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Barossa Development Drilling and Completions Oil Pollution Emergency Plan

PROJECT / FACILITY	Barossa Drilling
REVIEW INTERVAL	60 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Technical Reviewer(s)	Approver	Functional Endorser
	Barossa HSE Manager	Oil Spill and Emergency Response Coordinator Senior Oil Spill Coordinator	Barossa Project Director	Crisis, Emergency Response and Security Manager
1				p.p.

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Rev No	Date	Revision
0	14/07/2023	For submission to NOPSEMA for approval
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Distribution	.pdf
Intranet – Emergency Preparedness – both Oil Spill Tile & SO ER Documentation	link only
Manager – HSE Offshore Division	link only
Drilling Superintendent	link only
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Senior Oil Spill Response Coordinator	link only
Santos Company Site Representative (CSR)	link only
AMOSC	●
DoT	●
AMSA	●
OSRL	●

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Abbreviation	Description
AIS	automatic identification system
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
BAOAC	Bonn Agreement Oil Appearance Codes
BRUV	Baited Remote Underwater Video
CHARM	Chemical Hazard and Risk Management
CMT	Crisis Management Team
CSR	Company Site Representative
CTD	Conductivity Temperature Depth (meter)
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEPWS	Department of Environment, Parks and Water Security
DFAT	Department of Foreign Affairs and Trade
DISR	Department of Industry, Science and Resources
DMIRS	Department of Mines, Industry Regulation and Safety
DoT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environment Regulation
EMBA	Environment That May Be Affected
EP	Environment Plan
ER	Emergency Response
ERT	Emergency Response Team
FOB	Forward Operating Base
GIS	Geographic Information System
GPS	Global Positioning System
HMA	Hazard Management Agency
HR	Human Resources
IAP	Incident Action Plan
ICC	Santos Incident Coordination Centre
IMT	Incident Management Team
IR	Incident Response
LOWC	Loss of Well Control

Abbreviation	Description
LWIV	Light Well Intervention Vessel
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MNES	Matters of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MSA	Master Services Agreement
MSP	Monitoring Service Providers
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NT	Northern Territory
NT IC	Northern Territory Incident Controller
NT IMT	Northern Territory Incident Management Team
NT OWRP	Northern Territory Oiled Wildlife Response Plan
OPEP	Oil Pollution Emergency Plan
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSC	On-Scene Commander
OSRL	Oil Spill Response Limited
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
RCC	Rescue Coordination Centre (AMSA)
ROV	Remotely Operated Vehicle
SCP	Source Control Plan
SFRT	Subsea First Response Toolkit
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SIMA	Spill Impact Mitigation Assessment
SLA	Service Level Agreement
SMP	Scientific Monitoring Plans
SMPC	State Marine Pollution Coordinator
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plans
TMPC	Territory Marine Pollution Coordinator
TRP	Tactical Response Plan
VI	Varanus Island
VOC	Volatile Organic Compound

Abbreviation	Description
VOO	Vessels Of Opportunity
VPO	Vice President Offshore Upstream WA/NA
WA	Western Australia
WAOWRP	Western Australian Oiled Wildlife Response Plan
WOMP	Well Operation Management Plan
WSP	Waste Service Provider
WWCI	Wild Well Control Inc.

1. Quick Reference Information

<table>
<tr><th>Parameter</th><th colspan="3">Description</th><th>Further information</th></tr>
<tr><td>Petroleum Activity</td><td colspan="3">Barossa Development Drilling and Completions: drilling and completion of up to eight production wells using a semi-submersible mobile offshore drilling unit (MODU), light well intervention vessel (LWIV) and the ongoing management of the completed wells until future commissioning and production phases</td><td>Section 2: Environment Plan (EP)</td></tr>
<tr><td>Location</td><td colspan="3">Bonaparte Basin in Commonwealth waters approximately 285 km north-northwest of Darwin</td><td>Section 2.1.1: EP</td></tr>
<tr><td>Petroleum title/s (Blocks)</td><td colspan="3">NT/L1 (production licence)</td><td>N/A</td></tr>
<tr><td>Vessels</td><td colspan="4">MODU – semi-submersible
LWIV
Support vessels</td></tr>
<tr><td>Water depth</td><td colspan="3">204-376 m in the Barossa Operational Area</td><td>-</td></tr>
<tr><td rowspan="4">Worst-case spill scenarios</td><td>Scenario</td><td>Hydrocarbon</td><td>Worst-case volume</td><td rowspan="4">Section 6.1</td></tr>
<tr><td>Bunkering incident</td><td>MDO (Group II)</td><td>10 m³</td></tr>
<tr><td>Vessel collision</td><td>MDO (Group II)</td><td>250 m³</td></tr>
<tr><td>Loss of well control (LOWC) (subsea)</td><td>Barossa condensate (Group I)</td><td>129,000 m³</td></tr>
<tr><td rowspan="2">Hydrocarbon properties</td><td colspan="3">MDO:
Density at 25 °C = 829 kg/m³
Dynamic viscosity = 4 cP @ 25 °C
API Gravity = 37.6°
Wax content = 0.05%
Pour point = −14 °C
Oil property classification = Persistent – light (Group II)</td><td rowspan="2">Appendix A</td></tr>
<tr><td colspan="3">Barossa condensate:
Density at 16 °C = 782 kg/m³
Dynamic viscosity = 1.35 cP @ 10°C
API Gravity = 50.6°
Wax content = 3.6%
Pour point = -6 °C
Volatile components = 93%
Oil property classification = Non-persistent (Group I)</td></tr>
<tr><td>Weathering potential</td><td colspan="2">MDO is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of</td><td>Barossa condensate is a low viscosity, non-persistent hydrocarbon that if spilt on the sea surface, would rapidly spread and</td><td>Appendix A</td></tr>
</table>

Parameter	Description		Further information
	evaporation. Up to 60% will generally evaporate over the first two days. Approximately 5% is considered 'persistent', which are unlikely to evaporate and will decay over time.	thin out resulting in a large surface area available for evaporation. The fate of the condensate will depend greatly on the proportion that reaches the surface after rising through the water column. Hence, discharge conditions will have a strong influence on exposure risks for surrounding resources.	
Priority Areas (refer to **Section 6.5**)	Based on the hydrocarbon spill modelling, hydrocarbons are expected to remain in the upper water column with the probability of contact above the moderate impact exposure value decreasing with water depth. Modelling for both the MDO and LOWC scenarios did not predict contact with either NT or WA waters. Consequently, areas at greatest risk are the benthic habitats present on some of the shallower offshore banks and shoals, where the moderate exposure values are predicted to be exceeded, including: + Tassie Shoal + 'Unnamed' Shoal The following key ecological features and Australian Marine Parks are predicted to be contacted above the moderate exposure value: + Oceanic Shoals Australian Marine Park + Carbonate bank and terrace system of the Van Diemen Rise + The shelf break and slope of the Arafura Shelf Spill modelling predicted no shoreline accumulation above the low threshold (10 g/m^2) for any scenario.		

2. First-strike response actions

The initial response actions to major oil spill incidents will be undertaken by the relevant Vessel Master or the Offshore Installation Manager, depending on the nature of the incident (vessel or MODU based).

If the spill is from a vessel, the initial response actions to major oil spill incidents will be undertaken by the relevant Vessel Master or Santos Company Site Representative. If the spill is related to the MODU, the rig Offshore Installation Manager (OIM) will be notified. The On-scene Commander (OSC) is either the Santos Company Site Representative (if present) or Vessel Master for vessel-based incidents; or the OIM if the spill is related to the MODU. This will be determined during the initial activation stages of the incident.

Following those initial actions undertaken by the OSC to ensure the safety of personnel on the vessel or the MODU, and to control the source of the spill, the OSC will assess the situation based on:

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

For spills from support vessels, initial response actions to major incidents are under the direction of the Vessel Master and in accordance with vessel-specific procedures (e.g. Shipboard Oil Pollution Emergency Plans [SOPEPs]).

Response information contained within this OPEP is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) is engaged for support and implementation of response strategies. Level 1 spills are managed through on-site response and the IMT is available to assist with regulatory requirements/notifications and support if required. Therefore, the immediate response actions listed in **Table 2-1** are relevant for any spill. Once sufficient information is known about the spill, the Incident Commander will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander. The Barossa First Strike Response Plan (located on the Santos ER SharePoint) should be referred to alongside the first strike activations table below.

Table 2-1: First-strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (MODU Operator's Emergency Response Plan and Santos MODU Operator Emergency Response Bridging Plan) or vessel-specific procedures, as applicable	On-Scene Commander
Immediate	Control the source using site resources, where possible	Control the source using available on-site resources (vessel/MODU) Refer to source control plan – **Section 9**	On-Scene Commander
30 minutes of incident being identified	Notify Santos Offshore Duty Manager/Incident Commander	Verbal communication to Offshore Duty Manager/Incident Commander's duty phone	On-Scene Commander
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	On-Scene Commander
60 minutes of incident being notified	Gain situational awareness and begin on-site spill surveillance	Level 1 spills may only require the use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance). Refer to Monitor and Evaluate Plan – **Section 10**	On-Scene Commander Incident Commander
Refer timeframes Go to **Section 7**	Make regulatory and stakeholder notifications within specified timeframes	Activate the External Notifications and Reporting Procedures – **Section 7**	Initial notifications by Planning Section Chief – **Section 7**
Level 2/3 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Offshore Duty Manager/ Incident Commander
IMT actions (0 to 48 hours)			
Within 90 minutes from IMT call-out	Set up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager

When (indicative)	Activations		Who
	Objective	Action	
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive Incident Action Planning process Go to **Section 8** Review First-strike Activations (this table)	Incident Commander Planning Section Chief
Refer timeframes **Section 7**	Make regulatory and stakeholder notifications as required Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required	Go to **Section 7**	Initial notifications by Planning Section Chief Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)
Refer timeframes **Section 10**	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Vessel Surveillance (**Section 10.1**) Aerial Surveillance (**Section 10.2**) Tracking Buoys (**Section 10.3**) Oil Spill Trajectory Modelling (**Section 10.4**) Satellite imagery (**Section 10.5**) Initial Oil Characterisation (**Section 10.6**) Operational Water Quality Monitoring (**Section 10.7**)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader Environment Unit Leader
Activate on Day 1 as applicable to the incident	Source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario-dependent**	Activate the Source Control Plan. Go to **Section 9**	Operations Section Chief (Source Control Branch Director as appropriate to scenario) Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer **Section 11**	Reduce potential exposure of wildlife to floating oil through mechanical dispersion	Activate the Mechanical Dispersion Plan Go to **Section 11**	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan Go to **Section 14**	Environment Unit Leader Logistics Section Chief/ Supply Unit Leader

When (indicative)	Activations		Who
	Objective	Action	
Refer **Section 14**			Operations Section Chief
Day 1	Identify environmental sensitivities at risk and conduct operational Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (**Section 6.6**)	Environment Unit Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan (**Appendix M**)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Day 1	Ensure the health and safety of spill responders	Identify relevant hazards controls and develop hazard register Begin preparation Site Health and Safety Management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Safety Officer
If/ when initiated Refer **Section 12**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan Go to **Section 12**	Environment Unit Leader Operations Section Chief Logistics Section Chief/ Supply Unit Leader
If/when initiated Refer **Section 13**	Safely transfer, transport and dispose of waste collected from response activities.	Activate the Waste Management Plan. Go to **Section 13**	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
IMT Actions (48+ hours)			
Ongoing	+ For ongoing incident management – indicatively 48+ hours – a formal incident action planning process is to be adopted to continue with spill response strategies identified above. An Incident Action Plan (IAP) is to be developed for each successive operational period. + Santos will maintain control for those activities for which it is the designated Control Agency/ Lead IMT. + Depending on the specifics of the spill, the Australian Maritime Safety Authority (AMSA), the Northern Territory (NT) IMT, and/or Western Australia (WA) Department of Transport (DoT) may		Control Agency IMT Santos to provide the following roles to WA DoT Maritime Environmental Emergency Coordination Centre (MEECC) / IMT for WA State waters response (refer to **Table 5-5**) (N.B. similar roles may also be provided to support the NT IMT in the event of a response in NT waters, if requested):

When (indicative)	Activations		Who
	Objective	Action	
		be relevant Control Agencies (refer to **Section 4.2**), (however oil spill modelling did not predict contact to or within any NT or WA jurisdictional boundaries). + Where another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos' support to the NT IMT (for a spill that impacts the NT shoreline) and the WA DoT (for a WA State waters response) is detailed in **Sections 4.6.2** and **4.6.3** respectively.	+ Crisis Management Team (CMT) Liaison Officer + Deputy Incident Controller + Deputy Intelligence Officer + Deputy Planning Officer + Environment Support Officer + Deputy Public Information Officer + Deputy Logistics Officer + Deputy Waste Management Coordinator + Deputy Finance Officer + Deputy Operations Officer + Deputy Division Commander – Forward Operating Base (FOB)

3. Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Barossa Development Drilling and Completions Environment Plan (EP) (BAD-200-0003) required by Regulation 14(8) of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS (E) Regulations).

3.1 Description of activity

Santos Ltd. (Santos) is preparing to conduct drilling and completion activities within the Barossa field (production licence NT/L1). The Barossa field is located in Commonwealth waters approximately 285 km offshore of Darwin, Northern Territory (**Figure 3-1**). Water depth in the vicinity of the Barossa field is 204-376 m.

The drilling and completions activities include the use of a semi-submersible MODU to drill up to eight production wells. Additional detail on the activity, project timing and duration, and equipment to be used are included in Section 2 of the Barossa Development Drilling and Completions EP (BAD-200-0003).

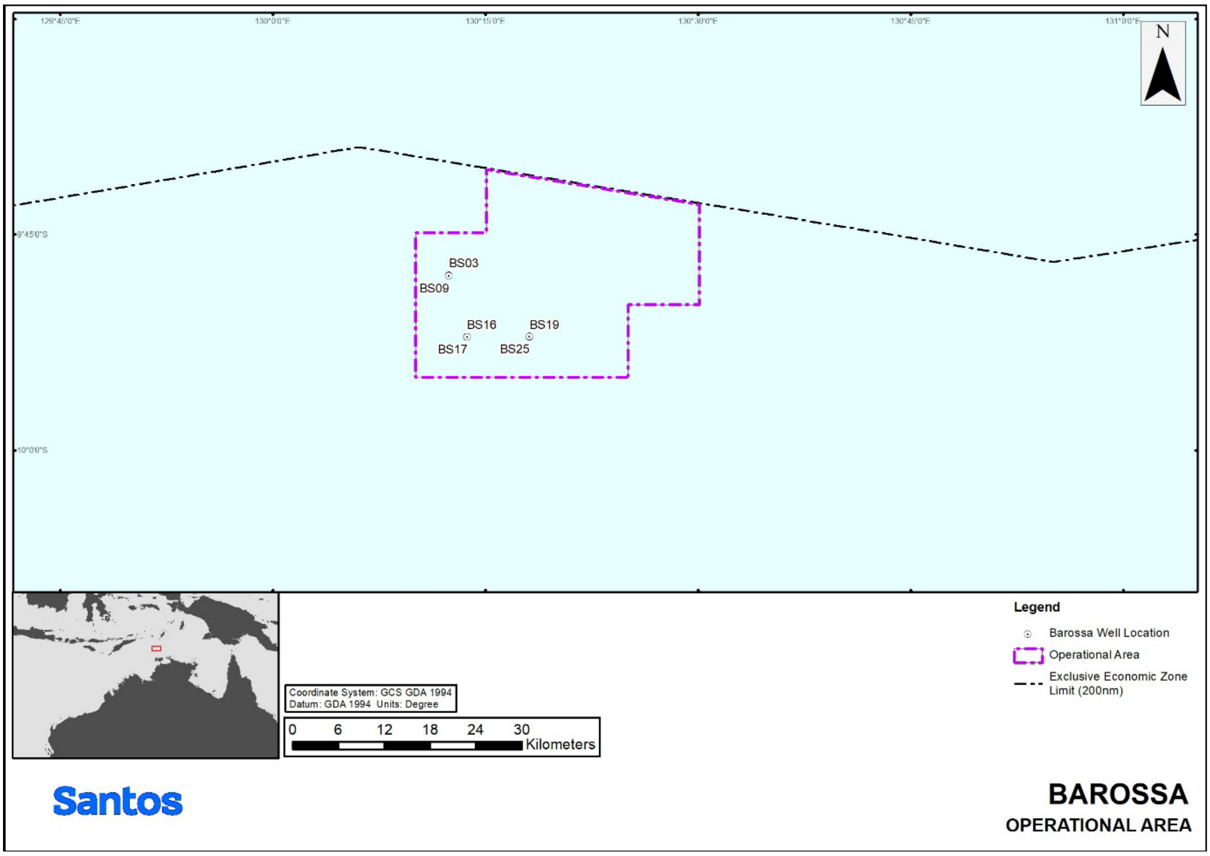

Figure 3-1: Location of the Barossa field Operational Area

3.2 Purpose

The purpose of this OPEP is to describe Santos' response to a hydrocarbon spill during Barossa Development Drilling and Completions activities.

