assemblages (fauna and flora) will be monitored using a quadrat/transect approach, with the positioning of quadrats/transects accounting for any natural variation in assemblage structure along a seaward-landward gradient. Assemblage structure to be recorded through in-situ counts of fauna and flora or still images taken for further analysis. Sandy shoreline infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists, the methodology will be adapted to available data so that results are comparable. Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists. Biomonitoring of hydrocarbon concentrations in shoreline invertebrates will occur through collection of replicated tissue samples from representative, and preferably widely available species, across impact and non-impacted locations. The laboratory(ies) will supply and inform the appropriate method for collection, storage and holding times of tissue samples for required laboratory analysis and to avoid cross-contamination among samples. Where limitations in the distribution and abundance of representative invertebrate species preclude collection of sufficient samples for analysis, in-situ biomonitoring using a locally available species (e.g. the use of caged oysters) shall be considered for assessing spatial and temporal changes in bioaccumulation of hydrocarbon concentrations in invertebrates across impact and reference sites.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	With the aim of collecting post-spill pre-impact data, service provider able to mobilise within 72 hours of the SoW having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP3 - Sandy Beaches and Rocky Shores	
Analysis and reporting	Specimens not identified in situ (in the field) will be processed and identified in the laboratory by appropriately qualified scientists. Biota tissue samples (if collected) analysed for hydrocarbon contaminants by NATA-accredited laboratories. Data will be entered to spatially explicit database and analysed in order to test for significant difference between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.4 SMP4 Mangrove Communities

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Rationale	In the event of Tier 2 or 3 spill, mangroves may be contacted by floating or entrained oil. Mangrove health may be adversely affected due to increased concentration of hydrocarbons in sediments and coating due to surface oil, which in turn can lead to leaf-loss, mortality and a reduction in areal extent of mangrove habitat. This plan's focus is mangrove vegetation. Associated monitoring of sediment quality and mudflat fauna is described in SMP2 and SMP5, respectively.
Aim	To monitor changes to mangrove extent and health in relation to an oil spill and associated activities.
Baseline	On-ground monitoring is ongoing at several locations , refer Baseline Data Review (QE-00-BI-20001). Santos holds long term data from field mangrove health surveys at Varanus Island/ Bridled Island (Lowendal Group). Baseline extent and of mangroves is monitored by remote sensing in several regions, and further historical and post-impact data for mangrove health and extent can be obtained as remotely sensed imagery (e.g., Sentinel, Landsat and Worldview).
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mangroves are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mangrove extent and health are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted mangroves; AND Sediment quality monitoring (SMP2) at the site has been terminated; AND Shoreline response at the site has been completed.

SMP4 - Shorelines and Coastal Habitats – Mangroves	
Receptor impact	Impact to mangroves from pressures including hydrocarbons is measured through change in: • Tree health • Aerial extent. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Litter • Introduction of marine pests • Dust • Sedimentation from human activities • Climate change.
Methodological approach	Remote sensing data will be accessed for the purpose of detecting change in aerial cover and change in canopy health through and index of plant health (e.g., NDVI or MSAVI) (Astron Environmental Services 2013). Where long term on-ground baseline monitoring has occurred, further post impact onground monitoring should be carried out to complement any analysis of remote sensing. Analysis of long-term onground monitoring data will be as follows: • Where long-term baseline data sites (only) are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See Figure 1). On-ground monitoring of mangroves will aim to detect change in mangrove health, including canopy cover and plant/leaf health indices. Field methodology will follow the routine monitoring techniques currently employed for Santos at Varanus Island (Quadrant Energy Australia Limited 2018), adapting where required to align with pre-existing baseline field data, where available. Sampling of sediments as per SMP2 will occur at mangrove health assessment sites to allow any changes in mangrove health to be related to sediment hydrocarbon levels. In-field mangrove health sampling frequency will be dictated by the number and location of sampling sites and the sampling design applied.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	On-ground monitoring will only occur where long-term baseline data has been collected, and hence no post-spill pre-impact data collection will be required. On-ground post-spill data will be collected at an appropriate time as guided by the analysis of remote sensing imagery, and potential on-ground assessment.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to test statistically significant change to parameters associated with hydrocarbon spill. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.5 SMP5 Intertidal Mudflats

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Rationale	Intertidal mudflat communities are primary producer habitats which support invertebrate fauna, which in turn provides a valuable food source for shorebirds. High diversity of infauna (particularly molluscs) occur within these habitats and may be affected by penetrating oil. At high tide, these habitats become foraging grounds for vertebrates such as rays and sharks. While there is some localised disturbance, most of the communities in the area of interest are generally in an undisturbed condition. These habitats are at high risk of impact as the sheltered environments promote high faunal diversity combined with low-energy wave action.
Aim	To monitor changes in intertidal mudflat communities associated with an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) . In addition, the IGEM shall be reviewed for applicable intertidal mudflat infauna baseline data.
Initiation criteria	Operational Monitoring, SMP1 or SMP2 indicates that mudflat habitats are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Mudflat infaunal assemblages are not significantly different from their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages; AND SMP2 Sediment Quality monitoring at the site has been terminated; AND Clean-up of the shoreline site has been completed.
Receptor impact	Impact to mudflat epifauna and infauna from pressures, including hydrocarbons, is measured through change in: • Species diversity • Assemblage composition • Abundance of indicator taxa. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Overfishing (bait collecting) • Introduction of marine pests • Climate change.

SMP5 - Shorelines and Coastal Habitats – Intertidal Mudflats	
Methodological approach	Monitoring will be designed as follows: • Where long-term baseline data sites (e.g., Roebuck Bay) are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See Figure 1). Owing to potentially high spatial variation in assemblage structure, post-spill pre-impact monitoring will be a priority if baseline data are not available. If this opportunity is not available, a gradient approach to monitoring will be applied. Mudflat infauna will be sampled by way of replicated grab/core samples. Sampling sites within impacted and non-impacted areas to consider any cross-shore gradient in assemblage structure that may exist. Where baseline data exists methodology to adapt to available data such that results are comparable. Sites selected for mudflat infauna sampling to be concurrently sampled for sediment quality as per SMP2. Sampling frequency will be dictated by the number and location of sampling sites and the philosophy of the sampling design. Samples to be sieved with collected infauna preserved (buffered formalin, formaldehyde or 70% ethanol) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	With the purpose of collecting post spill pre-impact data, service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilization time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.6 SMP6 Benthic Habitats

SMP6 - Benthic Habitats	
Rationale	Benthic habitats are those habitats associated with the seafloor. Major benthic habitats at risk are: • Coral reefs (likely high susceptibility to spill) • Macroalgae and seagrass (likely moderate susceptibility to spill) • Non-coral benthic filter feeders (likely moderate susceptibility to spill) • Sub-tidal pavement (likely moderate susceptibility to spill) • Soft-substrate (likely lower susceptibility to spill). Macroalgal and seagrass communities are important primary producers which also provide habitat, refuge areas and food for fish, turtles, dugongs and invertebrates. Seagrass and macroalgae also increase structural diversity and stabilise soft substrates. Non-coral benthic filter feeders, which include sponges, molluscs, sea whips and gorgonians, are considered indicators of disturbance due to their immobility and long living. Corals are important primary producers that provide food, substrate and shelter for a diversity of marine life, including invertebrates and fish. They also protect coastlines from wave erosion and provide important substrate for algae. Undisturbed intertidal and subtidal coral reefs occur in several locations throughout the EMBA and are generally considered to be in good condition.
Aim	To monitor changes in the cover and composition of benthic habitats in relation to an oil spill and associated activities. To monitor change in hard coral health and reproduction in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM will be reviewed for applicable benthic habitat and coral health and reproduction baseline data. Remote sensing data, satellite and aerial imagery previously acquired (for example Hyperspectral imagery along the Ningaloo lagoon) (Kobryn et al. 2013) may also be applicable for shallow clear-water benthic habitats to detect changes in benthic habitat cover and composition. Pollution-induced change to benthic habitat cover and composition may take some time to be detected. Therefore post-spill, pre-impact benthic survey data will be collected when required to have a baseline state following initial oil contact.
Initiation criteria	<u>Benthic habitat cover and composition</u> Operational Monitoring, SMP1 or SMP2 indicates that subtidal benthic habitats are contacted or are predicted to be contacted by a hydrocarbon spill. <u>Coral health and reproduction</u> Operational Monitoring, SMP1 or SMP2 indicates that coral habitat is contacted or is predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP6 - Benthic Habitats	
Termination criteria	<u>Benthic habitat cover and composition</u> Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages. <u>Coral health and reproduction</u> Hydrocarbon concentration in corals, reproductive state and settlement indices are not statistically different from the baseline state (where baseline data exists) or from comparable non-impacted assemblages.
Receptor impact	Impact to benthic habitats from pressures including hydrocarbons is measured through change in: • Species diversity • Assemblage composition • Percent cover. Other pressures to these states are: • Physical disturbance • Discharge of toxicants • Introduction of marine pests • Shading • Climate change.