This OPEP has been developed to meet all relevant requirements of the Commonwealth OPGGS (E) Regulations. It is consistent with the National, Northern Territory (NT) and State (WA) systems for oil pollution preparedness and response, being the National Plan for Maritime Environmental Emergencies (AMSA, 2020) managed by AMSA; the NT Oil Spill Contingency Plan (NT DoT, 2014); Territory Emergency Plan (NT Government, 2021); and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT, 2021).

This OPEP is to be read in conjunction with the Barossa Development Drilling and Completions EP (BAD-200-0003) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Santos Barossa Development Drilling and Completions EP (BAD-200-0003) and will remain valid for the duration of life of the EP.

The response strategies outlined in this OPEP have been developed by Santos using risk assessments to identify credible worst-case hydrocarbon spill scenarios, expected/calculated release rates, known information of hydrocarbon types and behaviour, and expected partitioning of the hydrocarbon within the marine environment with an estimate of the volume of persistent oil. This information has been modelled to give a theoretical zone of dispersion that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to 'as low as reasonably practicable' (ALARP). The response strategies are identified under a NEBA process so the most effective response strategies with the lowest environmental consequences can be identified, documented and prepared for.

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos' IMT, so that it will direct its response effort with the aim of preventing 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 ALARP. This will be achieved through the implementation of the various strategies and spill response mechanisms presented throughout this OPEP. Through their implementation, Santos will:

+ initiate spill response immediately following a spill
+ establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment
+ assess the spill characteristics and understand its fate in order to be able to make informed and clear response decisions
+ monitor the spill to identify the primary marine and coastal resources requiring protection
+ remove as much oil as possible from the marine environment while keeping environmental impacts from the removal methods to ALARP
+ reduce the impacts of the remaining floating and stranded oil to ALARP
+ respond to the spill using efficient response strategies that do not damage the environment themselves
+ comply with all relevant environmental legislation when implementing this OPEP
+ conduct all responses safely without causing harm to participants

- monitor the impacts from a spill until impacted habitats have returned to baseline conditions
- remain in a state of 'Readiness' at all times for implementation of this OPEP by keeping resources ready for deployment, staff fully trained and completing response exercises as scheduled
- keep stakeholders informed of the status of the hydrocarbon spill response to aid in the reduction of social and economic impacts.

3.4 Area of operation

The proposed Barossa development is located within permit area NT/L1 within Commonwealth waters of the Bonaparte Basin in Australia.

The Barossa Field is located within Commonwealth waters in the Timor Sea, approximately 140 km north of the Tiwi Islands and 285 km north-northwest of Darwin.

Section 3 of the Barossa Development Drilling and Completions EP (BAD-200-0003) includes a comprehensive description of the existing environment.

3.5 Interface with internal documents

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

- Barossa First Strike Response Plan
- Incident Management Plan – Upstream Offshore (SO-00-ZF-00025)
- Santos Incident Management Handbook
- Santos Crisis Management Plan (SMS-HSS-OS05-PD03)
- Barossa Development Drilling and Completions EP (BAD-200-0003)
- MODU Operator's Emergency Response Plan
- Santos-MODU Operator Emergency Response Bridging Plan
- Incident Response Telephone Directory (SO-00-ZF-00025.020)
- Refuelling and Chemical Management Standard (SO-91-IQ-00098)
- Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001)
- Santos Waste Management Plan – Oil Spill Response Support (BAA-201_0027)
- Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
- Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
- 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-91-RF-20022)
- Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)
- Santos Offshore Division Oil Spill Response Readiness Guideline (SO-91-OI-20001)
- Santos Offshore - Oil and Water Sampling Procedures (7710-650-PRO-0008)
- Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)

- Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

3.6 Interface with external documents

Information from the following external documents has 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.
- Offshore Petroleum Incident Coordination Framework
  - provides overarching guidance on the Commonwealth Government's role and responsibilities in the event of an offshore petroleum incident in Commonwealth waters.
- National Plan for Maritime Environmental Emergencies (National Plan) 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.
- Territory Emergency Plan
  - describes the NT approach to emergency and recovery operations, the governance and coordination arrangements, and roles and responsibilities of agencies (go to https://pfes.nt.gov.au/sites/default/files/uploads/files/2021/NTES_Territory_Emergency_Plan_2021.pdf).
- Northern Territory (NT) Oil Spill Contingency Plan
  - outlines the approach to management of marine oil pollution that are the responsibility of the NT Government (the NTOSCP is currently being revised).
- NT Oiled Wildlife Response Plan (NTOWRP)
  - an industry prepared plan, which is designed to ensure timely mobilisation of appropriate resources (equipment and personnel) in the event of an incident affecting wildlife in NT waters.
- Western Australia State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE)
  - details the management arrangements for preparation and response to a marine pollution incident occurring in State waters.
- WA DoT Oil Spill Contingency Plan
  - defines the steps required for the management of marine oil pollution responses that are the responsibility of the WA DoT
    - WA DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (go to: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements).
- Western Australia Oiled Wildlife Response Plan
  - establishes the framework for responding to potential or actual wildlife impacts in WA waters, within the framework of an overall maritime environmental emergency;

  - outlines risk reduction strategies, preparedness for, response to and initiation of recovery arrangements for wildlife impacts during a marine oil pollution incident.
- Western Australia Oiled Wildlife Response Manual
  - a companion document to the Western Australia Oiled Wildlife Response Plan for Maritime Environmental Emergencies, designed to standardise operating procedures, protocols and processes for wildlife response.
- Northern Territory Oiled Wildlife Response Plan
  - AMOSC on behalf of AMOSC Titleholder Members ConocoPhillips, Inpex and Shell Australia developed a Northern Territory Oiled Wildlife Response Plan (NTOWRP), this plan provides useful information relating to wildlife priority response areas in the NT based on the NT's prescribed Sites of Conservation Significance.
- Shipboard Oil Pollution Emergency Plans
  - under International Convention for the Prevention of Pollution from Ships (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.
- 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.

3.7 Document review

In line with regulatory requirements, this document shall be reviewed, updated and submitted to NOPSEMA every five years from date of acceptance.

The document may be reviewed and revised more frequently, if required, in accordance with the Santos 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 that affect oil spill response coordination or capabilities
- changes to the EP that affect oil spill response coordination or capabilities (e.g. a significant increase in spill risk)
- following routine testing of the OPEP if improvements or corrections are identified
- 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 Commonwealth regulations, i.e. the OPGGS (E) Regulations.

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

4. Spill management arrangements

4.1 Response levels and escalation criteria

Santos uses a tiered system of three incident response levels consistent with the National Plan (AMSA, 2020) and the WA SHP- MEE (WA DoT, 2021). 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 Incident Management Plan – Upstream Offshore (SO-00-ZF-00025) and further detailed in **Table 4-1** for hydrocarbon spills.

Table 4-1: Santos 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 on site without the need to mobilise the Santos IMT or other external assistance.	
+ Oil 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 On-site Emergency Response Team (ERT) 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 on-site resources alone and requires external support and resources to combat the situation; or An incident that can be controlled on site, 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	
An incident which has a wide-ranging impact on Santos 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.	+ Level 2 resources overwhelmed, requiring international assistance. + Level 3 resources to be mobilised. + Significant impact on local communities. + International media attention.

4.2 Jurisdictional authorities and Control Agencies

The responsibility for an oil spill is dependent on location and spill origin. The National Plan (AMSA, 2020) sets out the divisions of responsibility for an oil spill response. Definitions of Control Agency and Jurisdictional Authority are as follows:

+ **Control Agency:** the organisation assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency. Control Agencies have the operational responsibility of response activities but may have arrangements in place with other parties to provide response assistance under their direction.
+ **Jurisdictional Authority:** the agency which has responsibility to verify that an adequate spill response plan is prepared and, in the event of an incident, that a satisfactory response is implemented. The Jurisdictional Authority is also responsible for initiating prosecutions and the recovery of clean-up costs on behalf of all participating agencies.

Table 4-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State waters and for vessel and petroleum activity spills.

To aid in the determination of a vessel versus a petroleum activity spill, the following guidance is adopted:

+ In Commonwealth waters, a vessel is a ship at sea to which to which the *Navigation Act 2012* applies. Defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017a) as a seismic vessel, supply or support vessel, or offtake tanker.
+ A petroleum activity includes facilities such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. As defined by Schedule 3, Part 1, Clause 4 and Volume 2, Part 6.8, Section 640 of the OPGGS Act 2006.

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Table 4-2: Jurisdictional and Control Agencies for hydrocarbon spills

Jurisdictional boundary	Spill source	Jurisdictional Authority	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (three to 200 nautical miles from territory/state sea baseline)	Vessel[1]	AMSA	AMSA		Vessel SOPEP National Plan Barossa Development Drilling and Completions OPEP (this document)
	Petroleum activities[2]	NOPSEMA	Titleholder		Barossa Development Drilling and Completions OPEP (this document)
Northern Territory (NT) waters (Territory waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	NT Control Agency	Vessel owner	NT Control Agency	Vessel SOPEP Barossa Development Drilling and Completions OPEP (this document) Relevant NT Oil Spill Contingency Plan
	Petroleum activities	NT Control Agency	Titleholder	NT Control Agency	Barossa Development Drilling and Completions OPEP (this document) Relevant NT Oil Spill Contingency Plan
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	WA Department of Transport (DoT)	WA DoT	WA DoT	Vessel SOPEP State Hazard Plan: Maritime Environmental Emergencies (WA DoT, 2021) Oil Spill Contingency Plan (OSCP) (WA DoT, 2015) Barossa Development Drilling and Completions OPEP (this document)
	Petroleum activities	WA DoT	Titleholder	WA DoT	Barossa Development Drilling and Completions OPEP (this document) State Hazard Plan: Maritime Environmental Emergencies (WA DoT, 2021)

[1] Vessels are defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017a) as a seismic vessel, supply or support vessel. N.B. this definition does not apply to WA State waters.

[2] Includes a 'facility', such as a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. As defined by Schedule 3, Part 1, Clause 4 of the OPGGS Act 2006.

Jurisdictional boundary	Spill source	Jurisdictional Authority	Control Agency		Relevant documentation
			Level 1	Level 2/3	
International waters[3]	All activities	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		

[3] As per AMSA (2017b), Coordination of International Incidents: Notification Arrangements Guidance NP-GUI-007.

4.3 Petroleum activity spill in Commonwealth waters

For an offshore petroleum activity spill in Commonwealth waters, the Jurisdictional Authority is the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA). NOPSEMA is responsible for the oversight of response actions to pollution events from offshore Petroleum Activities, in areas of Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the *OPGGS Act 2006* and OPGGS (E) Regulations, including the issuing of directions as required, and investigate accidents, occurrences and circumstances involving deficiencies in environment management.

Under the OPGGS (E) Regulations and the *OPGGS Act 2006*, the petroleum titleholder (i.e. Santos) is responsible for responding to an oil spill incident as the Control Agency in Commonwealth waters, in accordance with its OPEP.

4.4 Vessel spills

AMSA manages the National Plan for Maritime Environmental Emergencies (AMSA, 2020) and is the Control Agency for all vessel-based spills in the Commonwealth jurisdiction. This includes vessels undertaking seismic surveys and associated supply or support vessels.

WA Department of Transport (DoT) manages the SHP – MEE (WA DoT, 2021) and is the Control Agency for all vessel-based spills in WA waters outside of a port proclaimed pursuant to the *Port Authorities Act 1999* (WA). For vessel-based spills within a port proclaimed pursuant to the *Port Authorities Act 1999* (WA), the relevant Port Authority or WA DoT may be the Control Agency.

If a vessel-based spill were to occur in NT waters, the relevant NT Control Agency would respond accordingly.

In all circumstances, the Vessel Master is responsible for implementing source control arrangements detailed in the vessel-specific SOPEP.

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a supporting agency throughout the response. This includes providing essential services, personnel, materials or advice in support of the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (**Section 10**) and Scientific Monitoring Plan (**Section 14**).

4.5 Cross-jurisdictional spills

N.B: Oil spill modelling did not predict contact to or within any NT or WA jurisdictional boundaries. The following information is included in this OPEP on a precautionary basis, however it is unlikely that a spill will cross from Commonwealth to NT or WA jurisdictions, and therefore unlikely that NT and/or WA DoT arrangements will be implemented.

4.5.1 Cross-jurisdictional petroleum activity spills

If a Level 2/3 petroleum activity spill crosses jurisdictions between Commonwealth and Territory/State waters, the Jurisdictional Authority remains true to the source of the spill (i.e. NOPSEMA for Commonwealth waters; NT Control Agency for Territory waters; and WA DoT for State waters).

Where a Level 2/3 spill originating in Commonwealth waters moves into Territory/ State waters, two Control Agencies will exist: NT Control Agency/ WA DoT and the petroleum titleholder (Santos), each with its own IMT and Lead IMT responsibilities. The arrangements between NT Control Agency/ WA DoT and Santos for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in **Section 4.6.**

4.5.2 Cross-jurisdictional vessel spills

If a Level 2/3 vessel spill crosses jurisdictions between Commonwealth and Territory/ State waters, up to three Jurisdictional Authorities will exist: AMSA for Commonwealth waters; NT Control Agency for Territory waters; and DoT for WA State waters. Coordination of Control Agency responsibilities will be determined by NT Control Agency, WA DoT and AMSA based on incident specifics, with Santos providing first strike response and all necessary resources (including personnel and equipment) as a supporting agency, as detailed in **Section 4.6.**

AMSA may request that WA DoT manage a vessel incident in Australian Commonwealth waters (WA DoT, 2021).

4.6 Integration with government organisations

4.6.1 Australian Maritime Safety Authority

While WA DoT and Santos would be Control Agencies initially for any spill in Territory and State waters (as outlined in **Section 4.2**), AMSA is the designated Control Agency for vessel spills in Commonwealth waters. Therefore, should a vessel spill enter Commonwealth waters, AMSA may also become a (or the) Control Agency. Arrangements for coordination and potential transfer of Control Agency status are outlined in AMSA Guidance Note NP-GUI-023: Coordination of Cross-Border Incidents (AMSA, 2017c).

AMSA is to be notified immediately of all ship-source incidents through the AMSA Rescue Coordination Centre (RCC) Australia (Santos Incident Response Telephone Directory [SO-00-ZF-00025.020]).

AMSA manages the National Plan, Australia's key maritime emergency contingency and response plan (AMSA, 2020). AMSA fulfils its obligations under the National Plan for non-ship source pollution incidents on the formal request from the respective Offshore Petroleum Incident Controller/s (AMSA, 2021a). AMSA also has a range of National Plan supporting documents containing related policies, guidance and advisory information.

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

4.6.2 Northern Territory – NT Government

N.B: Oil spill modelling did not predict contact to or within any NT jurisdictional boundaries. The following information is included in this OPEP on a precautionary basis, however it is unlikely that NT jurisdictional spill response arrangements will be implemented.

For a spill originating from a Santos activity, as soon as possible and within 24 hours of Santos becoming aware of an incident/spill that could reach Northern Territory (NT) coastal waters or shorelines, Santos will notify the NT Pollution Response Hotline and the NT Commissioner of Police in their role as the Territory Emergency Controller (TEC)[4].

Upon notification, the TEC will appoint an NT Incident Controller (NT IC), who in turn will call on competent personnel to form an IMT appropriate to the scale of the incident. This may include the NT IC calling upon support from the National Response Team.

For all Level 2/3 spills from vessel/petroleum activities that enter NT waters, the NT IC will assume the role of Control Agency. An NT IMT will be established in Darwin, made up of staff from across NT Government. The NT IMT will be supported by existing NT emergency response arrangements,

[4] At the time of drafting this OPEP (June 2023), the NT OSCP Steering Committee has not allocated roles under the NT OSCP across the NT Government; The revised NT OSCP, once endorsed, will be a sub-plan under the 'all-hazards' Territory Emergency Plan, which will align with the Territory emergency management arrangements and the National Plan. Until such time as the NT OSCP is endorsed, and a HMA is appointed by the Territory Emergency Management Committee (TEMC), the emergency decision-making authority remains with the Commissioner of Police, as the Territory Emergency Controller (TEC), under the Territory Emergency Management Plan (TEMP).

as defined in the NT *Emergency Management Act 2013*, through the TEMC and the NT Government Functional Groups.

The NT IC, with advice from NT Environment, Scientific and Technical advisors, will work with the Santos IMT to agree protection priorities and determine the most appropriate response in NT waters. Santos will provide support to the NT IMT from the Santos IMT at the Incident Coordination Centre (ICC) in Perth. The Santos IMT will provide support, including drafting of operational taskings or Incident Action Plans (IAPs), to the NT IC for approval prior to their release/implementation.

At the request of the NT IC, Santos will be required to provide all necessary resources, including personnel and equipment, to assist the NT IMT in performing its duties as the Control Agency for NT waters and shorelines. This may include the provision of personnel to:

+ work within the NT IMT located in Darwin; and
+ to assist response activities such as shoreline protection, clean-up and oiled wildlife response.

To facilitate coordination between the NT IMT and Santos IMT during a response, the NT IMT and Santos Forward Operating Base (FOB) will be established to ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests directly between the Santos IMT in Perth and NT IMT in Darwin.

The NT Government and relevant Control Agency plans to utilise the *Northern Territory Oiled Wildlife Response Plan* (AMOSC, 2019) as the basis for the determination of protection priorities and shoreline response planning.

4.6.3 Western Australia

N.B: Oil spill modelling did not predict contact to or within any WA DoT jurisdictional boundaries. The following information is included in this OPEP on a precautionary basis, however it is unlikely that WA DoT jurisdictional spill response arrangements will be implemented.

4.6.3.1 WA Department of Transport

In the event that a Level 2/3 Marine Oil Pollution Incident enters, or has potential to enter, WA State waters, the WA DoT is the Hazard Management Agency (HMA) (WA DoT Chief Executive Officer or proxy). The Assistant Executive Director (or proxy) has been nominated by the HMA to perform the role of State Marine Pollution Coordinator (SMPC) (as prescribed in Section 1.3 of the SHP – MEE [WA DoT, 2021]) and WA DoT will take on the role as a Control Agency. The role of the SMPC is to provide strategic management of the incident response on behalf of the HMA.

For Level 2/3 spills entering or within WA State waters/shorelines, WA DoT as the Control Agency is the ultimate decision maker regarding identification and selection of protection priorities. WA DoT will utilise their internal processes which typically includes the following:

+ evaluation of situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder;
+ evaluation of resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Commonwealth government databases or other information sources;
+ evaluation of shoreline types, habitat types and seasonality of environmental, socio-economic and cultural values and sensitivities;
+ consultation with the State Environmental Scientific Coordinator and other relevant State and Federal government departments with environmental responsibilities;
+ consultation with other relevant oil spill agencies, including the AMSA Environment, Science and Technology network or any other experts as necessary;
+ all information is utilised in a NEBA/Spill Impact Mitigation Analysis (SIMA) type process, to determine protection priorities and response strategies.

WA DoT will adjust/amend their internal processes to suit the spill situation at the time.

Santos will notify the WA DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring) if an actual or impending spill occurs within or may impact WA State waters. On notification, the SMPC will activate their MEECC and the WA DoT IMT.

For facility oil spills entering State waters (i.e., across jurisdictions) WA DoT will only assume the role of Control Agency for that portion of the response activity that occurs within State waters, and therefore both Santos and WA DoT will be Control Agencies. Titleholders will work in partnership with WA DoT during such instances, as outlined within the WA DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (WA DoT, 2020).

Santos will conduct initial response actions in State waters as necessary in accordance with its OPEP and continue to manage those operations until formal handover of incident control in State waters is completed. Appendix 1 in WA DoT's Offshore Petroleum Industry Guidance Note (WA DoT, 2020) provides a checklist for formal handover. Beyond formal handover, Santos will continue to provide all necessary resources, including personnel and equipment, to assist the WA DoT in performing duties as the Control Agency for State waters.

For a cross-jurisdictional response, there will be a Lead IMT (WA DoT or Santos) for each spill response activity, noting that WA DoT only has jurisdictional/control agency authority within State waters.

Appendix 2 in WA DoT's Offshore Petroleum Industry Guidance Note (WA DoT, 2020) provides guidance on the allocation of a Lead IMT to response activities for a cross-jurisdictional spill.

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

For a cross-jurisdictional response Santos will be responsible for ensuring adequate resources are provided to WA DoT as Control Agency, initially 11 personnel to fill roles in the WA DoT IMT or FOB (refer to **Section 5.2**) and operational personnel to assist with those response strategies where WA DoT is the Lead IMT. Concurrently WA DoT will also provide two of their personnel to the Santos IMT as described in

Table 5-4. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attend the WA DoT Fremantle Incident Control Centre as soon as possible after the formal request has been made by the SMPC. It is an expectation that the remaining initial cohort will attend the WA DoT Fremantle Incident Control Centre no later than 8am on the day following the request being formally made to Santos by the SMPC. Santos personnel designated to serve in WA DoT's FOB will arrive no later than 24 hours after receipt of formal request from the SMPC.

Figure 4-1 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within WA DoT's MEECC/ IMT.

Figure 4-2 shows the overall cross-jurisdictional organisational structure referenced from the SHP-MEE.

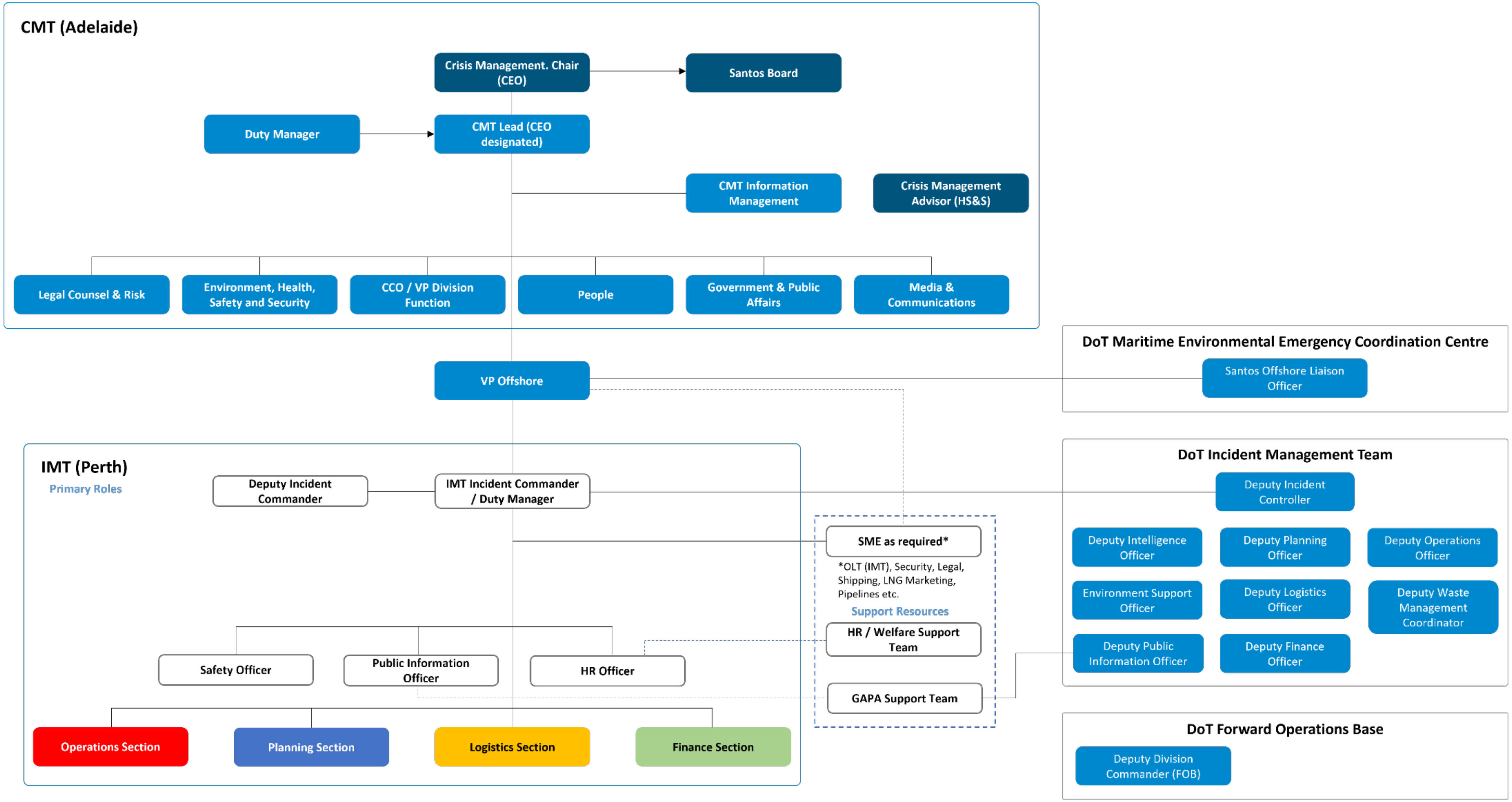

Figure 4-1: Santos cross-jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering WA State waters

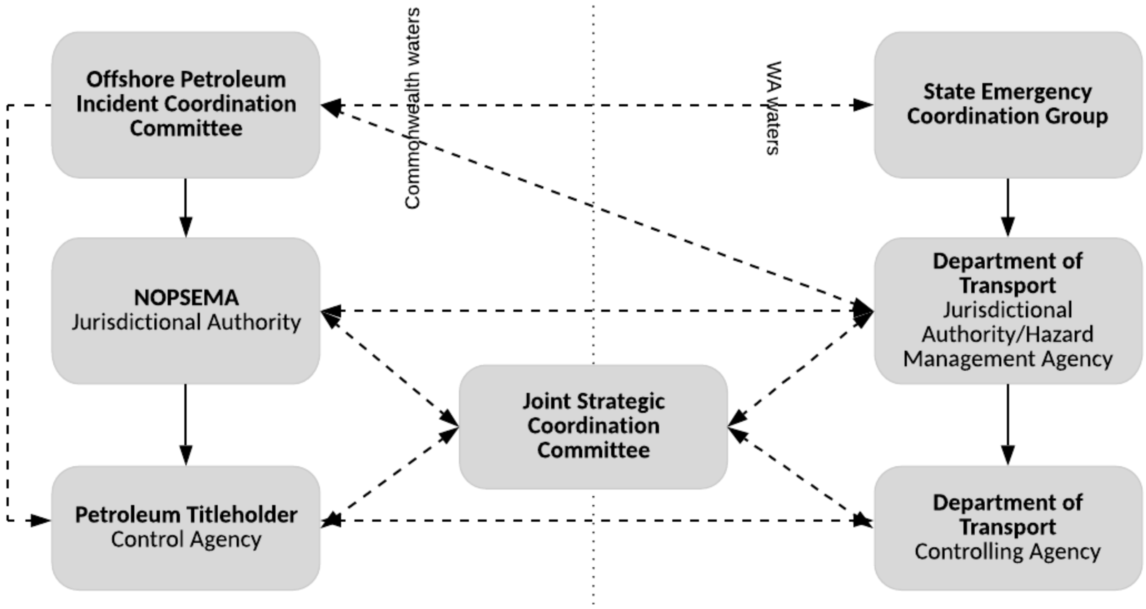

Figure 4-2: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

4.6.3.2 WA Department of Biodiversity, Conservation and Attractions

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 *Biodiversity Conservation Act 2016* (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 (WA DoT). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) (DBCA, 2022a).

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

For matters relating to environmental sensitivities and scientific advice in State waters DBCA may provide an Environmental Scientific Coordinator (ESC) to support the SMPC and/or WA 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.

4.6.4 Notification of use of dispersant in adjacent Commonwealth waters

The use of dispersant in Commonwealth waters does not require the consent of WA DoT or NT Control Agency. However, where the use of dispersant in Commonwealth waters may impact State waters, the WA DoT requests early notification, and the NT Control Agency should also be notified.

NOPSEMA's assessment of the OPEP prior to a petroleum activity commencing provides preapproval of dispersant use, where appropriate, and where it avoids any delay which might otherwise limit the window of opportunity available for an effective dispersant strategy (NOPSEMA, 2018).

4.6.5 Department of Foreign Affairs and Trade

In the event of a spill predicted to migrate into neighbouring countries, Santos will notify the Department of Foreign Affairs and Trade (DFAT) who will in turn notify the affected government(s) and engage the preferred methods for Santos to respond in order to minimise the impacts to ALARP. In most cases, NOPSEMA, Department of Industry, Science and Resources (DISR) and DFAT will form an inter-agency panel; the Australian Government Control Crisis Centre, who may request AMSA to coordinate the response operations across the trans-national boundary. Santos remains willing to respond as per the direction of the affected government(s) and designated Control Agency, following approvals established between DFAT and the affected countries government.

4.6.6 Department of Industry, Science and Resources

DISR will be the lead Commonwealth Agency for the provision of strategic oversight and Commonwealth government support to a significant offshore petroleum incident (including oil spill incidents). DISR will be notified by NOPSEMA of a significant oil pollution incident and under the Offshore Petroleum Incident Coordination Framework will stand up the Offshore Petroleum Coordination Committee as the mechanism to provide Commonwealth strategic advice and support to the incident. To facilitate information between the petroleum titleholder IMT and Offshore Petroleum Incident Coordination Committee, Liaison Officer/s will be deployed from DISR to the petroleum titleholder IMT.

For incidents that are classified at a greater level than Significant (i.e. crisis level), a whole of government crisis committee will be formed under the Australian Government Crisis Management Framework to provide strategic advice and support and the Offshore Petroleum Incident Coordination Committee will not be convened, although DISR will remain as the lead agency.

4.7 Interface with external organisations

Santos has contracts in place enabling access to Oil Spill Response Organisations (OSROs). OSROs have put specific measures in place to ensure that they are able to continue to meet their commitments to members. This support can be provided directly or remotely to aid the IMT and/or ERT.

4.7.1 Australian Marine Oil Spill Centre

Santos is a Participating Member of AMOSC and as such has access to AMOSC equipment and personnel as outlined in the AMOSPlan (AMOSC, 2021).

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

The mutual aid arrangements that AMOSC operates under are collaborated under the AMOSPlan, and are activated via the AMOSC Duty Officer. 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, Chevron, Woodside and Jadestone have signed a memorandum of understanding (MoU) that defines the group's mutual aid arrangements. Under this MoU, Santos, Chevron, Woodside and Jadestone have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

4.7.2 Oil Spill Response Limited

Through an associate membership, Santos has access to spill response services from OSRL with offices in Perth, Singapore, UK and at other various locations around the globe. In the event of a Level 2/3 response, Santos could access OSRL's international personnel, equipment and dispersants to supplement resources available within Australia. Santos may also call on OSRL for technical services to support its IMT.

Response equipment and personnel are allocated on a 50% of inventory basis under OSRL's Service Level Agreement (SLA). Santos also has access to additional dispersant stockpiles held by OSRL through a Global Dispersant Stockpile Supplementary Agreement.

4.7.3 Wild Well Control Inc.

Santos maintains a contract with Wild Well Control Inc. (WWCI) for well control specialist services including relief well drilling and capping stack deployment. WWCI maintains well control response teams on standby at all times to ensure a rapid response to a well control event anywhere in the world. WWCI maintains an inventory of well control, firefighting, and special services equipment at its Houston headquarters and at other locations in the US and internationally.