SMP6 - Benthic Habitats	
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. <u>Benthic Habitat Cover and Composition</u> Field survey methodology will be based upon acquiring repeat digital imagery (video or still images) of benthic habitats along fixed transects (preferable), using a stratified sampling approach at each site to target different habitat types and depths where clear gradients in these conditions exist. Site selection and image acquisition methodology will aim to align applicable baseline studies where these exist, such that imagery is comparable. The number of sites and frequency of sampling will depend upon the sampling design philosophy. Divers, towed video or remotely operated vehicles (ROVs) will be employed to collect imagery considering safety aspects and the depth of water at survey locations. Where divers are employed, fish species will also be recorded where practicable (for example following methodologies employed by Babcock et al. (2008) to contribute to SMP11. <u>Coral Health and Reproduction</u> Using divers, selected coral colonies will have tissue samples removed for the purpose of laboratory analysis of the concentration of accumulated hydrocarbons and for determining reproductive state, noting sampling for reproductive state will be dependent upon the timing of coral spawning. Reproductive state will be determined from measures of gamete size, stage and fecundity determined from in-field examination and laboratory analysis of histological samples. In addition to the standard suite of ecotoxicology testing done on the released hydrocarbon as part of the Operational Monitoring Program, ecotox testing of the released hydrocarbon on the larval competency of representative coral species will be conducted. Settlement plates will be deployed to monitor settlement of coral recruits following spawning periods to ascertain the level of coral recruitment at impacted and non-impacted sites.
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider is to be able to mobilise within 72 hours of the SoW being approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP6 - Benthic Habitats	
Analysis and reporting	Digital imagery will be analysed using a point-count technique (using software such as AVTAS, Coral Point Count with Excel extensions (CPCe) or TransectMeasure (SeaGIS)) to estimate the percentage cover of biotic and abiotic categories (in line with the CATAMI classification scheme) comprising the benthic habitat. Biotic categories to include the following as applicable: corals; macroalgae and seagrass; and non-coral benthic filter feeders. Live, dead and bleached coral cover shall be recorded. The imagery collected will allow for the determination of percent cover, abundance, measurement of size (if scaling lasers are included in the image) and a visual assessment of health (Kohler and Gill 2006). NATA accredited laboratory analysis to determine the concentration of hydrocarbons within coral tissue. Reproductive output to be determined by complementary means, including in-field and laboratory analysis of gametes, including microscopic examination of histological samples preserved in the field. Coral larval competency tests to be conducted by ecotox laboratory in addition to standard suite of ecotox tests using released hydrocarbon. Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card provided as part of report. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.7 SMP7 Seabirds and Shorebirds

SMP7 - Seabirds and Shorebirds	
Rationale	The region supports around 25 species of migratory shorebirds, 20 species of resident shorebirds, and approximately 30 species of seabirds. Shorebird foraging is most highly concentrated on tidal mudflats, while seabirds tend to nest on offshore islands. Impacts to seabirds and shorebirds due to the presence of surface, entrained and dissolved hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical (e.g. matting of feathers, inability to fly). These effects may ultimately lead to death or failed breeding. For the purposes of this document, seabirds and shorebirds are defined as: • shorebirds – those birds that inhabit and feed in the intertidal zone and adjacent areas and are resident or migratory, using the area principally during the austral summer • seabirds – those birds associated with the sea and deriving most of their food from it, and typically breeding colonially, including the marine raptors osprey and white-bellied sea eagle.
Aim	Quantify seabirds and shorebirds, in the spill and response areas. Quantify lethal and/or sub-lethal impacts of hydrocarbon spill exposure on seabirds and shorebirds. Monitor changes in seabird populations (reproductive success) in relation to the hydrocarbon spill and clean-up activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted. Long-term seabird monitoring has been conducted on Lowendal, Airlie and Serrurier Islands by Santos as part of seabird and shearwater monitoring programs.
Initiation criteria	Operational monitoring indicates that known foraging, roosting or nesting areas for seabirds and/or shorebirds has been contacted, or are predicted to be contacted, by a hydrocarbon spill; OR Operational monitoring indicates that seabirds and shorebirds have been contacted, or are predicted to be contacted, by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Detectable levels of hydrocarbons attributable to the hydrocarbon spill are not present in seabird and shorebird tissues; AND measured variables are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured variables at non-impacted sites; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).

SMP7 - Seabirds and Shorebirds	
Receptor impact	Impact to sea and shore birds from pressures including hydrocarbons is measured through change in: • Species diversity • Bird abundance • Health/condition • Breeding success (resident species only). Other pressures to these states are: • Physical disturbance of foraging and nesting habitat • Accidental chemical spillage • Entanglement in litter • Displacement by less favourable species (e.g. Silver Gull) • Predation • Climate change.
Methodological approach	Monitoring design will be as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. Given the ease of survey establishment, post-spill pre-impact monitoring will be attempted wherever practicable in order to established pre-impact state. • Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied. Monitoring for seabirds and shorebirds will measure abundance and diversity in key foraging/roosting areas with the timing of surveys to coincide with seasonal peaks in abundance. The seabird and shorebird roost count monitoring will follow current accepted survey methodology conducted in the area, such as Bamford and Moro (2011) at Barrow Island, and survey guidelines standardised by the Department of the Environment and Energy (2017). Monitoring of seabirds to focus on nesting (burrow) density, breeding participation and breeding success, taking measurements of the number of adults, eggs and chicks with the timing of surveys to allow assessments immediately after egg laying and immediately prior to chick fledging. Bird mortality to be recorded during monitoring of seabirds and shorebirds with tissue samples taken from dead birds for hydrocarbon analysis in the laboratory. Necroscopies will follow the process of Gagnon and Rawson (2010).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been provided to them (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and associated timing requirements.

SMP7 - Seabirds and Shorebirds	
Analysis and reporting	Data will be entered to spatially explicit database and analysed in order to determine significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Draft annual report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.8 SMP8 Marine Megafauna

SMP8 - Marine Megafauna	
Rationale	Thirty-eight species of marine mammals are known to occur within the region. These include cetaceans (whales and dolphin) and sirenians (dugong). The whale shark (*Rhincodon typus*) is also included within this plan. Effects to marine megafauna due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural (e.g. deviation from migratory routes), physiological (e.g. disruption to digestion) or physical effects. Given large spatial variation in occurrence and broad scale movement, population estimates and associated change are not often available. This plan will focus on assessing the extent of impacts to animals within the region, and where possible, the level of recovery. This will then be used to deduce potential impacts at a population level.
Aim	To monitor short and long-term environmental effects on marine mammals and whale sharks that may have resulted from the hydrocarbon spill and associated response.
Baseline	Refer Baseline Data Review (QE-00-BI-20001)
Initiation criteria	Operational monitoring indicates that marine megafauna are contacted or predicted to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP8 - Marine Megafauna	
Termination criteria	Restoration or resumption of key biological processes (e.g. abundance, distribution, breeding) necessary to ensure post-impact recovery is demonstrated. Specific criteria to be developed by Marine Scientist(s) with expertise in marine mammals in the north-west of Western Australia; AND No further instances of dead marine megafauna with detectable levels of hydrocarbons attributable to the hydrocarbon spill; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine mammals and whale sharks from pressures including hydrocarbons is measured through observed injury and mortality. Other pressures to these states are: • Physical disturbance • Entanglement in fishing gear and litter • Accidental chemical spillage • Climate change • Over-exploitation.
Methodological approach	Aerial and marine surveys will be implemented to identify individuals in proximity of the spill and to quantify damage: • Aerial surveys will follow the protocols of Hedley et al. (2011) • Marine surveys will follow the protocols of Watson et al. (2009) Tissue sampling of dead or injured animals will follow the protocols of: • Department of Environment and Heritage (DEH) (2006) (Cetaceans) • Eros et al. (2000) (Dugongs).
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP8 - Marine Megafauna	
Analysis and reporting	Data will be entered to spatially explicit database. Data and conclusions will be summarised in an environmental report card. Statistical power related to these receptors is likely to be low, due to observational data and small sample sizes. Therefore, the assessment of quantified impacts will be corroborated with marine scientist(s) with expertise in relevant fauna in the north west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.9 SMP9 Marine Reptiles

SMP9 - Marine Reptiles	
Rationale	Six species of marine turtle, 22 species of sea snake and one species of estuarine crocodile are considered to occur within the region. Impacts to marine reptiles due to presence of surface oil, entrained oil and dissolved aromatic hydrocarbons may include behavioural, physiological (e.g. disruption to digestion) or physical effects. This plan is primarily focussed on marine turtles, while assessing other reptiles where encountered.
Aim	To observe and quantify the presence of marine reptiles in the spill and response areas, and broader regional areas. To assess and quantify lethal impacts or sub-lethal impacts of this exposure or interactions. To monitor changes in turtle populations in relation to an oil spill and associated activities.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) The Oil Spill Response Atlas (Department of Transport (DoT)) and National Conservation Values Atlas (Department of the Environment and Energy - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) should also be consulted.

SMP9 - Marine Reptiles	
Initiation criteria	Operational monitoring indicates that marine reptiles or nesting sites are contacted or likely to be contacted by a hydrocarbon spill; OR Operational monitoring indicates that marine reptiles are contacted, or are predicted to be contacted, by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Detectable levels of hydrocarbons attributable to the hydrocarbon spill are no longer present in marine reptile tissues collected from live or dead individuals; AND In the event that an impact attributable to the hydrocarbon spill is detected on marine reptiles, the measured parameters are not statistically significantly different from their baseline or pre-spill state (where these data exist) or from measured parameters at non impacted sites; AND Monitoring is terminated in consultation with the relevant environmental authority (DBCA and/or DoEE).
Receptor impact	Impact to marine turtles from pressures including hydrocarbons is measured through change in: • Abundance • Health/condition • Nesting success. Impact to other marine reptiles from pressures including hydrocarbons is measured through change in observed injury and condition. Other pressures to these states are: • Lighting and flares causing disorientation (turtles) • Vessel strike • Physical disturbance of nesting sites • Predation • Entanglement in fishing gear and litter • Accidental chemical spillage • Habitat loss or change due to dredging • Climate change • Over-exploitation.

SMP9 - Marine Reptiles	
Methodological approach	**Abundance** In-water impacts – aerial surveys. Shoreline impacts – ground surveys (either rapid track census survey or tagging program). **Health/condition** In-water impacts – vessel surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Shoreline impacts – ground surveys (collecting observations on animal condition and collection of tissue samples or dead specimens for analysis). Dead reptiles will be collected for autopsy following Gagnon (2009) **Reproductive success** Shoreline impacts – ground surveys (detailed tagging and/or nesting success studies). Design of ground surveys for turtles will be applied as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • Where no baseline data sites are involved, and timing allows, a post spill pre-impact approach will be attempted • If a post-spill pre-impact approach is not practicable, a gradient approach to quantifying impacts will be applied
Scope of works	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP9 - Marine Reptiles	
Analysis and reporting	Data will be entered to spatially explicit database. Turtle data will be analysed in order to test for significant differences between impacted and non-impacted assemblages. Data and conclusions will be summarised in an environmental report card. Owing to their observational nature and potentially low sample size, observed impacts to other reptile fauna will be corroborated with marine scientist(s) with expertise in relevant fauna in the north-west of Western Australia. Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.10 SMP10 Seafood Quality

SMP10 - Seafood Quality	
Rationale	Exposure of commercial and recreationally targeted demersal and pelagic fish species to entrained and dissolved aromatic hydrocarbons can cause flesh tainting and increase the levels of toxicants above human consumption guidelines. Aromatic hydrocarbons are carcinogenic to humans. This scope includes finfish, sharks and invertebrates (principally crustacea).
Aim	To identify potential human health risks due to the presence of hydrocarbon concentrations in the flesh of targeted seafood species for consumption.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) Human health benchmarks relating to the exposure of PAHs shall be used to determine health effects as per Yender et al. (2002). Flesh samples from non-impacted sites to be used as baseline for olfactory analysis for flesh taint.
Initiation criteria	Operational monitoring and results from SMP1 predicts or observes contact of oil to target species for consumption. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.

SMP10 - Seafood Quality	
Termination criteria	Hydrocarbon concentrations in the tissues of seafood are not above levels considered a human health risk from consumption; AND Flesh taint is not detected from olfactory testing of seafood samples; AND Target species are no longer exposed to hydrocarbons in the water column.
Receptor impact	Impact to seafood quality from hydrocarbons is measured through change in: • Toxicity indicators • Olfactory taint. Other pressures to these states are: • Accidental chemical spillage • Disease.
Methodological approach	Target fish species determined from water quality monitoring results and relevant and available commercial and recreational-fished species. Sampling of target species will follow a gradient design (Gagnon and Rawson 2012) ranging from impacted to non-impacted (or non-suspect) catches using commercial and recreational fishing techniques undertaken by commercial and recreational fishers. Sampling method (netting, trawling, baited fish traps, spear fishing, line fishing) will be determined by habitat, target species and spill location. If more than one target species is affected, replicate samples of each species shall be collected, with a minimum of five replicate samples. Olfactory testing will follow Rawson et al. (Rawson et al. 2011), following the duo-trio method (Standards Australia 2005).
Scope of works	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP10 - Seafood Quality	
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed in order to test for significant differences between impacted and non-impacted seafood. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.11 SMP11 Fish, Fisheries and Aquaculture

SMP11- Fish, Fisheries and Aquaculture	
Rationale	Impacts to fisheries species due to presence of entrained hydrocarbons may include lethal and sub-lethal physiological effects (e.g. reduced growth) and physical effects. The region comprises the Indo-West Pacific area which consists of a high diversity of fish species and assemblages and provides important spawning and nursery grounds for several fisheries species. Fish are concentrated in a number of biodiversity hotspots. The environment is also conducive to aquaculture including pearl production. Fisheries species that spawn or inhabit near shore areas face a greater risk to an oil spill than finfish found in deeper waters.
Aim	To monitor changes in structure and distribution of fish assemblages in relation to an oil spill and associated activities. To monitor the effect of hydrocarbon exposure and physiological condition on fisheries and aquaculture species.
Baseline	Refer Baseline Data Review (QE-00-BI-20001) In addition, the IGEM shall to be reviewed for applicable baseline data.
Initiation criteria	Operational monitoring indicates fish, fisheries or aquaculture are contacted or likely to be contacted by a hydrocarbon spill. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	Fish assemblages are not statistically significantly different than those of baseline or similar non-impacted assemblages; AND Hydrocarbon concentrations, physiological condition indices, and biomarker levels in affected fish and aquaculture species are not statistically significantly different from those of non-impacted samples; AND Termination of monitoring is done in consultation with the Department of Primary Industries and Regional Development (DPIRD).