5. Santos incident management arrangements

5.1 Incident management structure

The Santos IMT (Perth) and CMT will be activated in the event of a Level 2/3 hydrocarbon spill regardless of the type of spill or jurisdiction. Santos maintains internal resources (trained personnel and equipment) across its activities that provide first strike response capability and to also support an ongoing response. Should an incident occur, the IMT Duty Manager would be notified immediately. This rostered role is on-call, filled by trained Incident Commanders and available 24 hours/day and 7 days/week. The IMT Duty Manager would then activate the IMT via an automated call-out system. Documentation required in a response is accessed via the Santos Emergency Response (ER) intranet site.

As outlined in **Section 4**, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Santos Incident Management Plan – Upstream Offshore (SO-00-ZF-00025) and the Santos Incident Management Handbook. The Incident Management Plan – Upstream Offshore and Santos Incident Management Handbook describe response planning and incident management that would operate under emergency conditions – describing how the Santos IMT operates and interfaces with the CMT and external parties.

The first priority of an escalating oil spill response to a Level 2/3 spill is the formation of an IMT and establishment of an incident coordination centre (ICC)[5]. The ongoing involvement of the IMT and CMT will be dependent on the severity and type of spill and the obligations of Santos and other agencies/authorities in the coordinated spill response.

Santos' incident response structure relevant to a Barossa Development Drilling and Completions incident includes:

- Facility-based ERT
- Santos IMT – Perth-based ICC to coordinate and execute responses to an oil spill incident
- CMT – to coordinate and manage threats to the company's reputation and to handle Santos' corporate requirements in conjunction with the Perth-based Santos – Vice President Offshore Upstream WA
- Other field-based command, response and monitoring teams for implementing strategies outlined within the OPEP.

The Santos incident response organisational structure is defined in the Incident Management Plan – Upstream and Offshore (SO-00-ZF-00025) and Santos Incident Management Handbook, and in **Figure 5-1** for reference. The Santos IMT roles and field-based teams are scalable; roles can be activated and mobilised according to the nature and scale of the incident response.

If the incident involves a LOWC, the Santos Source Control Branch would also be included in the incident response structure. This team would be comprised of the following sub-teams, according to the applicable source control strategies:

- Relief Well Team
- Well Intervention Team.

The Santos Source Control Branch would report directly to the Operations Section Chief and would be responsible for:

- coordination of engineering safety and operational activities
- managing source control technical personnel from third parties (e.g. Wild Well Control)
- developing task-specific plans and procedures

[5] The Santos ICC is located in the Santos WA Perth office.

- identification and sourcing of required tools and equipment
- approving source control components of IAPs.

In the event of a Level 2 or 3 spill event, such as a LOWC, Santos will review the Relevant Persons identification process described in Section 4.2 of the Barossa Development Drilling and Completions EP (BAD-200 0003). Relevant Persons, whose functions, interests or activities that may be affected by the spill event or response arrangements will be identified and engaged in accordance with the Santos incident management process, noting notification and communications requests made by Relevant Persons during EP consultation with respect to emergency situations.

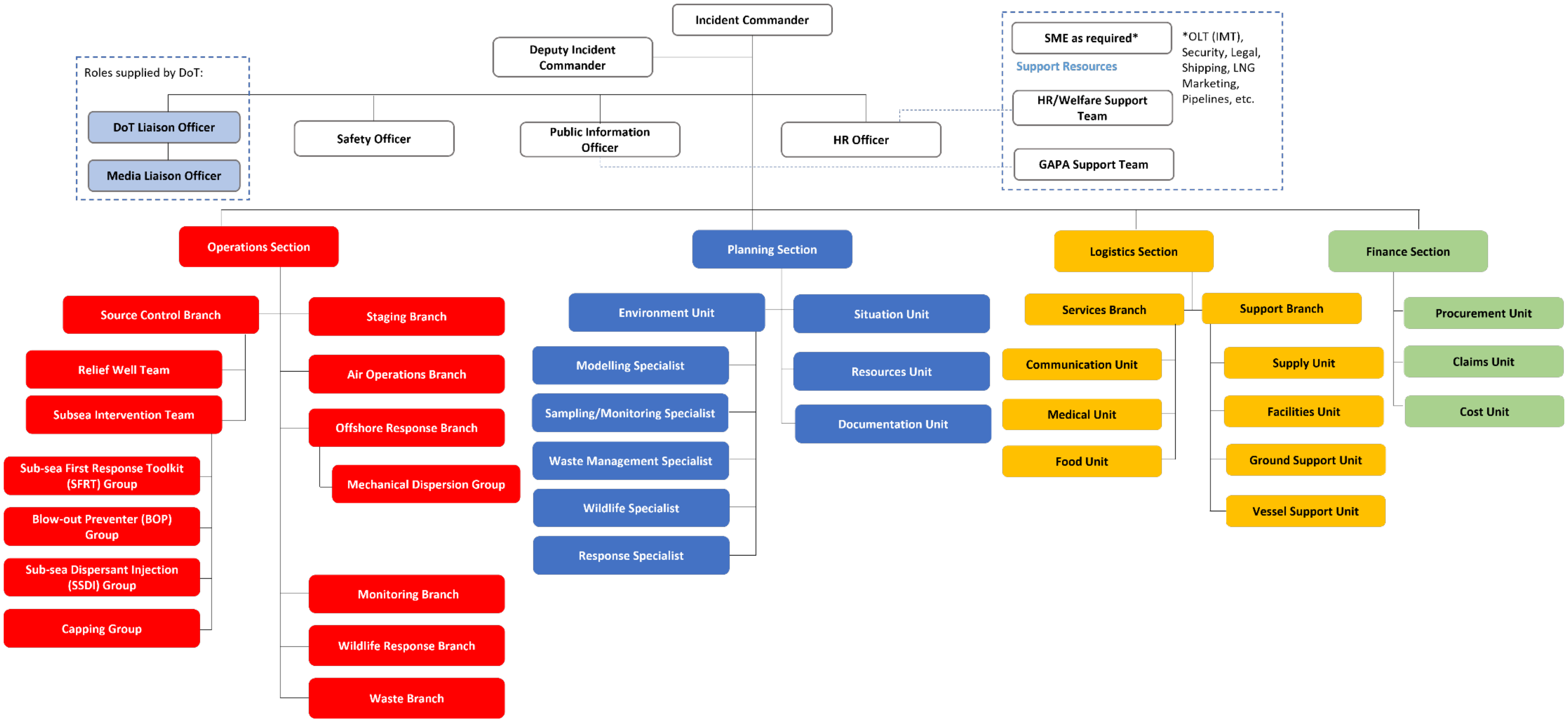

Figure 5-1: Santos incident management team organisational structure

N.B. For a Level 2/3 petroleum activity spill whereby WA DoT is involved as a Control Agency (cross-jurisdictional spills from Commonwealth to State waters, in the event a spill reaches WA State waters), Santos will work in coordination with WA DoT in providing spill response capability. Santos' expanded organisational structure for these situations is detailed in ***Section 4.6.3****.*

5.2 Roles and responsibilities

The following tables provide an overview of the responsibilities of the Santos CMT (**Table 5-1**), IMT (**Table 5-2**), and ERT in responding to an incident (**Table 5-3**). Not all of the roles listed are shown in **Figure 5-1**, as some of the roles in

Table 5-2 are support roles or are specific to a particular response strategy. Full responsibilities checklists/job cards of each role are described in the Incident Management Plan – Upstream Offshore (SO-00-ZF-00025), Santos Incident Management Handbook and Santos Crisis Management Plan (SMS-HSS-OS05-PD03) to support the incident action planning process.

The IMT and ERT are scalable to the nature and scale of the response i.e. one person can take on multiple roles or one role can be filled by multiple people, where circumstances permit.

Also provided are the roles and responsibilities of Santos personnel required to work within WA DoT's organisational structure (**Table 5-5**), where WA 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.

WA DoT will provide a Liaison Officer/Duty Incident Commander to the Santos IMT in a coordinated response, as outlined for reference (**Table 5-4**). However, it should be noted that oil spill modelling did not predict contact to or within any WA jurisdictional boundaries (refer to **Section 4.5**).

Table 5-1: Roles and responsibilities in the Santos Crisis Management Team

Santos CMT Role	Main Responsibilities
Crisis Management Chair (CEO)	The CM Chair (Santos Chief Executive Officer) is responsible for the following: + Leads crisis management direction + Provides governance and oversight of CMT operations. + Provides enterprise and strategic direction to the CMT for the resolution of the crisis event. + Delegates the CM Lead role and accountability to the appropriate ExCom designee. + Engages with the CM Lead to endorse the crisis resolution plan. + Liaises with the Santos Board and strategic stakeholders. + Provides the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Lead/ Duty Manager	The CMT Lead is responsible for: + Determining the need for establishing a Level 3 response and for activating the CMT. + Determining which / if any Crisis Management Support Teams (CMST) are mobilised. + Leading the crisis resolution process. + Ensuring internal and external notifications to key stakeholders. + Using the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives. + Ensuring a crisis resolution plan is developed and direct the CMT functions to implement strategies, action plans and tasks. + Determining when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.
CMT Information Management	The CMT Information Managers directly support the CMT as follows: + Support the CMT during crisis management operations. + Sets up the crisis management room, assist with set-up of communications, video conferences and information transfer within the CMT. + Advises on CMT operating processes and available resources. + Assist with reserving break out rooms for the CMT functions and CMSTs. + Ensure CMT crisis resolution forms are used and displayed on the monitors. + Provides incident action plan information when an IMT is established. + Monitor and manage the welfare needs of the CMT.

Santos CMT Role	Main Responsibilities
Crisis Management Advisor	The Crisis Management Advisor is responsible for the following: + Provides CMT process guidance and advice to CMT Lead, Function Leads, and CMST. + Supports and facilitates the crisis resolution planning process. + Acts as the liaison between the CMT and IMT. + Work with CMT Information Managers to manage roster and handovers for extended CMT operations. + Schedules and facilitates post crisis debriefs and after-action reviews. The Crisis Management Advisor will support the CMT Lead as follows: + Facilitates CMT activation requirements with the CMT Lead. + Assists the CMT Lead in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts. + Advises the CMT Lead on CMT structure and requirements for CMST engagement. + Coordinates tasks delegated by CMT Lead. + Provide tools to the CMT Lead for review and crisis assessment meetings.
CMT Function Leads	CMT Function Leads include Leads for the following areas: + Legal Counsel and Risk, + Environment Health Safety and Security, + Operating Unit VP + People + Government and Public Affairs (GAPA) + Media and Communications The CMT Function Leads are responsible for the following: + Participate and contribute to the crisis resolution planning process. + Each Function Lead shall determine critical communications pertaining to their area. + Mobilise and coordinate activities of the function CMST. + Advise the CMT Lead on strategic impacts, threats and mitigation created by the crisis event. + Develop and execute strategies to meet objectives endorsed by the CM Chair. + Provide support and resources via the CMST to divisional IMTs. + Ensures critical actions, decisions or points of strategic criticality are included in the CMT log. + Participates in the crisis management debrief and after-action reviews.

Table 5-2: Roles and responsibilities in the Santos Incident Management Team

Santos Management/ IMT Role	Main Responsibilities
Vice President Offshore (VPO) Upstream WA/NA	+ Depending on the level of the incident, the VPO (and/or their delegate) will act as the primary liaison to the CMT Duty Manager. + On the activation of the IMT, the VP is advised by the IMT Duty Manager.
Incident Commander	+ Incident Commander is responsible for the overall management of the incident. Will set response objectives and strategic directions and oversee the development and implementation of Incident Action Plans.
Safety Officer	+ Safety Officer is responsible to develop and recommend measures for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. Safety Officer may have specialists as necessary.
Public Information Officer	+ Public Information Officer is responsible for developing and releasing information about the incident to media, incident personnel and to appropriate agencies and organisations
Human Resources Officer	+ HR Officer is responsible for advising and assisting the Incident Commander, Command Staff and Section Chiefs on any HR related aspects of an incident.
Operations Section Chief*	+ The Operation Section Chief leads the Operations Section within the IMT and is responsible for the management of all tactical operations directly applicable to the primary assignments. The Operations Section Chief activates and supervises operational elements in accordance with the IAP and directs its execution.
Source Control Branch Director	+ The Source Control Branch Director will be responsible for the implementation of the Source Control Plan (Source Control Planning and Response Guideline – DR-00-OZ-20001). The Source Control Branch Director will activate and supervise source control elements in accordance with the Incident Action Plan and direct its execution.
Relief Well Team Leader	+ The Relief Well Team Leader is responsible for the management and coordination of relief well design and operations. The Relief Well Team Leader coordinates the development of the drilling plans and procedures, secures resources and manages relief well operations to ensure the relief well reaches its target. + Create groups as required to acquire relief well MODU, equipment and services and perform detailed relief well planning.
Subsea Well Intervention Team Leader	+ The Subsea Well Intervention Team Leader is responsible for well intervention activities including initial site survey and debris clearance.
SFRT Group Leader	+ The SFRT Group Leader is responsible for the activation of the SFRT via the AMOSC Duty Officer and mobilisation to site. Mobilisation includes sourcing two vessels for SFRT deployment according to vessel criterion in Santos Source Control Planning and Response Guideline. The Group Leader manages and coordinates SFRT functions including debris clearance survey and operations.
BOP Group Leader	+ The BOP Group Leader is responsible for the management and coordination of an intervention on the BOP of the incident well. Based on the initial subsea survey results, the group assess the situation and develops the BOP intervention plans and procedures, secures resources and manages BOP intervention operations with the objective of closing the BOP.

Santos Management/ IMT Role	Main Responsibilities
SSDI Group Leader	+ The SSDI Group Leader is responsible for the management and coordination of subsea dispersant operations at or near the source at seabed. The group coordinates application and monitoring plans, prepares procedures, secures resources and approvals, and oversees the application and efficacy of subsea dispersant operations.
Capping Group Leader	+ The Capping Group Leader responsible for the management and coordination of overall capping stack staging, installation plan, and operations. The group begins its task early in the process and continues to operate concurrently with all other source control efforts until the well is secured.
Staging Branch Director	+ The Staging Branch Director is responsible for supervising the Staging Area Managers as well as coordinating their activities including assigning Staging Area Managers, receiving, maintaining, checking in/out, storing and distributing resources.
Air Operations Branch Director	+ The Air Operations Branch Director is ground-based and is primarily responsible for the coordination of the air operations section (ICS 220) of the IAP and for providing logistical support to incident aircraft.
Offshore Response Branch Director	+ The Offshore Response Branch Director is responsible for leading the offshore response activities. Depending on the size and nature of the incident, various, groups, teams and task forces will be implemented including Mechanical Dispersion group.
Monitoring Branch Director	+ Working closely with the Environmental Unit, the Monitoring Branch Director will be responsible for implementing the operational and scientific monitoring plans required based on the nature and scale of the incident.
Wildlife Response Branch Director	+ Working with relevant state authorities, the Wildlife Response Branch Director will be responsible for implementing the OWR plan for the incident including the deployment of equipment and personnel required.
Waste Branch Director	+ The Waste Branch Director is responsible for coordinating the on-site activities of personnel engaged in collecting, storing, transporting and disposing of waste materials, in compliance with the IAP.
Planning Section Chief*	+ Planning Section Chief will lead the Planning Section within the IMT and is responsible for the collection, evaluation, dissemination and use of incident information and maintaining status of assigned resources.
Situation Unit Leader	+ The Situation Unit Leader is responsible for collecting, processing, and organizing incident information relating to escalation, mitigation or intelligence activities taking place in an incident. The Situation Unit will be responsible for preparing future projections of incident growth, maps, and intelligence information.
Resources Unit Leader	+ The Resource Unit Leader is responsible for maintaining the status of all assigned tactical resources and personnel at an incident. The Resource Unit will oversee the check-in of all tactical resources and personnel, maintaining a status-keeping system indicating current location and status of all the resources.
Documentation Unit Leader	+ The Documentation Unit Leader is responsible for maintenance of accurate, up-to-date incident files including Incident Action Plans. Incident reports, communication logs, situation status reports etc.
Environment Unit Leader	+ The Environment Unit Leader is responsible for environmental matters associated with the response, including strategic assessment, modelling, surveillance and environmental monitoring and permitting.