SMP11- Fish, Fisheries and Aquaculture	
Receptor impact	Impact to fish, fisheries and aquaculture from pressures including hydrocarbon concentrations is measured through change in: • Species diversity • Abundance of indicator taxa • Assemblage structure • Health. Other pressures to these states are: • Accidental chemical spillage • Over fishing • Introduction of marine pests • Habitat disturbance • Climate change.
Methodological approach	Fish assemblages will be assessed using the stereo-baited remote underwater videos (BRUVs) following Shortis et al. (2009). Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas. Sampling design for fish assemblages will be as follows: • Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. • Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. • If baseline data is not available, a gradient approach to quantifying impacts will be applied (See Figure 1). Where relevant, data available from DPIRD, including catch/effort data, will be assessed to determine potential changes from baseline levels in fishing grounds potentially affected by an oil spill compared to after the event. For fish and aquaculture species potentially exposed to an oil spill, species will be sampled across the contamination gradient as per Gagnon and Rawson (2012). Hydrocarbon concentrations (particularly PAH) within tissues of fish and aquaculture species will be determined. Exposure to hydrocarbons on fish health will also be determine through analysis of physiological indices and biochemical markers following Gagnon and Rawson (2012). If fish kills are observed, whole specimens will be obtained and preserved (frozen) for necropsy to determine the cause of death.
Scope of works	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.

SMP11- Fish, Fisheries and Aquaculture	
Analysis and reporting	BRUV imagery will be processed using EventMeasure (SeaGIS) software. NATA-accredited laboratories will be employed for health analyses. Data will be entered to spatially explicit database and analysed to test for statistically significant differences between non-impacted and impacted fish assemblages. Data and conclusions will be summarised in an environmental report card. Final draft report to be prepared within one month of monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

2.12 SMP12 Whale Shark

SMP12- Whale Shark	
Rationale	Whale sharks inhabit most of the Western Australian coast and seasonally aggregate at Ningaloo Reef in the austral autumn and winter, coinciding with a pulse of productivity following mass coral spawning in early autumn, with the population during this period dominated by juveniles (Bradley et al. 2016). In addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks along the Ningaloo Coast will be undertaken (SMP12). Santos has historically and currently supported research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef. In the event of a spill that could impact whale sharks, Santos will leverage off this long term research program to assess potential impacts to whale sharks at, and migrating to-and-from, Ningaloo Reef. SMP12 is regarded as complementary to SMP8 which will detect potential impacts to whale sharks from visual surveys of whale sharks wherever they may occur in relation to a spill.
Aim	To quantify impacts of an oil spill on whale sharks at the Ningaloo Coast

Baseline	Baseline monitoring information of whale sharks includes: 1) Aerial survey. Monthly surveys funded by Woodside Energy were completed from 2000 to 2002. DEC undertook monthly surveys of Ningaloo Reef during the whale shark season from 2006 to 2010. The results of work funded by Woodside were published by Sleeman *et al*. (2010). Because whale sharks are not constrained to visit the surface in the same way as marine mammals, both surveys recorded relatively few whale sharks. Analysis of the DEC survey data by Professor Helene Marsh of James Cook University concluded its surveys did not account for problems of availability and perception errors and that due to the relatively low numbers of sharks available to be counted in the Ningaloo region, aerial survey was probably not an appropriate means to census these sharks (DEC pers. comm.). Note that while aerial survey techniques have shortfalls for determining abundance patterns, they are still useful for identifying aggregation sites of whale sharks in the Exmouth sub-basin. 2) Photo-identification databases. Two databases of whale sharks sighted at Ningaloo Reef are available although there is likely to be considerable overlap in their content. The first of these is held by AIMS and uses open-source software to compare and match images of sharks. Access to this database is not restricted. The second is held by Ecocean and requires user-access agreements to deposit, match and retrieve images or access metadata. The software used by Ecocean to compare images is proprietary. In the case of the AIMS database, images are available from 1992 to the present day with most of them provided by ecotourism operators at the end of each whale shark season. As part of licence agreements with DBCA, videographers working with each tourist operator must surrender footage of each shark encountered by the operator. DBCA staff then download id-images from these videos. Metadata and id-images are provided to both Ecocean and AIMS databases. These databases can be used in mark-recapture modelling frameworks to examine trends in the composition and abundance of whale sharks at Ningaloo, but outputs must be considered in the light of the caveats mentioned earlier (i.e. representativeness, sampling protocol etc.). 3) Operator and researcher trip logs. Each time a whale shark is encountered by a tourist and research vessel, or by a spotter plane, a record is kept of the location, size and sex (where possible) of the animal and the date and time. These records now exist from 1994 to the present day. These data suffer from the same caveats applicable to photo-id databases (e.g. representativeness of sampling of the entire population within the Exmouth region). Furthermore, planes do not search for animals in any formally structured manner, but rather fly up and down the reef at varying distances from the reef crest until a whale shark is sighted. If animals are sighted early in the day and all operators have completed tourist swims with sharks, then searches are terminated and the plane returns to base. Conversely, if whale sharks are difficult to find the area of search is widened and the plane will search for longer. Thus, the area and duration of searches can be highly variable. There have been changes in the format of reporting (written logs to GPS records) of encounters both by the boats and the planes through time. Finally, at times when there are few whale sharks, encounters with the same shark may be shared among tourist vessels, so that there is the possibility of double (or even triple) counting of the same shark in the database. Despite these problems, analysis of tourist industry databases have returned valuable insights into physical drivers of whale shark abundance at Ningaloo Reef (e.g. Sleeman *et al*., 2010) Other relevant baseline datasets include: 4) Sightings by the oil and gas industry. Occasional sightings of whale sharks either from the decks of oil rigs or by remotely operated vehicles (ROVs) around oil platforms and deepwater facilities have been compiled by AIMS for the past six years. No formal sampling program exists and these sightings occur largely by