Santos Management/ IMT Role	Main Responsibilities
Technical Specialists	+ Certain incidents may require the use of Technical Specialists who have specialized knowledge or expertise. Technical Specialists may function within the Planning Section or be assigned wherever their services are required. Santos will activate Technical Specialists, based on the requirements of the incident, through a range of arrangements and this may include, Modelling Specialist, Operational/Scientific Monitoring Specialist, Response Technology Specialist, Waste Management Specialist, etc.
Logistics Section Chief*	+ Logistics Section Chief is responsible for providing facilities, services and materials in support of the incident. The Logistics Section Chief participates in the development and implementation of the Logistics Section of the IAP.
Services Branch Director	+ Service Branch Director, when activated is under the supervision of the Logistics Section Chief and is responsible for the management of all service activities for the incident including the operations of the Communications, Medical and Food Units.
Support Branch Director	+ Support Branch Director, when activated, is under the supervision of Logistics Section Chief and is responsible for the development and implementation of logistics plan in support of the IAP. The Support Branch supervises the operations of the Supply, Facilities, Ground Support and Vessel Support Units.
Finance Section Chief*	+ Finance Section Chief is responsible for all the financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance Section.
Procurement Unit Leader	+ The Procurement Unit Leader is responsible for administering all financial matters pertaining to vendor contracts and leases. The Procurement Unit Leader will execute all procurements in accordance with the policies and procedures of Santos.
Claims Unit Leader	+ The Claims Unit Leader is responsible for the management and direction of all administrative matters pertaining to compensation and claims related matters for any incident.
Cost Unit Leader	+ The Cost Unit Leader is responsible for collecting all cost data and providing cost estimated and any cost saving recommendations for the incident.

* N.B. The Section Chiefs are supported by various other roles that will be mobilised depending on the severity of the incident.

Table 5-3: Roles and responsibilities in the field-based response team

Field-based position	Main responsibilities
On-Scene Commander[6]	+ Assess facility-based situations / incidents and respond accordingly. + Single point of communications between facility/site and IMT. + Communicate the incident response actions and delegate actions to the Incident Commander. + Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity-specific Oil Spill Contingency Plan or OPEP. + Coordinate medical evacuations as required. + Refer to the Facility Incident Response Plan for detailed descriptions of roles and responsibilities.

[6] The OSC is either the OIM (MODU spills); or the Santos Company Representative or the Vessel Master (vessel spills).

Field-based position	Main responsibilities
Company Site Representative	+ Notify the Perth-based Incident Commander of oil spills. + Coordinate on-site monitoring of oil spill and ongoing communication with Incident Commander.
Medical Evacuation Team	+ Manage all medical and transportation requirements related to injured personnel to an appropriate medical facility + Refer to the Medical Evacuation Procedure (SO-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team
Emergency Commander / Division Commander	+ Coordinate the field response as outlined in the First Strike Response Plan and/or Incident Action Plan developed by the IMT. + Command an FOB for the coordination of resources mobilised to site.
Oil Spill Response Teams	+ Respond to oil spills at sea to minimise the impacts to as low as reasonably practicable. + Refer to activity-specific Oil Spill Contingency Plans (OSCP) and OPEP for detailed descriptions of roles and responsibilities within the Off-Asset Oil Spill Response Team
Source Control Branch	+ Respond to incidents involving well loss of containment to stop the flow of oil to sea. + Refer to the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Branch.
Wildlife Response Branch	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife. + Refer to the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for a description of the wildlife response branch, and the Santos Incident Management Handbook for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team.
Monitoring Branch	+ 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 5-4: Department of Transport roles embedded within Santos' CMT / IMT

WA DoT roles embedded within Santos' CMT/IMT	Main responsibilities
WA DoT Liaison Officer (before WA DoT assuming role of Control Agency) **Deputy Incident Controller – State Waters** (after WA DoT assumes role of Control Agency)	+ Provide a direct liaison between the Santos IMT and the State MEECC. + Facilitate effective communications between WA DoT's State Marine Pollution Coordinator (SMPC)/SMEEC/the Incident Controller and Santos' appointed CMT Lead / Incident Commander. + Provide enhanced situational awareness to WA DoT of the incident and the potential impact on State waters. + Assist in the provision of support from WA DoT to Santos. + Facilitate the provision of technical advice from WA DoT to Santos' Incident Commander as required.
Media Liaison Officer	+ Provide a direct liaison between the Santos Media team and WA DoT IMT Media team.

WA DoT roles embedded within Santos' CMT/IMT	Main responsibilities
	+ Facilitate effective communications and coordination between the Santos and WA 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 WA DoT Information and Warnings team. + Offer advice to the Santos Media Coordinator on matters pertaining to WA DoT and wider Government media policies and procedures.

Table 5-5: Santos personnel roles embedded within the WA State Maritime Environmental Emergency Coordination Centre/Department of Transport Incident Management Team/ Forward Operations Base (N.B. similar roles may also be provided to support the NT IMT, if requested, in the event of a response in NT waters)

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB	Main responsibilities
CMT Liaison Officer[7]	+ Provide a direct liaison between the Santos CMT and the State MEECC. + Facilitate effective communications and coordination between the Santos CMT Lead and the SMPC. + Offer advice to SMPC on matters pertaining to Santos crisis management policies and procedures.
Deputy Incident Controller	+ Provide a direct liaison between the WA DoT IMT and the Santos IMT. + Facilitate effective communications and coordination between the Santos Incident Commander and the WA DoT Incident Controller. + Offer advice to the WA DoT Incident Controller on matters pertaining to the Santos incident response policies and procedures. + Offer advice to the Safety Coordinator on matters pertaining to Santos safety policies and procedures particularly as they relate to Santos employees or contractors operating under the control of the WA DoT IMT.
Deputy Intelligence Officer	+ As part of the WA DoT Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situational awareness. + Facilitate the provision of relevant modelling and predictions from the Santos IMT. + Assist in the interpretation of modelling and predictions originating from the Santos IMT. + Facilitate the provision of relevant situational awareness information originating from the WA DoT IMT to the Santos IMT. + Facilitate the provision of relevant mapping from the Santos IMT. + Assist in the interpretation of mapping originating from the Santos IMT. + Facilitate the provision of relevant mapping originating from the Santos IMT.
Deputy Planning Officer	+ As part of the WA DoT Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of

[7] The role described as Santos Offshore Liaison Officer in **Figure 4-1**.

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB	Main responsibilities
	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 IMT. + Assist in the interpretation of the Santos OPEP from Santos. + Assist in the interpretation of the Santos IAP and sub-plans from the Santos IMT. + Facilitate the provision of relevant IAP and sub-plans originating from the WA DoT IMT to the Santos IMT. + Assist in the interpretation of Santos' existing resource plans. + Facilitate the provision of relevant components of the resource sub-plan originating from the WA DoT IMT to the Santos IMT. *(Note this individual must have intimate knowledge of the relevant Santos OPEP and planning processes).*
Environment Support Officer	+ As part of the Intelligence Team, assist the Environment Coordinator 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 OPEP and relevant Tactical Response Plan (TRPs). + Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos IMT. + Facilitate the provision of relevant environmental information and advice originating from the WA DoT IMT to the Santos IMT.
Deputy Public Information Officer[8]	+ As part of the Public Information Team, provide a direct liaison between the Santos Media team and WA DoT IMT Media team. + Facilitate effective communications and coordination between Santos and WA DoT media teams[9]. + 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 WA DoT Information & Warnings team. + Offer advice to the WA DoT Media Coordinator on matters pertaining to Santos media policies and procedures. + Facilitate effective communications and coordination between Santos and WA DoT Community Liaison teams. + Assist in the conduct of joint community briefings and events. + Offer advice to the WA DoT Community Liaison Coordinator on matters pertaining to Santos community liaison policies and procedures. + Facilitate the effective transfer of relevant information obtained from the Contact Centre to the Santos 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.

[8] In the event of an incident, Santos can provide the WA DoT IMT with a list of agencies, organisations, representative bodies, and other stakeholders that were consulted in the development of the EP to assist WA DoT with the management and provision of public information.

[9] In the event WA DoT assumes the role of Control Agency in State Waters, Santos acknowledges that the WA DoT IMT will be the lead IMT for public information and warnings and community liaison. In such circumstances, Santos retains the right to manage its own media interests, but acknowledges the strong preference for WA DoT and Santos to issue joint media statements and conduct joint media conferences and the importance of close liaison between the respective Media Teams.

Santos roles embedded within the State MEECC/ WA DoT IMT/ FOB	Main responsibilities
	+ Facilitate the acquisition of appropriate supplies through Santos' existing OSRL, AMOSC and private contract arrangements. + Collect Request Forms from WA DoT to action via the Santos IMT. *(Note this individual must have intimate knowledge of the relevant Santos logistics processes and contracts).*
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 acquisition of appropriate services and supplies through Santos' existing private contract arrangements related to waste management; + Collect Waste Collection Request Forms from WA DoT to action via the Santos IMT.
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' existing OSRL, AMOSC and private contract arrangements. + Facilitate the communication of financial monitoring information to Santos to allow tracking the overall cost of the response. + Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by WA DoT and to be charged back to Santos.
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 the Santos Operations Section and the WA DoT Operations Section. + Offer advice to the WA DoT Operations Officer on matters pertaining to Santos incident response procedures and requirements. + Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of Santos and WA DoT response efforts.
Deputy Division Commander (FOB)	+ 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 Santos' Forward Operations Base/s (FOB/s) and the WA DoT FOB. + Facilitate effective communications and coordination between Santos FOB Operations Commander and the WA DoT Division Commander. + Offer advice to the WA DoT FOB Operations Commander on matters pertaining to Santos 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 employees or contractors. + Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to Santos safety policies and procedures.

5.3 Cost recovery

As required under Section 571(2) of the OPGGS Act 2006, Santos 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 Control Agencies (e.g. WA DoT) and third-party spill response service providers.

5.4 Training and exercises

In order to refresh IMT roles and responsibilities and provide familiarisation with OPEP processes and arrangements, IMT workshops are conducted as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

To familiarise the IMT with functions and processes, an OPEP Desktop and Activation Exercise is undertaken as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Exercise planning takes into consideration virtual/remote access requirements.

All workshops and exercises undertaken are recorded in the Santos EHS Toolbox, with the key recommendations recorded and tracked.

5.4.1 Incident management team training and exercises

Santos provides training to its personnel to fill all required positions within the IMT.

Competency is maintained through participation in regular response exercises and workshops. Exercise and training requirements for Santos' IMT members are summarised in **Table 5-6**.

Table 5-6: Training and exercise requirements for incident management team positions

IMT Role	Exercise	Training
Incident Commander	One Level 3 exercise annually or two Level 2 exercises annually[10]	+ PMAOMIR418 + AMOSC – IMO3 equiv. Oil Spill Response Command & Control
Operations Section Chief / Source Control Branch Director		+ PMAOMIR322 + AMOSC – IMO3 equiv. Oil Spill Response Command & Control
Planning Section Chief Logistics Section Chief Environment Unit Leader		+ PMAOMIR322 + AMOSC – IMO2 equiv. Oil Spill Response Management
Safety Officer Supply Unit Leader GIS Team Leader Data Manager[11] HR Officer Situation Unit Leader Documentation Unit Leader IMT Log & Situation		+ PMAOMIR322 + AMOSC – Oil Spill Response Familiarisation Training

[10] All IMT members are required to participate in at least one Level 3 exercise every two years

[11] Data Manager is an administrative support role, not an IMT role, but is included here for completeness

IMT Role	Exercise	Training
Relief Well Team Leader Well Intervention Team Leader		+ Drilling Well Control accredited training through International Well Control Forum (IWCF) + Level 4 (Well Site Supervisor Training)

5.4.2 Oil spill responder training

Santos has an internal capability of trained oil spill responders who can be deployed in the field in a spill response and has access to external, trained spill responder resources (**Table 5-7**).

Table 5-7: Spill responder personnel resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group Responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations.	AMOSC Core Group Workshop (refresher training undertaken every two years). AMOSC – IMO1 equiv. Oil Spill Response Operations	12
Santos Facility Emergency Response Teams	Present at Facility for first-strike response to incidents.	Internal Santos training and exercises as defined in each facility's Emergency Response Plan OSC to have AMOSC – Oil Spill Response Familiarisation Training.	One Emergency Response (ER) team per operational facility per shift
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken triennially).	7
Santos Oil Spill Response Team	Provides a pool of Santos employees trained to perform leadership roles in an IMT or in the field during an oil spill response.	As per the Santos OSR training matrix	140
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every two years). AMOSC – IMO1 equiv. Oil Spill Response Operations and/or IMO2 equiv. Oil Spill Response Management	As defined in Core Group Member Reports[12] Target to maintain at least 84 members (Ref.: AMOSC Core Group Program and Policies)

[12] An average of 51 personnel as of June 2023 (AMOSC Member's website)

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-OSRL contract.	As per OSRL training and competency matrix.	18 responders guaranteed 80 responders may be approved under best endeavours
AMOSC Staff	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix.	16[13]
Santos Source Control Personnel	Management and coordination of source control strategies including relief well drilling and subsea intervention	Internal Santos training and exercises. IWCF Level 4 certification	60[14]

[13] AMOSC has a permanent staff of 16 available on a 24/7 basis (AMOSC Plan, 2021),12 of which are available for field response, and 4 for admin/management support roles.

[14] Made up of D&C staff that are members of the Santos OSR Team, and other D&C staff.

Responder	Role	Training	Available Number
Oiled Wildlife Response Roles	Refer to **Section 12** and **Appendix I**		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and Scientific Monitoring Plan Teams	Monitoring Coordination Team (MCT) Scientific Monitoring Plan 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 Scientific Monitoring Plan Teams 12+ per team
Tiwi Islands Ranger Groups	Rapid assessment for incidents with the potential to contact Tiwi Islands	Subject to the availability and the participation of the Tiwi Islands Ranger Groups, Santos undertakes to train the Tiwi Islands Ranger Groups prior to the activity and provide additional on the job training post-spill to additional personnel (if required).	10-20 Tiwi Islands Rangers (subject to availability)
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
Other First Nations groups (*as agreed through the post acceptance consultation implementation process and through the NLC*)	*To be determined through post acceptance consultation*	*To be determined through post acceptance consultation*	*To be determined through post acceptance consultation*

In addition to the resources listed in **Table 5-7**, the following resources are available for spill response and may be activated by the relevant Control Agency:

+ National Plan: National Response Team – Trained oil spill response specialists, including aerial observers, containment and recovery crews, and shoreline clean-up personnel, will be deployed under the direction of the relevant Control Agency in a response. The National Response Team is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2021b).
+ NT Oil Spill Contingency Plan (NT OSCP): NT Response Team are available to assist under the jurisdiction of the NT IMT. NT Response Team members remain trained and accredited in line with the NT OSCP.
+ WA SHP-MEE: State Response Team (SRT) – Oil pollution response team available to assist under the jurisdiction of the WA DoT in State waters. SRT members remain trained and accredited in line with the SHP-MEE requirements (WA DoT, 2021).

In the event of a spill, the trained spill responders listed in **Table 5-7** 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.

In the event of a spill, Team Leader roles for protection and deflection and shoreline clean-up would be filled through Santos' AMOSC Core Group Responders and then industry Core Group Responders.

5.5 Response testing arrangements and audits

Santos has oil spill response testing arrangements in place in accordance with the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001) which provides a process for continual monitoring of OSRO capability. This also includes regular oil spill response equipment inventory checks from the various sources. Testing of key response provider arrangements may be done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider are assessed against the performance requirement.

5.5.1 Testing arrangements

Not all spill preparedness and response arrangements will be tested simultaneously. The frequency of testing will relate to the potential spill level, spill risk and complexity of response.

Santos employs a range of tests to ensure that the various response arrangements function as required. These tests include:

1. Contract/ Plan Review
2. Audit
3. Notification/ Communication Check
4. Desktop Exercise
5. Deployment Exercise
6. Level 2/3 IMT Exercise

The above tests and the testing schedule are detailed in full within the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001); an excerpt of the testing arrangements plan is provided in **Figure 5-1** . Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified Key Performance Indicators (KPIs).

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
1	**Source Control**				
	Source Control a) Relief Well Drilling - Access to MODU	Review - MODU Register	Once per month for the duration of drilling campaign	Identify suitable MODU that can be utilized in the event of a Source control incident requiring a relief well	Document the identified suitable MODU by: •Name •MODU Type •Location •Contract Status
	Source Control b) Well Capping - Access to Capping Stack	Review - Contract/Agreement	Annually (when drilling activity is occurring)	To confirm access to capping stack for well capping	Review to confirm access to Capping Stack through maintenance of service provision contract
	Source Control c) Access to Source Control Emergency Response Personnel	Desktop Exercise	Annually (when drilling activity is occurring)	To check arrangements for access to Well Control Specialists from WWC as per Source Control Planning and Response Guideline DR-00-OZ-20001	Confirmation (email) from WWC that listed Well Control specialists can be made available and will be mobilized within 72 hours of a notification
	Source Control d) Vessel Fuel Tank Rupture - SOPEP	Review - Plan	Prior to vessel arrival in field	To confirm that each vessel within the field has an approved SOPEP in place	Review to confirm approved SOPEP in place for vessels
2	**Operational Monitoring**				
	Operational Monitoring - Vessel Surveillance a) Access to vessels	Review - Contract/Agreement	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
	Operational Monitoring - Aerial Surveillance a) Access to aircrafts	Review - Contract/Agreement	Annually	To confirm access to aircrafts for surveillance	Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance
	Operational Monitoring - Aerial Surveillance b) Access to trained aerial observers	Review - Contract/Agreement	Annually	To confirm access to trained aerial observers	Review to confirm access to trained aerial observers through; •Trained Santos personnel or •AMOSC Member Contract or •OSRL Associate Member Contract

Figure 5-2: Excerpt of testing arrangements plan, taken from Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001)

All testing activities are documented, and all reports generated will be saved in Santos's EHS Toolbox system. Once completed, records of testing arrangements are entered into the Santos EHS Toolbox and any actions, recommendations or corrective actions identified are assigned a responsible party for completion and tracked to closure. The status of completion is tracked through the 'Action module' in the EHS Toolbox and communicated widely through monthly EHS KPI reporting.

Source control testing arrangements have been formulated with reference to industry guidelines including the Australian Petroleum Production & Exploration Association (APPEA) Offshore Titleholders Source Control Guideline (June 2021) and the NOPSEMA Information Paper: Source Control Planning and Procedures IP1979 (June 2021).

Source control objectives and KPIs are developed in order to test the response arrangements specified in this OPEP and the Source Control Planning and Response Guideline (DR-00-OZ-20001). In addition to objectives and KPIs, test frequency and type of test are also detailed in the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001).

For each source control exercise, a copy of the exercise materials is recorded in the EHS toolbox. Action items identified are tracked in EHS toolbox to completion. Lessons learnt are incorporated into Santos guidelines and procedures as part of a process of continual improvement.

5.5.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos 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.

Multiple oil spill response organisations are engaged by Santos. These organisations are responsible for the audit and maintenance of their own capacity. The Santos Emergency Response Coordinator (Oil Spill) maintains oversight of the audit and maintenance programs of its service providers through regular reporting requirements and any third-party assurance activities. These include:

+ The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong, Fremantle, Exmouth and Broome are audited every two years under the direction of AMOSC's participating members. The intent is to provide assurances to Santos and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in OPEPs and AMOSC's Service Level Statement.
+ The deployment readiness and capability of OSRL's oil spill response equipment and personnel are audited every two years by the Oil Spill Response Coordinator. The intent of this audit is to provide assurances to Santos of OSRL's ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos' OPEPs and OSRL's SLA.

6. Response strategy selection

6.1 Spill scenarios

This OPEP outlines strategies, actions and supporting arrangements applicable for all credible oil spill events associated with Barossa Development Drilling and Completions activities. Of the credible spill scenarios identified in the Barossa Development Drilling and Completions EP (Section 7), all have been selected to represent worst-case spills from a response perspective, taking into account the following characteristics:

+ They represent all hydrocarbon types that could be spilt during Barossa Development Drilling and Completions activities.
+ They represent maximum credible release volumes.
+ Those scenarios that represent the greatest spatial extent from a response perspective based on surface oil and shoreline accumulation as these are the key factors contributing to response.
+ Proximity to sensitive receptors, shorelines, Territory/State and Commonwealth boundaries etc.

The worst-case credible spill scenarios selected to inform this OPEP are presented in **Table 6-1**. The Barossa Development Drilling and Completions EP (Sections 7.5 to 7.8) details the derivation of these maximum credible spills.

For a description of the characteristics and behaviour associated with hydrocarbons that may unintentionally be released refer to **Appendix A**.

Table 6-1: Maximum credible spill scenarios for Barossa Development Drilling and Completions activities

Worst-case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)	Release duration	Maximum extent of surface hydrocarbons
Bunkering incident	MDO	10	Instantaneous	Within the extent of the worst-case spill trajectory of MDO from a vessel collision
Vessel collision	MDO	250	6 hours	Approx. 368 km (at 1 g/m^2)
LOWC – subsea release	Barossa condensate	129,000	90 days	Approx. 370 km (at 1 g/m^2)

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in Section 7.5.4 of the EP. In addition to the environmental impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These thresholds are provided as a guide for response planning based on case studies that have demonstrated some response strategies require certain oil spill thicknesses and conditions to be effective.

For example, 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 <50 g/m^2.

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50–100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes Bonn Agreement Oil Appearance Codes (BAOAC) 1–3 (EMSA, 2010).

Response planning thresholds are provided in **Table 6-2.**

Table 6-2: Surface hydrocarbon thresholds for response planning

Hydrocarbon concentration (g/m²)	Description
≥1	Estimated minimum threshold for commencing some scientific monitoring components (refer to **Appendix J**)
≥50	Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
≥100	Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application Estimated minimum shoreline accumulation threshold for shoreline clean-up

6.3 Stochastic spill modelling results

Spill modelling was conducted for the LOWC (subsea) scenario (129,000 m^3 of Barossa Condensate) and vessel collision scenario (250 m^3 of MDO). These scenarios represent the worst-case volumes for Barossa Condensate and MDO for the Barossa Development Drilling and Completions activities. The results are presented in **Table 6-3**.

Stochastic oil spill modelling was performed using a three-dimensional spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program). This model is designed to simulate the drifting, spreading, weathering and fate of specific oil types under the influence of changing meteorological and oceanographic forces.

A stochastic modelling approach was followed for each of the scenarios. The stochastic model involves the repeated application of SIMAP (100 simulations for each season; summer, transitional and winter) to simulate the defined spill scenarios using different start-date samples of current and wind data from a historical metocean dataset. The model results were then combined to provide a stochastic summary of each season.

The stochastic modelling outputs do not represent the potential behaviour of a single spill (which would have a much smaller area of influence) but provides an indication of the probability of any given area of the sea surface being contacted by hydrocarbons above impact exposure values in the unlikely event of a worst-case spill.

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. Results for the worst-case credible scenarios have only been included if there was a floating hydrocarbon concentration ≥1 g/m^2 at >5% probability.

Modelling results for dissolved and entrained oil for the worst-case scenarios have not been included in the OPEP given there are limited response strategies that will reduce subsurface impacts. However, these modelling results inform the EMBA and are presented in Section 7.6 and 7.7 of the Barossa Development Drilling and Completions EP (BAD-200-0003). Santos also uses the modelling results for entrained oil from the worst-case scenarios for the purposes of identifying scientific monitoring priority areas (**Appendix L**).

Table 6-3: Worst-case spill modelling results for Barossa Development Drilling and Completions activities (RPS, 2019a)

Location	Water depth (average) (m)	Total contact probability (%) floating oil ≥1 g/m²	Minimum arrival time floating oil ≥1 g/m² (days:hours)	Total contact probability (%) floating oil ≥10 g/m²	Minimum arrival time floating oil ≥10 g/m² (days)	Total probability (%) shoreline oil accumulation ≥10 g/m²	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days)
Scenario: Vessel collision of 250 m³ over 6 hours							
Flinders Shoal*	6.8	14 (transitional)	3 days:12 hours	NC	NC	N/A	N/A
Evans Shoal*	18	22 (transitional)	2 days:9 hours	NC	NC	N/A	N/A
Franklin Shoal*	10.5	13 (transitional)	3 days:12 hours	NC	NC	N/A	N/A
Blackwood Shoal*	15	12 (transitional)	3 days	NC	NC	N/A	N/A
Oceanic Shoals Australian Marine Park (AMP)*	87	6 (summer)	3 days:14 hours	NC	NC	N/A	N/A
Shelf break and slope of the Arafura Shelf Key Ecological Feature (KEF)*	100	100 (summer)	1 hour	100 (summer)	1 hour	N/A	N/A
Carbonate bank and terrace system of the Van Diemen Rise KEF*	140	16 (transitional)	2 days:9 hours	1 (transitional)	3 days:7 hours	N/A	N/A
Scenario: Loss of well control (subsea) of 129,000 m³ over 90 days							
Oceanic Shoals IMCRA*	110	79 (transitional)	2 days:14 hours	47 (transitional)	9 days:2 hours	N/A	N/A
Indonesian EEZ*	N/A	98 (summer)	2 days:12 hours	24 (summer)	18 days:7 hours	N/A	N/A
Oceanic Shoals AMP*	87	52 (transitional)	10 days:2 hours	12 (transitional)	19 days:12 hours	N/A	N/A
Shelf break and slope of the Arafura Shelf KEF*	100	100 (all)	1 hour	100 (all)	1 hour	N/A	N/A
Carbonate bank and terrace system of the Van Diemen Rise KEF*	140	74 (transitional)	2 days:16 hours	39 (transitional)	10 days:4 hours	N/A	N/A
Margaret Harries Bank*	3	23 (transitional)	16 days	NC	NC	N/A	N/A

Location	Water depth (average) (m)	Total contact probability (%) floating oil ≥1 g/m²	Minimum arrival time floating oil ≥1 g/m² (days:hours)	Total contact probability (%) floating oil ≥10 g/m²	Minimum arrival time floating oil ≥10 g/m² (days)	Total probability (%) shoreline oil accumulation ≥10 g/m²	Minimum arrival time shoreline oil accumulation ≥10 g/m² (days)
'Unnamed' Shoal*	60	66 (transitional)	4 days:16 hours	17 (transitional)	12 days:7 hours	N/A	N/A
Evans Shoal*	18	67 (transitional)	2 days:7 hours	NC	NC	N/A	N/A
Franklin Shoal*	10.5	44 (transitional)	3 days:14 hours	NC	NC	N/A	N/A
Flinders Shoal*	6.8	36 (transitional)	3 days:19 hours	NC	NC	N/A	N/A
Blackwood Shoal*	15	53 (transitional)	3 days	NC	NC	N/A	N/A
Tassie Shoal*	15	40 (transitional)	4 days:19 hours	17 (transitional)	12 days:7 hours	N/A	N/A
Loxton Shoal*	10.1	24 (transitional)	6 days:19 hours	NC	NC	N/A	N/A

** Submerged receptor that has no features above the sea surface. Modelling indicates 'contact' with these receptors when the hydrocarbons pass over the receptor on the sea surface.*

NC: No contact to receptor predicted for specified threshold

6.4 Evaluation of applicable response strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 6.1** and spill modelling results (**Section 6.3**) the following spill response strategies have been assessed as potentially applicable for combatting a spill from the Barossa Development Drilling and Completions activities (**Table 6-4**).

N.B. The information contained in **Table 6-4** has been developed by Santos for preparedness purposes. The relevant Control Agency (Santos / NT Government Control Agency / WA DoT) will ultimately determine the strategies and controls to be implemented.

Table 6-4: Evaluation of applicable response strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Barossa Condensate	MDO	
Source Control	Spill kits	✓ 1	✓ 1	Relevant for containing spills that may arise onboard a vessel.
	Secondary containment	✓ 1	✓ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or MODU. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable open deck drainage will be closed to prevent hydrocarbon draining into the marine environment.
	Shipboard Oil Pollution Emergency Plan	✘	✓ 1	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing fuel via transfer to another storage area onboard 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 aim to minimise the volume of fuel spilled.
	Surface well kill	✓ 1	✘	Considered during relief well planning but may not be possible depending upon technical and safety constraints. Surface well kill is only considered when the estimated leak rate is small enough not to generate an explosive gas cloud and access to the MODU is still preserved. This methodology would not be considered should safe access to the MODU or ability to operate a vessel alongside the MODU not be achievable.
	Blowout preventer – emergency activation	✓ 1	✘	A blow-out preventer (BOP) stack will be installed onto the wellhead prior to drilling of the reservoir well sections. The purpose of a BOP is to provide a secondary barrier to hydrocarbons by providing a mechanical means of shutting in the well if primary well control is lost, and hydrocarbons enter the wellbore.
	Capping stack	✓ 2	✘	A Capping Stack may be a viable option for controlling a subsea well drilled using a semi-submersible drilling rig. A Capping Stack installed onto a subsea wellhead can be used to divert the flow of hydrocarbons and potentially reduce the release rate of hydrocarbons prior to well kill via a relief well. Capping stack deployment is a secondary response measure with deployment limited to appropriate conditions (e.g., blowout rates within safe operating limits, safe vertical access) and when operating conditions permit (wind speed, wave height, current and plume radius). Debris clearance using the Subsea First Response Toolkit (SFRT) would be implemented prior to Capping Stack installation.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Barossa Condensate	MDO	
	Relief well drilling	✓ 1	✗	Relevant to LOWC. Relief well drilling is the primary method for killing a blow-out well. To be conducted as per the Source Control Planning and Response Guideline (DR 00 OZ 20001) and Well-specific Source Control Plan.
	Subsea dispersant injection (SSDI)	✓ 2	✗	SSDI is known to reduce VOC levels at the sea surface and is shown to be effective at dispersing condensates when applied subsea (RPS, 2019b), making conditions safer for responders and source control personnel. SSDI is shown to reduce surface concentrations of hydrocarbons, thereby reducing the exposure of seabirds and surfacing marine fauna to hydrocarbons. It also disperses hydrocarbons into a larger volume of water, reducing concentrations and enhances biodegradation (French McCay *et al.*, 2018). A potential drawback of this response tactic is that it will result in smaller droplet sizes and entrainment of hydrocarbons into the water column, which may affect some oceanic and benthic organisms (e.g. fish, plankton). However, this is likely to be temporary and restricted to the top ~3 m of the water column whilst SSDI is being used (RPS, 2019b). This increase in entrainment is partially offset by significant increases in biodegradation rates. SSDI is only suitable for subsea LOWC scenarios. Barossa condensate is considered a Group 1 oil (non-persistent) hydrocarbon that has rapid evaporation rates (57% within a few hours to a day – **Appendix A**). There is therefore little to no direct environmental benefit from SSDI and potential drawbacks associated with the enhancement of entrainment. However SSDI may be employed as a secondary strategy and only if it was necessary to reduce VOCs in the atmosphere, improving the safety of response personnel working close to the well site. In this case, SSDI may have an overall environmental benefit, as enabling source control personnel access to the site to bring the release under control (e.g. for BOP intervention and/or deployment of a Capping Stack) may reduce the overall volume of hydrocarbons being released into the environment. The reduction in atmospheric VOC levels at the surface through executing SSDI would be closely monitored – if there was no reduction in VOCs being achieved, SSDI would cease.
In-Situ Burning	Controlled burning of oil spill	✗	✗	Not applicable to wells with light hydrocarbons due to safety hazards. Not applicable to MDO spills due to inability to contain MDO making it very difficult to maintain necessary slick thickness for ignition and sustained burning. In addition, in-situ burning is not normally considered as an acceptable response strategy due to the atmospheric emissions created.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Barossa Condensate	MDO	
Monitor and Evaluate Plan (Operational Monitoring)	Vessel surveillance	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). Informs implementation of other response strategies. Vessel personnel may not be trained observers. Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure implementation. Constrained to daylight. Limited to visual range from the vessel. Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). Provides information on the effectiveness of response strategies. Informs implementation of other response strategies.
	Tracking buoys	✓ 1	✓ 1	Can be implemented rapidly. Can provide indication of near-surface entrained/dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory Modelling	✓ 1	✓ 1	Can be implemented rapidly. Predictive – provides estimate of where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite Imagery	✓ 1	✓ 1	Can work under large range of weather conditions (e.g. night-time, cloud cover, etc.). Mobilisation restricted to image availability.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Barossa Condensate	MDO	
				Requires processing. May return false positives.
	Operational Water Quality Monitoring	✓ 1	✓ 1	Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of a continuous subsea spill and validate the spill fate modelling predictions.
	Shoreline Clean-up Assessment	N/A	N/A	Modelling indicates no probability of shoreline accumulation at any exposure value.
Chemical dispersion	Vessel Application	✗	✗	Neither Barossa condensate or MDO are persistent hydrocarbons, both having high natural spreading, dispersion and evaporation rates in the marine environment. Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50–100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes Bonn Agreement Oil Appearance Codes (BAOACs) 1–3 (EMSA, 2010). Barossa Condensate and MDO would rapidly spread and thin out on the sea surface, so are unlikely to reach this required thickness. Therefore, considering the rapid evaporation rates (57% within a few hours to a day – **Appendix A**) of Barossa Condensate (a Group I hydrocarbon) and MDO, the tendency to naturally disperse and the remoteness of the spill location, the addition of surface chemical dispersants would have little to no environmental benefit, whilst potentially increasing localised toxicity in the water column.
	Aerial Application	✗	✗	
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil	✗	✗	Not suitable for Barossa condensate or MDO given their rapid weathering nature. These hydrocarbons spread quickly to a thin film, making recovery via skimmers difficult and ineffective. The ability to contain and recover rapidly weathering hydrocarbons on the sea surface is extremely limited due the very low viscosity of these hydrocarbons.
Mechanical Dispersion	Vessel prop- washing	✓ 2	✓ 2	Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission are not suitable.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Barossa Condensate	MDO	
				Mechanical dispersion may be applicable for the localised entrainment of surface oil but is not considered to have a significant effect on removing oil from the surface. 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. MDO 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. Mechanical dispersion may be considered for targeted small breakaway patches of hydrocarbons but may have limited effectiveness. 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 OSC/IMT or by the relevant Control Agency. It is unlikely that vessels would be specifically allocated for mechanical dispersion but support vessels in the field undertaking primary strategies may be used opportunistically.
Protection and Deflection	Booming in nearshore waters and at shorelines	N/A	N/A	Modelling indicates no probability of shoreline accumulation at any exposure value.
Shoreline clean-up	Activities include physical removal, surf washing, flushing,	N/A	N/A	Modelling indicates no probability of shoreline accumulation at any exposure value.