SMP12- Whale Shark	
	chance, although they do indicate the presence of these animals around oil and gas facilities offshore and in deep water on the shelf. 5) Tagging data. Satellite telemetry has been used to describe the movement patterns of whale sharks along the Ningaloo coast and extending into the Timor Sea and south-east Indian Ocean. This data cannot be used to estimate patterns of abundance, but does provide important insights into the feeding, residency and migratory behaviours of sharks under 'normal' oceanographic conditions within the Exmouth sub-basin. Much of this data has been gathered by tag deployments led or assisted by AIMS. Researchers from other institutions have also deployed tags on whale sharks at Ningaloo at tracked movement, including a recent study by Ecocean/University of QLD (Reynolds et al., 2017). 6) Food chain studies. Surveys of euphausiids (a major food item of whale sharks at Ningaloo; Jarman and Wilson, 2004) and other mesoplankton in the region of Ningaloo Reef have been published by Wilson et al. (2001; 2003). Preliminary work on the food chains leading to the prey of whale sharks is underway (Marcus et al., 2016, 2019). This ongoing research may identify the physical and biological factors correlated with whale shark abundance at Ningaloo and thus result in a better understanding of variability in the ecosystem. Such information is essential if the effects of an oil spill or development are to be discerned against a background of natural changes in distribution and abundance of whale sharks.
Initiation criteria	Operational monitoring indicates that Ningaloo Coast whale shark aggregations are contacted or predicted to be contacted by oil. Contact is defined as hydrocarbon exceeding one of the following thresholds: • 1 g/m^2 Floating oil • 10 ppb Dissolved Aromatic Hydrocarbons • 10 ppb Entrained hydrocarbons.
Termination criteria	The termination criteria for this monitoring program are: • Measured parameters of whale shark abundance and distribution are not significantly different to baseline levels ; **AND** • The water quality at feeding/ aggregation sites has been measured as not significantly different to baseline levels.
Methodological approach	During spill activities may require the following surveys and sampling: • Aerial surveys • Satellite tagging • Toxicology • Food chain studies • Photo-identification • Vessel and plane logs • Acoustic tagging The methodologies adopted will follow the approaches of those baseline studies identified allowing consistency of data from baseline to impact and recovery phases.
Scope of works	Prepared within 24 hours of this SMP being activated
Implementation	Service provider able to mobilise within 72 hours of the scope of work having been approved
Analysis and reporting	Draft annual report to be prepared within one month of annual monitoring completion; external peer review of final draft within two weeks of report provision to reviewer; finalise report within two weeks of peer review having been completed.

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Appendix B2: Scientific Monitoring Activation and Response Process and Form

Oil Spill Scientific Monitoring Activation and Response Process

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
Phase 1 – Activation					
1	Santos IMT (Environmental Team Leader (ETL))	Astron Monitoring Coordinator notified of incident.	On approval from Santos Incident Commander	Astron oil spill response phone number and answering service	
2	Astron Monitoring Coordinator (MC)	Call back client for further details, request *Activation Form* if not received.	Within 30 minutes of receiving initial notification	Activation Form	
3	Astron MC	Call Planning & Logistics Officer to advise of incident.	Immediately following Step 2	n/a	
4	Santos IMT (ETL)	Complete *Activation Form* and submit to Astron via email.	Within one hour following initial notification (Step 2)	Activation Form	
5	Astron Planning & Logistics Officer (PLO)	Notify MCT, Technical Advisors and key subcontractors via SMS Global.	Within 30 minutes of Step 3	SMS Global Guidance	
6	Astron PLO	Notify all staff of incident via SMS Global.	Within one hour of receiving Activation Form	SMS Global Guidance	
Phase 2 – Response Planning					
7	Astron MC	Maintain verbal communication with Santos IMT (ETL).	At least twice daily (0800 and 1700)	n/a	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
8	Astron MC Astron Operations Officer Astron PLO	Maintain Functional Log.	Daily	Functional Log	
9	Astron PLO	Set up Command Room.	Within 4 hours of activation (Step 5)	Command Room Resource Checklist	
10	Astron MC, PLO and BMT Oceanica Operations Officer	Attend Santos incident briefing and relay information to MCT.	As advised by the Santos IMT (ETL)	n/a	
11	Astron Operations Officer	MCT and Technical Advisors to meet at Royal St office, review personnel and equipment resource status.	Within 6 hours of activation (Step 5)	Capability report Training matrix Resource chart	
12	Astron PLO	Confirm availability of additional personnel and equipment resources.	Within 16 hours of activation (Step 5)	External Supplier Details Requisition Request Form	
13	Santos IMT (ETL)	Provide spill trajectory modelling and sensitive receptor information to Astron.	When available	APASA modelling Department of Transport database Santos GIS Mapping	
14	Astron MC in consultation with Santos ETL	Define the scale of response - identify which SMPs are activated. Identify if operational water quality monitoring is required.	Within 2 hours of receiving spill and receptor information (Step 13).	Scientific Monitoring Plan* Relevant OPEP Spill trajectory modelling Operational monitoring results	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
15	Astron Technical Advisors in consultation with Santos ETL	**Determine monitoring locations for activated SMPs:** • Identify monitoring locations in order of priority for activated SMPs based on: o nature of hydrocarbon spill o spill trajectory modelling and time to shoreline impacts o sensitive receptors impacted or potentially at risk of being impacted o state of current baseline data o current environmental conditions o current results of operational monitoring. • Determine if post-spill pre-impact data is required to be collected from any locations. See SMP Work Method Statements for decision making process when considering availability of baseline data.	Within 6 hrs of relevant SMP activation (Step 14).	Relevant SMPs Information from Astron: • baseline information for relevant receptors. Information from Santos IMT: • sensitive receptor information from relevant EP, Santos GIS mapping and online resources (DoT oil spill response atlas, DoE conservation values atlas) • oil spill trajectory modelling • response strategies and priority protection areas • results from OMPs currently activated • baseline information for relevant receptors as reference in the relevant SMP.	
16	Astron Technical Advisors in consultation with Santos ETL	Submit Department of Parks and Wildlife Licence applications	Within 12 hrs of relevant SMP activation (Step 14)	• Proposed monitoring locations • SMP methods	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
17	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine personnel requirements:** • Identify number and competencies of personnel required for monitoring teams for each SMP based on: o activated SMPs o number of locations to be monitored o number of locations where pre-spill baseline data needs to be collected o timing of hydrocarbon spill and overlap with sensitive receptors in activated SMPs o logistical and equipment resource constraints. • Arrange additional personnel if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Capability report • Training matrix • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • sensitive receptor information • oil spill trajectory modelling • response strategies and priority protection areas • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	
18	Astron Operations Officer, PLO & Technical Advisors in consultation with Santos ETL	**Determine equipment requirements:** • Identify number and competencies of equipment required for each SMP based on: o activated SMPs o number of locations to be monitored o number of field teams and timing of mobilisation to the field o logistical and equipment resource constraints. • Arrange additional equipment resources if required.	Within 12 hrs of activation if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
19	Astron MC, Operations Officer, PLO & Technical Advisors	**Prepare and submit Monitoring Action Plan** (mission, objectives, strategies, tactics, tasks), including scope of works. **Prepare and submit cost estimate.** **Prepare and submit logistics request:** • Allocate personnel and equipment resources to field teams for relevant SMPs. • Submit SOW and logistics request for each activated SMP to Santos IMT for approval.	Within 24hrs of request for SoW (Step 15) for relevant SMP if pre-impact data is needed.**	Information from Astron: • Resource chart • relevant SMPs and WMS • agreed monitoring locations • Mobilisation and Logistics Form (incorporating SOW) • Monitoring Action Plan. Information from Santos IMT: • request for SoW • agreed monitoring locations.	
20	Santos IMT (ETL)	Santos to approve SOW, provide purchase order and initiate logistical arrangements.	Within 24 hours of SOW submission (Step 19).	Astron Mobilisation and Logistics Request	
21	Astron MC	Advise field personnel by email meeting invite, or phone if not in office.	Within 24 hours of SOW approval (Step 20).	Field team allocation	
22	Astron	Conduct incident briefing with all available Astron personnel.	Within 24 hours of SOW approval (Step 22).	Briefing template Monitoring Action Plan	
Phase 3 – Mobilisation					
24	Astron PLO	GIS and device preparation requests (field maps, data capture) submitted, and discussed with Geospatial team.	Within 24 hours of SOW approval (Step 22).	https://voyager/	
25	Astron Operations Officer	Conduct field team overview briefing, allocate tasks.	Within 36 hours of SOW approval (Step 22).	Briefing Template	