<table>
<tr><th rowspan="2">OSR Strategy</th><th rowspan="2">Tactic</th><th colspan="2">Applicability and Designated Primary (1) or Secondary (2) Response Strategy</th><th rowspan="2">Considerations</th></tr>
<tr><th>Barossa Condensate</th><th>MDO</th></tr>
<tr><td></td><td>bioremediation, natural dispersion</td><td></td><td></td><td></td></tr>
<tr><td>Oiled wildlife response</td><td>Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation</td><td>✓ 1</td><td>✓ 1</td><td>Can be used to deter and protect wildlife from contact with oil.
Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines.
Surveillance can be carried out as a part of the fauna specific operational monitoring.
Wildlife may become desensitised to hazing method.
Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging).
Permitting requirements for hazing and pre-emptive capture.</td></tr>
<tr><td>Scientific Monitoring</td><td>The monitoring of environmental receptors to determine the level of impact and recovery from the oil spill and associated response activities</td><td>✓ 1</td><td>✓ 1</td><td>Monitoring activities include:
+ water and sediment quality
+ biota of shorelines (sandy beaches, rocky shores and intertidal mudflats)
+ mangrove monitoring
+ benthic habitat monitoring (seagrass, algae, corals, non-coral benthic filter feeders)
+ seabirds and shorebirds
+ marine megafauna (incl. whale sharks and mammals)
+ marine reptiles (incl. turtles)
+ seafood quality
+ fish, fisheries and aquaculture
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.</td></tr>
</table>

6.5 Identification of priority areas

When dealing with oil spills in remote environments, it is not always realistic or feasible to protect all receptors. Therefore, prioritising receptors helps identify where available resources (for response and/or monitoring) should be directed for the best effect. It enables the Control Agency to make informed decisions, and ultimately in the development and execution of an effective response strategy.

Following the identification of hot spots (Section 7.5.5.3 of the EP), Santos typically identifies priority protection areas, in order to identify high value emergent features that are at risk of greatest impact which would be the focus of protection or clean-up efforts. However, modelling results (**Table 6-3**) predict that no emergent features will be contacted by either floating or stranded oil at any threshold. Hence, there are no priority protection areas to conduct shoreline protection or clean-up activities.

Although shoreline protection and clean-up are not applicable response strategies, **Table 6-4** has identified oiled wildlife response and scientific monitoring as primary response strategies in the event of a worst-case credible spill from Barossa Development Drilling and Completions activities. **Section 12.2** provides guidance on wildlife priority protection areas and **Appendix L** outlines the process for identifying Scientific Monitoring Priority Areas (SMPAs) using modelling results for entrained and floating hydrocarbon concentrations from the worst-case scenarios.

6.6 Net environmental benefit analysis

The IMT uses a NEBA, also referred to as a spill impact mitigation assessment (SIMA), to inform the incident action planning process (**Section 8**), so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed.

The Environment Unit Leader will use the information in **Section 6.5** to identify and prioritise initial response priorities and apply the NEBA to identify which response strategies 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 and WA DoT, consultation will be required during the NEBA process such that there is consistency in the sensitivities prioritised for response across the Control Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to both the LOWC and vessel spill scenarios, with the benefit or potential impact to each sensitivity identified (refer to **Table 6-5)**.

In the event of a spill, NEBA is applied with supporting information collected as part of the Operational Monitoring Plan (**Section 10**) to achieve the following:

+ Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally).
+ Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority.
+ 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. Operational NEBA Templates are filed within the Environment Unit Leader folder on the Santos ER Intranet site. To complete the Operational NEBA:

+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are recorded.

- Potential effects of response strategies on each sensitivity are assessed in terms of their benefit or otherwise to the socio-economic sensitivities.
- All persons involved and data inputs have been considered for the analysis.

The Operational NEBA Form documents the decisions behind the recommendation to the Incident Commander 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.

Table 6-5: Strategic net environmental benefit analysis matrix – Barossa Development Drilling and Completions

Priority area	No controls	Source control	Monitor and evaluate	Mechanical dispersion	Oiled wildlife response	Scientific monitoring
Shoals (submerged receptors) - Unnamed Shoal, Evans Shoal, Franklin Shoal, Flinders Shoal, Blackwood Shoal, Tassie Shoal, Loxton Shoal, Lynedoch Shoal, Margaret Harries Bank						
Coral and other subsea benthic primary producers					N/A	
Important fish communities					N/A	
Oceanic Shoals Marine Park (submerged receptor)						
Turtle habitat – flatback, olive ridley, loggerhead						
Coral and other subsea benthic primary producers					N/A	
Important fish communities					N/A	
Carbonate bank and terrace system of the Van Diemen Rise (submerged receptor)						
Coral and other subsea benthic primary producers – soft corals, sponges, epifauna					N/A	
Important fish communities					N/A	
Turtle habitat – flatback, olive ridley, loggerhead						
The shelf break and slope of the Arafura Shelf (submerged receptor)						
Phytoplankton and invertebrates					N/A	
Important fish communities					N/A	

Key:

	Beneficial impact		Possible beneficial impact depending on the situation (e.g. timeframes and metocean conditions to dilute entrained oil)		Negative impact	N/A	Not applicable for the environmental value or not applicable for hydrocarbon type

6.7 Oil spill response as-low-as-reasonably-practicable assessment

For each response strategy included within this OPEP an environmental performance outcome has been determined and key control measures and performance standards have been identified such that the response can meet the required performance outcome. For each response strategy, an ALARP assessment has been conducted to demonstrate that the control measures mitigate the risk of an oil spill to ALARP.

Appendix B details the ALARP assessment framework and the results of the ALARP assessment conducted to inform the control measures and performance standards contained within this OPEP.

7. External notifications and reporting requirements

For oil spill incidents, the OSC (or Company Site Representative) will notify the Perth-based IMT for delegation of further notifications to relevant regulatory authorities and stakeholders and for further spill response assistance for Level 2/3 spills.

7.1 Regulatory and stakeholder notification and reporting

The Incident Commander (IC) is to delegate the following regulatory and stakeholder reporting requirements. Typical delegated parties will be the Planning Section Chief.

Contact details for the regulatory agencies and stakeholders outlined in **Table 7-1** are provided within the Incident Response Telephone Directory (SO-00-ZF-00025.020).

Table 7-1 outlines the external reporting requirements specifically for oil spill incidents outlined within this OPEP in Commonwealth, Territory and State jurisdictions, noting that regulatory reporting may apply to smaller Level 1 spills that can be responded to using on-site resources as well as larger Level 2/3 spills. 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), the NT Government and WA DoT (MEER unit).

The Incident Response Telephone Directory (SO-00-ZF-00025.020) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.2 Activation of external oil spill response organisations and support agencies

Table 7-2 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined within this plan. This list contains key OSROs that have pre-established roles in assisting Santos in an oil spill response. It is not an exhaustive list of all providers that Santos may use for assisting an oil spill response.

7.3 Environmental performance

Table 7-3 lists the environmental performance standards and measurement criteria for external notifications and reporting.

Santos

Table 7-1: Regulatory and stakeholder notification and reporting requirements (Commonwealth, state and international waters)

Regulator / stakeholder	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 two hours Written report as soon as practicable, but no later than three days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (as amended 2014)	A spill associated with the activity in <u>Commonwealth waters</u> that has the potential to cause moderate to significant environmental damage[1]	Notification by Planning Section Chief (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
National Offshore Petroleum Titles Administrator (NOPTA) (Titles Administrator)	Written report to NOPTA within seven days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in <u>Commonwealth waters</u> that is reportable to NOPSEMA	Notification by Planning Section Chief (or delegate)	Provide same written report as provided to NOPSEMA
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within two hours of incident Written POLREP form, within 24 hours on request from AMSA	MARPOL	Santos to notify AMSA of any marine pollution incident[1]	Notification by Planning Section Chief (or delegate)	Not applicable
Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (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 Planning Section Chief (or delegate)	Not applicable
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable	*Environment Protection and Biodiversity*	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by Planning Section Chief (or delegate)	Not applicable, but the following information should be provided:

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
		Conservation Act 1999			+ 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 + confirmation of providing access to relevant monitoring and evaluation reports when available + Details of the relevant contact person in the IMT
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1] Fisheries within the environment that may be affected (EMBA) Consider a courtesy call if not in exposure zone	Notification by Planning Section Chief (or delegate)	Not applicable
If spill is heading towards NT waters					
NT Commissioner of Police	Verbal notification as soon as practicable by calling the NT Pollution Response Hotline	*Northern Territory Environment Protection Authority Act 2012*	Santos to notify of actual or impending Marine Pollution Incidents (MOP) that are in, or may impact, Territory waters	Notification by Planning Section Chief	Not applicable

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
NT Regional Harbourmaster	Verbal notification Follow up with POLREP as soon as practicable after verbal notification	Northern Territory Oil Spill Contingency Plan. As per Territory legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in NT waters, regardless of source or quantity Notify if spill has the potential to impact wildlife in Territory waters (to activate the Oiled Wildlife Coordinator)	Notification by IMT Planning Section Chief (or delegate)	POLREPs to be emailed to rhm@nt.gov.au (Regional Harbourmaster) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government webpage: https://nt.gov.au/marine/marine-safety/report-marine-pollution
NT Department of Environment, Parks and Water Security (DEPWS) NT Environmental Protection Authority (EPA) (Pollution Response Hotline; Environmental Operations)	Verbal notification as soon as practicable Written report to be provided as soon as practicable after the incident, unless otherwise specified by the Minister	Northern Territory Oil Spill Contingency Plan. As per State legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in NT waters	Notification by IMT Planning Section Chief (or delegate)	Marine Pollution Reports (POLREPs) are to be emailed to pollution@nt.gov.au (Environmental Operations) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government web page: https://nt.gov.au/marine/marine-safety/report-marine-pollution https://ntepa.nt.gov.au/make-a-report
NT Department of Primary Industry and Fisheries (DPIF)	Verbal notification, timing not specified	Not applicable	Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by Planning Section Chief (or delegate)	Not applicable

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
If spill is heading towards WA waters					
Department of Mines, Industry Regulation and Safety (DMIRS) (Petroleum Environment Duty Officer)	Verbal phone call within two hours of incident being identified Follow up written notification within three days	Regulations 28, 29 and 30 of the Petroleum (Submerged Lands) (Environment) Regulations 2012 Guidance Note on Environmental Non-compliance and Incident Reporting	All actual or impending spills in State waters	Notification by Planning Section Chief (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Documents/Environment/ENV-PEB-189.docx
WA Department of Transport (WA DoT)[2] (MEER Duty Officer)	Verbal notification within two hours Follow up with Pollution Report (**Appendix C**) as soon as practicable after verbal notification If requested, submit Situation Report (**Appendix D**) within 24 hours of request	*Emergency Management Act 2005* State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos 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 damage to the health of a person, property or the environment[1]	Notification by Planning Section Chief (or delegate) MEER Duty Officer contacted per Incident Telephone Directory	WA DoT POLREP (**Appendix C**): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP (**Appendix D**): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
WA Department of Biodiversity Conservation and Attractions (DBCA) (State Duty Officer) and	Verbal notification as soon as reasonably practicable	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 Adviser)	Notification by Planning Section Chief (or delegate)	Not applicable

Santos

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
DBCA-WA Kimberley Regional Office					
Department of Primary Industry and Regional Development (DPIRD) Fisheries	Verbal phone call notification within 24 hours of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution[1] Notify if spill has the potential to impact or has impacted fisheries in State waters	Notification by Planning Section Chief (or delegate)	Not applicable
Department of Water and Environmental Regulation (DWER)	Initial verbal or electronic notification of the discharge as soon as practicable Written notification of the incident to the CEO of the DWER, copied to the local DWER Industry Regulation Office, as soon as practicable	*Environmental Protection Act 1986* (Section 72) Environmental Protection (Unauthorised Discharge) Regulations 2004	Call DWER 24-hour Pollution Watch hotline Environmental Protection Act: Spill or discharge of hydrocarbons to the environment that has caused, or is likely to cause pollution, or material or serious environmental harm (Level 2 / 3 spills) Environmental Protection (Unauthorised Discharge) Regs.: Unauthorised discharge (where there is potential for significant impact or public interest) to environment of Schedule 1 material	Notification by Planning Section Chief (or delegate)	Reporting requirements: https://www.der.wa.gov.au/your-environment/51-reporting-pollution/110-reporting-a-life-threatening-incident-or-pollution-emergency
If spill is heading towards international waters					
Department for Foreign Affairs and Trade (DFAT)	Verbal phone call notification within 8 hours, if the spill is likely	NP–GUI–007: National Plan coordination of	Notify DFAT that a spill has occurred and is likely	Notification by Planning Section Chief (or delegate)	Email details of incident to

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
(24-hour consular emergency centre)	to extend into international waters Follow up with email outlining details of incident	international incidents: notification arrangements guidance (AMSA, 2017b)	to extend into international waters Inform DFAT of the measures being undertaken to manage the spill. NOPSEMA, DISR and DFAT will form an inter-agency panel; the Australian Government Control Crisis Centre		globalwatchoffice@dfat.gov.au
Stakeholders (including Relevant Persons)					
Tiwi Resources (Ranger Coordinator), Tiwi Land Council and Munupi Clan members [redacted], [redacted] and [redacted]	Verbal phone call notification - Verbal phone call within eight hours of incident being identified. Follow up with email outlining details of incident.	Not applicable	All spills heading towards the Tiwi Islands	Notification by Planning Section Chief (or delegate)	Not applicable
The Mulurryud Consultative Committee, via [redacted] at [redacted]	Verbal phone call notification - Verbal phone call within eight hours of incident being identified. Follow up with email outlining details of incident.	Not applicable	All spills heading towards Croker Island	Notification by Planning Section Chief (or delegate)	Not applicable
Other First Nations groups (*as agreed through the post acceptance consultation implementation process and through the NLC*)	Verbal phone call notification - Verbal phone call within eight hours of incident being identified.	Not applicable	All spills heading towards relevant parties' interests	Notification by Planning Section Chief (or delegate)	Not applicable

Regulator / stakeholder	Type of notification/ timing	Legislation/guidance	Reporting requirements	Responsible person/group	Forms
	Follow up with email outlining details of incident.				