Step	Responsibility	Action	Timeframe[#]	Resources	Date/Time Complete
26	Field Team Leaders	Compile SMP grab packs, GIS information, field equipment, and prepare and submit HSE documentation to Santos IMT.	Within 48 hours of SOW approval (Step 22).	Information from Astron • SoW • Grab packs, SMP WMS and HSE documentation • GIS information/field maps • field equipment. Information from Santos IMT: • booking and logistics confirmations.	
27	Astron Technical Advisors	Conduct scope specific pre-mobilisation briefings.	Prior to mobilisation.	Pre-mob Briefing Template	
28	Santos ETL	Santos to approve HSE plan.	Within 24 hours of receiving HSE Plan.	Mobilisation and Logistics Form HSE plan	
29	Astron PLO	Personnel mobilised to site.	Within 72 hrs of SOW approval (Step 22) if pre-impact data is needed.**	Approved SOW	
Phase 4 – Response Operations					
30	Astron MC	Conduct Monitoring Action Plan review with MCT and Technical Advisors and communicate to Santos IMT (ETL).	Daily	Monitoring Action Plan template	
31	Astron PLO	Hold post-demobilisation debrief with field teams.	Within 3 days of demobilisation.	Demob Meeting Template	
32	Santos ETL	Santos to arrange approval of Monitoring Action Plan revisions and any additional mobilisation/logistics requirements.	Daily or as required	Monitoring Action Plan Mobilisation and Logistics Form	
33	Astron Field Team Leaders	Provide activity reports to Santos ETL.	Daily	Daily Activity Report Template	

[#] Timeframes are indicative and may be require adjustment where activities are dependent on information availability or affected by logistical constraints

*The Scientific Monitoring Plan (EA-00-RI-10099) provides the most up to date list of SMPs and activation criteria. Refer to the OPEP for operational water quality monitoring requirements.

**If post-spill, pre-impact data is not required then timeframes will be specific to each SMP. The lead times for resourcing, preparation of SoW and mobilisation of field teams may be longer depending on the timing of the spill, likely trajectory and life stages of receptors present or likely to be impacted.

For example, in SMP4 if post-spill, pre-impact data collection is not required then mangrove decline is likely to take several weeks to occur and there is lower priority for mobilisation of field teams for this SMP within the 72 hr timeframe. In this case, mobilisation within 30 days may be more appropriate.

Abbreviations

EMBA – Environment that May Be Affected
IMT – Incident Management Team
OMP – Operational Monitoring Program
OPEP – Oil Pollution Emergency Plan
Santos – Santos Energy Australia Limited
SMP – Scientific Monitoring Plan/Program
SoW – Scope of Works
WMS – Work Method Statement

Appendix B3: Scientific Monitoring Resource Capability Report

SMP	No. personnel per team	No. teams	Survey type	Required Competencies	Desirable Competencies
SMP 1 - Water quality	2	3	Undefined	One member in each team to have experience in water sampling	
SMP 2 - Sediment quality				One member in each team to have experience in deep sea sediment sampling	
SMP 3 - Sandy beaches/rocky shore	2	2	Undefined	One team member in each team to have experience in shoreline macrofauna/infauna assessment	
SMP5 - Intertidal mudflats					
SMP 6 - Benthic habitats	2	2	Undefined	One team member in each team to have experience in benthic habitat assessment	
				ROV operator or divers	
SMP 7 - Seabirds/shorebirds	2	1	Ground survey	One member in each team to be experienced ornithologist	
SMP 8 - Marine mammals (can be concurrent with SMP9)	2	1	Aerial survey	Both team members to be experienced wildlife observers	
	2	1	Vessel-based survey	Both team members to be experienced wildlife observers	
SMP 9 - Marine reptiles (can be concurrent with SMP 8)	2	1	Aerial surveys	Both team members to be experienced wildlife observers	
	2	1	Vessel-based survey	Both team members to be experienced wildlife observers	
	2	1	Ground survey	One member with experience in turtle survey techniques	
SMP 10 - Seafood quality	3	2	Undefined	One member in each team to have experience in fish identification and necropsy	
SMP 11 - Fish, fisheries and aquaculture			Undefined	One member in each team to have BRUV experience	

Competencies	Abbreviation	Criteria	Ranking
Office Support	OS	No direct experience but able to provide office support	0
Non-independent Field Team Member	FS	No direct experience or <1 years experience, but relevant transferable experience and able to work with experienced team member	1
Independent Team Member	TM	Moderate level of experience 1-2 years, independent team member	2
Field Team Leader	FTL	High level of experience, >2 years, team leader capability	3
Technical Advisor	TA	Office-based, >5 years experience in identified field	4

Role	Qualification	Experience
Principal Scientist	Must have: Graduate Degree or Higher in Natural Resource Management, Biological and/or Environmental Science, Botany, Zoology or relevant natural sciences	• 12 years plus experience in Natural Resource Management / Botanical / Biological / Environmental Science / Fauna studies, investigations, monitoring and/or research • Prior experience in the management and/or directing of projects, personnel and teams.
Senior Scientist	Must have: Graduate Degree or Higher in Natural Resource Management, Biological and/or Environmental Science, Botany, Zoology or relevant natural sciences	• 6 years plus experience in Natural Resource Management / Botanical / Biological / Environmental Science / Fauna studies, investigations, monitoring and/or research • Prior experience in the management and/or directing of projects, personnel and teams.
Scientist	Must have: Graduate Degree or Higher in Natural Resource Management, Biological and/or Environmental Science, Botany or Zoological Sciences	2 years plus experience in Natural Resource Management / Botanical / Zoological / Biological / Environmental Science studies, investigations, monitoring and/or research.
Technician	Preferred: Teritiary qualification in Environmental and/or Natural Resource Management	Some exposure to botanical / biological / environmental science field programs

Surname	First name	Role	Monitoring Coordination Team	SMP 4 (Mangroves)	SMP 9 (Reptiles)	SMP4 (Shorebirds/Seabirds)	SMP 8 (Megafauna)	Pathology /veterinary skills	Certified Marine Mammal Observer	Aerial survey experience	Vessel survey experience	Terrestrial fauna surveys	Terrestrial vegetation surveys	TBOSIET
Arrowsmith	Hugh	Technical Advisor/Principal Scientist	4	4	1	1	1	1	0	1	1	1	3	
Bleby	Tim	Senior Scientist	0	4	1	1	1	1	0	1	1	1	3	
Brown	Michael	Senior Scientist	0	1	1	2	1	1	0	1	1	3	1	
Cottrill	Rachael	Environmental Technician	0	1	1	1	1	1	0	1	1	1	1	
Dadour	Lucy	Environmental Scientist	0	1	3	3	1	1	0	1	1	2	3	
De Vos	Roxanne	Environmental Technician	0	1	2	1	1							
Dorrington	Kate	Environmental Technician	0	1	1	1	1	1	0	1	1	1	1	
Dundon	Daemia	Environmental Technician	0	1	1	1	1	1	0	1	1	1	1	
Eckermann	Ben	Senior Scientist	0	1	1	1	1	1	0	1	1	1	3	
Hall	Matthew	Planning and Logistics Officer (Deputy)	5	0	1	1	1	1	0	1	1	1	1	
Funnekotter	Anna	Environmental Scientist	0	2	1	1	1	1	0	1	1	1	2	
Gore	Tyron	Senior Scientist	4	4	1	4	1	1	0	3	3	3	1	
Hall	Kayla	Environmental Scientist	0	1	1	2	1							
Jayasekara	Palitha	Environmental Scientist	0	1	1	1	1	1	0	1	1	1	3	
Johnston	Jess	Techinical Advisor/Senior Scientist	4	3	4	4	2	2	0	3	3	3	1	
Kaminski	Kate	Environmental Technician	0	0	1	1	1	1	0	1	1	1	1	
Keirle	David	Environmental Scientist	0	1	2	3	1	1	0	1	1	3	1	
Kraan	Lihan	Monitoring Coordinator	4	0	1	1	1	1	0	1	1	1	1	
Lowe	Kate	Associate Scientist	0	4	1	3	1	1	0	1	3	2	3	
Low	Wahl	Senior Scientist	4	4	3	4	1	2	0	1	3	3	2	
Lucas	Brett	Assistant Manager	5	2	1	1	1	1	0	1	1	1	1	
McMahon	Emily	Senior Scientist	0	1	1	1	1	1	0	1	1	1	3	
Mori	Kyle	Environmental Scientist	0	2	1	1	1	1	0	1	1	1	2	
Melville	Bethany	Senior Scientist	0	2	1	1	1	1	0	1	1	1	3	
Mitchell	Rachael	Environmental Scientist	0	1	1	1	1	1	0	1	1	1	3	
Mitchell	Dylan	Graduate Environmental Scientist	0	1	1	1	1	1	0	1	1	1	1	
Moore	Sharyn	Senior Scientist	0	1	1	1	1	1	0	1	1	1	3	
Morris	Kate	Senior Scientist	0	0	1	1	1	1	0	1	1	1	1	
Morris	Dawn	Senior Environmental Technician	0	1	3	1	1	1	0	1	1	2	1	
Osborn	Brittany	Environmental Scientist	0	0	1	1	1	1	0	1	1	2	1	
Parker	Frank	Operations Officer	5	0	1	1	1	1	0	1	1	1	1	
Poole	Chris	Graduate Environmental Scientist	0	1	1	1	1	1	0	1	1	1	1	
Ronan	Sam	Environmental Technician	0	0	0	1	0							
Rumble	Kate	Environmental Technician	0	1	1	1	1	1	0	1	1	1	1	
Stalker	Megan	Planning and Logistics Officer	5	0	1	1	1	1	0	1	1	2	1	
Vaughan	Linda	Environmental Scientist	0	1	1	1	1	1	0	1	1	1	2	
Vercoe	Rachael	Environmental Scientist	0	1	1	1	1	1	0	1	1	1	1	
Wishart	Kyal	Monitoring Coordinator (Deputy)	5	0	1	1	1	1	0	1	1	1	1	
***This is a subset**	**4**	**TA***	**5**	**5**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
	3	**FTL**	**0**	**1**	**4**	**6**	**0**	**0**	**0**	**2**	**4**	**5**	**10**	
	2	**TM**	**0**	**4**	**2**	**2**	**1**	**2**	**0**	**0**	**0**	**5**	**4**	
	1	**FS**	**0**	**19**	**31**	**30**	**36**	**33**	**0**	**33**	**31**	**25**	**21**	
	5	**Monitoring Coordination Team - Office Support**	**5**	**0**	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
External Suppliers														
Turpin	Jeff	Kingfisher Environmental Consulting (subcontractor)	0		1	3	1	1	1	1	1	4	1	
Lee	Marcus	Independent	5		1	1	1	1	1	1	1	1	1	
Swan	George	Kimberley Birdwatching (subcontractor)	0		1	3	1	1	1	4	3	3	1	
Pearson	Grant	Casual	0		1	3	1	1	1	1	1	1	1	
Kenyon	Alex	Casual	0		1	3	1	1	1	1	1	4	1	
Thomson	Georgia	Casual	0		1	3	1	1	1	1	1	4	1	
Vitenberg	Anna	Casual	0		4	3	2	1	1	1	3	3	1	
Thomas	Diane	Independent	0		1	1	3	1	1	2	2	1	1	
Waayers	David	Imbricata Environmental (subcontractor)	4		4	2	4	1	4	4	4	4	1	
Fortune	Tyne	Halfmoon Biosciences (subcontractor)	0		1	4	1	2	1	2	4	4	1	
Sanders	Kate	University of Adelaide (subcontractor)	4		1	1	1	4	1	1	4	1	1	
Guinea	Michael	Charles Darwin University (subcontractor)	4		4	1	1	4	1	4	4	4	1	
Fisher	Daniel	Aquatica Environmental (subcontractor)	4		4	2	3	1	1	2	4	4	1	
Nardi-Wallace	Amanda	Independent	0		1	1	2	1	1	1	1	2	1	
Morgan	Andreas	NRGseascapes (subcontractor)	4		3	1	3	1	1	1	3	3	1	
Steptoe	Verity	Independent	4		1	1	4	1	4	4	4	4	1	
***This is a subset**	**4**	**TA***	**6**		**4**	**1**	**2**	**2**	**2**	**4**	**6**	**8**	**0**	
	3	**FTL**	**0**		**5**	**7**	**5**	**2**	**2**	**4**	**9**	**11**	**0**	
	2	**TM**	**0**		**0**	**2**	**2**	**1**	**0**	**3**	**1**	**1**	**0**	
	1	**FS**	**0**		**11**	**7**	**9**	**13**	**14**	**9**	**6**	**4**	**16**	
	5	**Monitoring Coordination Team - Office Support**	**1**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
TOTAL (INTERNAL AND EXTERNAL CAPACITY)														
of the FTL	**4**	**TA***	**11**	**5**	**5**	**4**	**2**	**2**	**2**	**4**	**6**	**8**	**0**	
	3	**FTL**	**0**	**1**	**9**	**13**	**5**	**2**	**2**	**6**	**13**	**16**	**10**	
	2	**TM**	**0**	**4**	**2**	**4**	**3**	**3**	**0**	**3**	**1**	**6**	**4**	
	1	**FS**	**0**	**19**	**42**	**37**	**45**	**46**	**14**	**42**	**37**	**29**	**37**	
	5	**Monitoring Coordination Team - Office Support**	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

***This is a subset of the FTL numbers, not additional to.**

Surname	First name	Title	Role	Competency to support SMPs									Relevant skills											
				SMP 1 - Water quality	SMP 2 - Sediment quality	SMP 3 - Sandy beaches/rocky shore	SMP 5 - Intertidal mudflats	SMP 6 - Benthic habitats	SMP 8 - Marine mammals	SMP 9 - Marine reptiles	SMP 10 - Seafood quality	SMP 11 - Fish, fisheries and aquaculture	Water sampling experience	Vessel based sediment sampling experience	Shoreline assessment experience	Benthic habitat assessment experience	ROV operator experience	Diving experience (ADAS)	Diving experience (Scientific)	Marine fauna observer experience	Turtle survey experience	Fish identification and necropsy	BRUV experience	Vessel survey experience	Aerial survey experience
BMT staff in WA																								
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	4	4	4	4	4	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	4	4	4	4	4	3	1	1	1	Competent	Competent	Competent	Competent		Competent		Competent				Competent	Competent
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	4	4	3	3	4	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	4	4	3	3	4	1	1	1	1	Competent	Competent	Competent	Competent		Competent						Competent	
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	4	4	4	4	4	1	1	4	4	Competent	Competent	Competent	Competent								Competent	
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	2	2	4	4	2	1	3	1	1	Competent	Competent	Competent	Competent					Competent			Competent	
[redacted]		Principal Marine Environmental Scientist	Principal Scientist	2	2	4	4	2	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Associate Principal Marine Environmental Scientist	Principal Scientist	4	4	4	4	4	1	1	1	1	Competent	Competent	Competent	Competent		Competent						Competent	
[redacted]		Associate Principal Marine Environmental Scientist	Senior Scientist	3	3	3	3	3	1	1	4	4	Competent	Competent	Competent	Competent		Competent				Competent		Competent	
[redacted]		Associate Principal Marine Environmental Scientist	Senior Scientist	4	4	3	3	3	1	1	1	1	Competent	Competent	Competent	Competent		Competent						Competent	
[redacted]		Associate Principal Marine Environmental Scientist	Senior Scientist	4	4	3	3	3	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Senior Marine Environmental Scientist	Senior Scientist	3	3	3	3	3	3	1	1	1	Competent	Competent	Competent	Competent	Competent			Competent				Competent	Competent
[redacted]		Senior Marine Environmental Scientist	Senior Scientist	2	2	2	2	2	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Senior Marine Environmental Scientist	Senior Scientist	2	3	3	3	2	1	1	1	1	Competent	Competent	Competent	Competent								Competent	
[redacted]		Senior Marine Environmental Scientist	Senior Scientist	2	2	3	3	2	3	1	1	1	Competent	Competent	Competent	Competent				Competent		Competent	Competent	Competent	Competent
[redacted]		Marine Environmental Scientist	Scientist	3	3	2	2	2	1	2	1	1	Competent	Competent	Competent	Competent					Competent			Competent	
[redacted]		Graduate Marine Environmental Scientist	Scientist	1	1	1	1	1	1	1	1	1	Competent	Competent	Competent	Competent					Competent			Competent	
[redacted]		Graduate Marine Environmental Scientist	Scientist	1	1	1	1	1	1	2	1	1	Competent	Competent	Competent	Competent					Competent	Competent	Competent	Competent	
[redacted]		Graduate Marine Environmental Scientist	Scientist	1	1	1	1	1	3	1	1	1	Competent	Competent	Competent	Competent				Competent				Competent	
[redacted]		Graduate Marine Environmental Scientist	Scientist	1	1	1	1	1	1	2	1	1	Competent	Competent	Competent	Competent					Competent	Competent	Competent	Competent	
[redacted]		Graduate Marine Environmental Scientist	Scientist	1	1	1	1	1	1	2	1	1	Competent	Competent	Competent	Competent					Competent			Competent	
[redacted]		Spatial Services	Office Support	0	0	0	0	0	0	0	0	0												
[redacted]		Spatial Services | Remote Sensing Analyst	Office Support	0	0	0	0	0	0	0	0	0												
[redacted]		Spatial Services | Remote Sensing Analyst	Office Support	0	0	0	0	0	0	0	0	0												
Subcontractor support in WA (Curtin University Fish Ecology Group)																								
[redacted]		Marine Science Professor	Principal Scientist	1	1	1	1	1	1	1	4	4							Competent			Competent	Competent	Competent	
[redacted]		Marine Science Lecturer	Principal Scientist	1	1	1	1	1	1	1	4	4							Competent			Competent	Competent	Competent	
[redacted]		Research Officer	Senior Scientist	1	1	1	1	1	1	1	3	3							Competent			Competent	Competent	Competent	
[redacted]		Research Officer	Senior Scientist	1	1	1	1	1	1	1	3	3							Competent			Competent	Competent	Competent	
[redacted]		Research Assistant	Scientist	1	1	1	1	1	1	1	3	3							Competent			Competent	Competent	Competent	
Total internal capacity																								
		4*	TA*	8	8	6	6	6	0	0	2	2												
		3	FTL	3	4	8	8	4	4	1	0	0												
		2	TM	5	4	2	2	6	0	4	0	0												
		1	FS	5	5	5	5	5	17	16	19	19												
		0	OS	3	3	3	3	3	3	3	3	3												
Total external capacity																								
		4*	TA*	0	0	0	0	0	0	0	2	2												
		3	FTL	0	0	0	0	0	0	0	3	3												
		2	TM	0	0	0	0	0	0	0	0	0												
		1	FS	5	5	5	5	5	5	5	0	0												
		0	OS	0	0	0	0	0	0	0	0	0												
Total internal and external capacity																								
		4*	TA*	8	8	6	6	6	0	0	4	4												
		3	FTL	3	4	8	8	4	4	1	3	3												
		2	TM	5	4	2	2	6	0	4	0	0												
		1	FS	10	10	10	10	10	22	21	19	19												
		0	OS	3	3	3	3	3	3	3	3	3												

Notes:
*This is a subset of the FTL numbers, not additional to
Refer to 'skill ranking criteria' tab for explanation of rankings and competencies

Receptors	Priority Protection Areas					Required capability for rapid response (per Priority Protection area)	Actual Team Capability	Summary of Team Capability
	Montebello Islands	Barrow Island	Lowendal Islands	Dampier Archipelago	Ningaloo/Muiron Islands			
Water Quality (SMP1)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	1 team of 2 personnel • at least one member in each team to have experience in water sampling • at least one member in each team to have experience in deep sea sediment sampling	3 teams of 2 avaliable	6 potential field team members all with water sampling experience and vessel based sediment sampling experience (3 FTLs, 2 TMs and 1 FS), 1 office based TA and 3 office support
Sediment Quality (SMP2)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey			
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	1 team of 2 personnel • at least one team member with experience in shoreline macrofauna/infauna assessment	3 teams of 2 avaliable	6 potential field team members all with shoreline assessment experience (3 FTLs and 2 TMs and 1 FS), 1 office based TA and 3 office support
Intertidal Mudflats (SMP5)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey			
Mangroves (SMP4)	Survey	Survey	Survey	Survey	Survey (not applicable for Muiron Islands)	Not required[3]		Not required
Benthic Habitats (SMP6)	Priority survey	Survey	Priority survey	Priority survey	Survey	1 team of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers	2 teams of 2 avaliable	4 potential field team members all with benthic habitat assessment experience (2 FTLs [1 is ADAS diver], 1 TM [with ROV operator experience] and 1 FS), 1 office based TA and 3 office support
Seabirds/ shorebirds (SMP7)	Priority survey	Survey	Survey	Priority survey	Survey	1 ground-based survey team of 2 personnel[2] • at least one member be experienced ornithologist	4 teams of 2 available	11 potential field team members (4 FTLs (experienced ornithologists), 5 Moderate Experience, 2 Low Experience)
Marine megafauna (SMP8)	Survey	Not applicable	Priority survey	Survey	Survey (not applicable for Muiron Islands)	1 aerial survey team of 2 personnel[1] • both to be experienced wildlife observers 1 vessel-based survey team of 2 personnel[1] both to be experienced wildlife observers	2 teams of 2 available 2 teams of 2 available	9 potential field team members (7 FTLs (experienced wildlife observers), 2 Relevant Experience)
Marine reptiles (SMP9)	Priority survey	Survey	Survey	Survey	Survey	1 aerial survey team of two personnel[1] • both to be experienced wildlife observers 1 vessel-based survey team of two personnel[1] • both to be experienced wildlife observers 1 ground-based survey team of 2 personnel[2] • at least one member with experience in turtle survey techniques	2 teams of 2 available[1] 3 teams of 2 available[1] 3 teams of 2 available[2]	14 potential field team members (10 FTLs (7 experienced wildlife observers and 3 turtle survey experience), 5 Relevant Experience)
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	1 team of 3 personnel • at least one member to have experience in fish identification and necropsy • at least one member to have BRUV experience	3 teams of 3 avaliable	9 potential field team members with fish identification and necropsy experience and/or BRUV experience (3 FTLs, 4 TMs and 2 FS), 1 office based TA and 3 office support
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey			

[1]Aerial and vessel surveys could be conducted by the same team. The aerial-based surveys would be conducted first and then this would help inform target areas for vessel-based surveys if time allowed for it.

[2]Ground based surveys for shorebirds/seabirds and marine reptiles at Montebello Islands, Dmapier Archipelago and Ningaloo/Muiron Islands could be conducted concurrently by one survey team per location

[3]Remote sensing data would be collected for mangroves, with no field team required to be mobilised.

[1] Two of these teams are those also assigned to SMP8.

[2] One of these teams is also assigned to vessel-based surveys for the same SMP. They can be moved according to priority for either vessel-based or ground surveys.

Role	Name	Comments
Monitoring Coordinator	Julian Kruger	n/a
Operations Officer	Stuart Pearse	n/a
Operations Officer (BMT)	Mark Westera	n/a
Planning and Logistics Officer	Megan Stalker	n/a
Planning and Logistics Officer (BMT)	Luca Chiaroni	n/a