1: For clarity and consistency across Santos regulatory reporting requirements, Santos will meet the requirement of reporting a marine oil pollution incident by reporting oil spills assessed to have an environmental consequence of moderate or higher in accordance with Santos' environmental impact and risk assessment process outlined in Section 5 of the EP.

2: Santos 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); in NT waters, NT Pollution Response Hotline and the NT Commissioner of Police; in State waters, WA DoT MEER.

Table 7-2: List of spill response support notifications

Organisation	Indicative timeframe	Type of communi-cation	Resources available	Activation instructions	Santos person responsible for activating
AMOSC Duty Officer	As soon as possible but within two hours of incident having been identified	Verbal Service Contract	Santos is a Participating Member of AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos 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.** Email confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment. Only a Santos call-out authority (registered with AMOSC) can activate AMOSC and will be required to supply their credentials to AMOSC. A signed service contract note must also be completed by the Santos call-out authority and returned to AMOSC before mobilisation.	Planning Section Chief (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place	Phone call.	Logistics Section Chief (or delegate)
Duty Officers/ Incident Commanders	Within two hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual aid arrangement)	Phone call.	Incident Commander (or delegate)

Organisation	Indicative timeframe	Type of communi-cation	Resources available	Activation instructions	Santos person responsible for activating
(Woodside, Chevron, Jadestone)					
Toll - Freight & Logistics	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call.	Logistics Section Chief (or delegate)
Waste Service Provider/s	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place with Waste Service Providers 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.	Logistics Section Chief (or delegate)
Monitoring Service Provider	Scientific Monitoring Plan initiation criteria are met (**Appendix J**)	Verbal and written	Santos' Monitoring Service Provider has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1 to 11. This includes provision of personnel and equipment. The Monitoring Service Provider annually reviews the SMPs for continual improvement	**Step 1.** Obtain approval from Incident Commander to activate Monitoring Service Provider for Scientific Monitoring. **Step 2.** Verbally notify Monitoring Service Provider followed by the submission of an Activation Form (Environment Unit Leader Folder) via email. **Step 3.** Provide additional details as requested by the Monitoring Service Provider Monitoring Coordinator on call-back. **Step 4**. Monitoring Service Provider initiates Scientific Monitoring Activation and Response Process.	Planning Section Chief (or delegate)
Dispersant Operational Monitoring Provider	When application of dispersant is activated (**Section 9.2.5**).	Verbal and Activation Form	Santos' Dispersant Operational Monitoring Provider has been contracted to provide operational	Phone call to the Dispersant Operational Monitoring Provider	Planning Section Chief (or delegate)

Organisation	Indicative timeframe	Type of communi-cation	Resources available	Activation instructions	Santos person responsible for activating
			dispersant monitoring, including the provision of personnel and equipment.	– Operational Stand-by Response (refer to **Appendix K**)	
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 10.6**)	Verbal	Oil analysis including gas chromatography/mass spectrometry fingerprinting	Phone call.	Planning Section Chief (or delegate)
Oil Spill Response Limited, OSRL Duty Manager	Within two hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form	Santos has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios At minimum OSRL will provide technical support to the IMT and place resources on standby 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 3**. Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby.	Designated call-out authorities (including Incident Commanders)
RPS Group	As soon as possible but within two hours of incident having been identified	Verbal and written	Santos 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, if required, as part of contracting arrangements with RPS Group	Contact RPS Group Duty Officer.	Environment Unit Leader (or delegate)
Wild Well Control Inc. (WWCI)	Within four hours of a loss of well control	Loss of well control only Verbal	Well intervention services. Under contract.	**As per Source Control Planning and Response Guideline (DR-00-OZ-20001):**	Drilling Representative

Organisation	Indicative timeframe	Type of communi-cation	Resources available	Activation instructions	Santos person responsible for activating
	incident having been identified			**Step 1.** Following Santos management confirmation of a subsea loss of containment, the Santos Incident Command Team (IMT) Drilling Representative is to call the Wild Well Control 24-hour emergency hotline number to notify WWCI of the incident. **Step 2.** As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form must be filled out, signed off by the authorised Santos Manager and sent through to WWCI. Obtain the most current emergency mobilisation form from the WWCI emergency hotline attendant. The form shall be submitted as directed by WWCI, as advised by the emergency hotline attendant.	

Table 7-3: Environmental performance – external notification and reporting

Environmental performance outcome	Make notifications and reports within regulatory and defined timeframes.		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
External notifications and reporting plan	**Response preparedness**		
	Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)	Incident Response Telephone Directory is revised every six months	Document revision history
	OPEP communications test	OPEP contact details for regulatory and service provider notifications are checked annually	Test records
	Response implementation		
	External notifications and reporting tables	External notification and reporting undertaken as per **Table 7-1** and **Table 7-2**	Incident log

8. Incident action planning

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

1. Understand the situation.
2. Establish incident priorities, objectives and tasks.
3. Develop a plan (IAP).
4. Prepare and disseminate the plan.
5. Execute, evaluate and revise the plan for the next operational period.

The Santos IMT will use the IAP process to determine and document the appropriate response priorities, objectives, strategies and tasks to guide the incident response which are reviewed and updated as more information becomes available. The IMT will use an IAP for each operational period following the initial first-strike assessments, notifications, and activations undertaken.

When acting as the support agency, Santos may be requested by the Control Agency to develop or support the development of an IAP to help guide the incident response.

The Santos IAP process is built on the phases described in **Figure 8-1**.

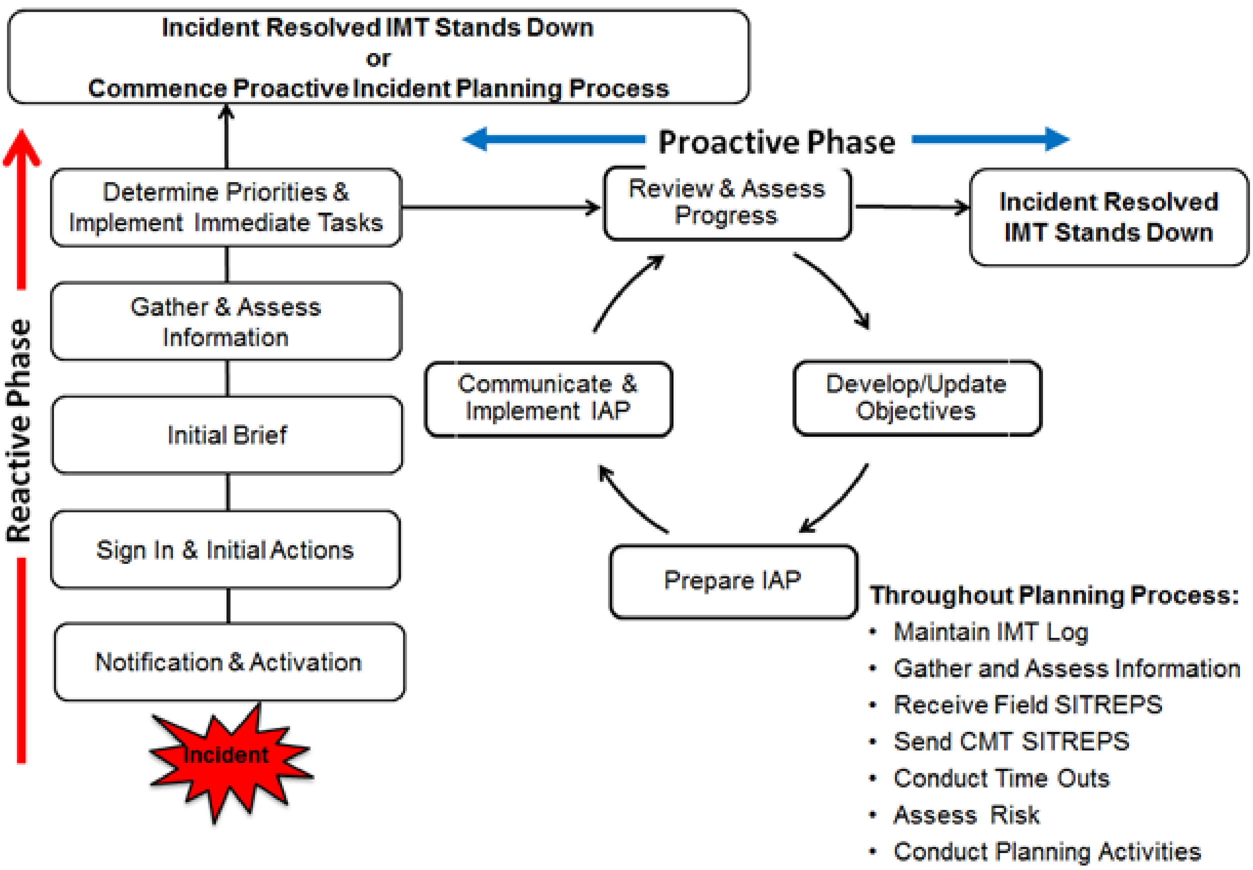

Figure 8-1: Incident action plan process

8.1 Reactive phase planning

The initial phase of the incident action planning process can be considered a reactive phase (indicatively lasting up to 48 hours) where information on the incident is being progressively established through reports coming in from the field. During this phase there is no formal incident action plan to follow (given the incident has just begun and details are still being established) however the OPEP (this document) has been prepared to contain all first-strike oil spill response actions required to be followed during this phase in lieu of a formal IAP.

First-strike response actions are summarised in **Section 2** and provide links to relevant oil spill strategy sections within the OPEP which contain a more detailed list of implementation actions and considerations as well as statements of performance (performances standards) that must be followed to ensure the initial response meets regulatory requirements and environmental performance outcomes.

For each credible oil spill scenario covered by this OPEP, the first-strike response actions have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic NEBA (also referred to as a SIMA). This pre-planning is included in **Section 6**. During the reactive phase the strategic NEBA is to be reviewed and, using the specific information gathered from the spill, operationalised into an operational NEBA. This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

8.2 Developing an incident action plan

At the end of the reactive phase where the incident specifics have been determined, a more formal phase of spill response is entered whereby a documented IAP is developed to guide the incident response activities for the next operational period. An operational period is defined as the period scheduled for execution of actions specified in the IAP. The next operational period is nominally a daily period but for long running incidents may be extended further where the pace of the incident response has settled, and the level of new information has decreased.

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' 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, team leaders, laboratory chemists) who report on the effectiveness of the response strategies.

IAP forms and processes are documented in the Santos SharePoint Oil Spill Response Tile, and in the SO ER Documentation SharePoint site. Access subfolders to display all forms required to conduct incident action planning. Each functional position within the IMT has subfolders carrying forms and processes unique to the functional position on the Oil Spill Tile.

8.3 Environmental performance

Table 8-1 lists the environmental performance standards and measurement criteria for incident action planning.

Table 8-1: Environmental performance – incident action planning

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Incident action planning	**Response preparedness**		
	IMT Exercise and Training Plan	Incident action planning and NEBA is practiced by the IMT during exercises	Exercise records

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
	Response implementation		
	Incident action plan	Incident action plan is completed for each operational period and approved by the Incident Commander	Incident log Incident action plan/s
		Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident log Incident action plan/s
	NEBA	An operational NEBA will be undertaken for each operational period of the incident	NEBA Incident action plan
	IMT activation and de-escalation	IMT will be activated Immediately once notified of a Level 2/3 spill (to Incident Commander).	Incident Action Plan
		The decision to de-escalate the IMT will be made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role.	NEBA Incident Action Plan
	Tactical Response Plans	If operational monitoring shows that shoreline contact is likely, TRPs will be developed or sought from other titleholders/ regional industries prior to shoreline contact.	TRP

9. Source control

The initial and highest priority response to an oil spill incident following the health and safety of on-site personnel is to prevent or limit further loss of hydrocarbons to the environment.

For major hydrocarbon release incidents during Barossa Development Drilling and Completions activities, the MODU Operator's Emergency Response Plan and the Santos-MODU Operator Emergency Response Bridging Plan outline the initial actions to be taken by onsite personnel to control the source of a hydrocarbon spill and limit the volume released to the environment.

For vessels with a SOPEP, the SOPEP will provide the relevant initial actions to control the source of the spill.

For the ongoing response to a LOWC incident, the Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) is to be consulted as the overarching source of information for implementing a relief well.

The sections below provide an outline of source control activities noting that the Vessel SOPEP and Source Control Planning and Response Guideline (DR-00-OZ-20001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Vessel collision – fuel tank rupture

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control response to a fuel tank rupture. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-1: Vessel collision – source control environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome.	Implementation of source control methods to stop the release of hydrocarbons into the marine environment	
Initiation criteria	Notification of a spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✗
Termination criteria	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons	

9.1.1 Implementation guidance

Implementation guidance is summarised in **Table 9-2.** In the event MDO is released from a vessel due to a tank rupture, the relevant vessel-specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident. **Table 9-9** lists the environmental performance standards and measurement criteria for this strategy.

Table 9-2: Implementation guidance – fuel tank rupture

	Action	Consideration	Responsibility	Complete
Initial actions	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed, as applicable.	Notwithstanding vessel-specific procedures for source control, the following activities would be evaluated immediately for implementation, providing it is safe to do so: + Reduce the head of fuel 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 fuel inventory loss. + If the affected tank is not easily identified, reduce the level of the fuel in the tanks in the vicinity of the suspected area if stability of the vessel will not be compromised. + Evaluate the transfer of fuel to other vessels. + Trim or lighten the vessel to avoid further damage to intact tanks. + Attempt repair and plugging of hole or rupture.	Vessel Master	☐

9.2 Loss of well control

Table 9-3 provides the environmental performance outcome, initiation criteria and termination criteria for controlling the source of a loss of well control.

Table 9-3: Loss of well control – source environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment	
Initiation criteria	LOWC	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	×	✓
Termination criteria	The primary well is contained and killed to prevent any further release of hydrocarbon to the environment	

Santos identified the worst-case credible oil spill scenario for assessment as:

+ a subsea LOWC with the release of 800,000 STB (129,000 m³) of Barossa Condensate (approximately 1,433 m^3/day or 9,015 bbl/day) over 90 days.

9.2.1 Emergency blowout preventer activation

As part of the drilling and completions activity, a blow-out preventer (BOP) stack will be installed onto the wellhead whenever there are less than two permanent barriers present, in accordance with API Standard 53: *Well control equipment systems for drilling wells* (API, 2018). The purpose of a BOP is to provide a secondary barrier to hydrocarbons by providing a mechanical means of shutting in the well if primary well control is lost, and hydrocarbons enter the wellbore.

9.2.1.1 Manual activation

If primary well control actions have failed and a loss of well control incident is anticipated, or is occurring, the drilling crew will initiate emergency BOP activation procedures immediately to shut in the well.

The relevant BOP rams will be activated, via the BOP control panel located in the drill shack. There is an additional BOP control panel located remote to the drill shack. BOP rams commonly include:

+ **pipe ram**: seals the wellbore by sealing around drill pipe of a specific size
+ **variable-bore ram**: seals the wellbore by sealing around various sizes of drill pipe
+ **blind ram**: seals the wellbore when there is no tubing across the BOP
+ **blind-shear ram**: seals the wellbore by cutting through and displacing drill pipe/ tubing.

One or more of the BOP rams may be activated depending on the status of the well and the severity of the well control incident. Once a ram is closed it cannot be opened without further hydraulic intervention. Well pressure acts to hold the ram closed. BOP shear rams often have a secondary lock mechanism to further ensure that the well remains shut-in.

Sealing the wellbore in this manner provides an important safety barrier. It also allows the drill crew time to consider and plan actions to bring the well back under primary control.

9.2.1.2 Automatic activation

In the event of loss of communication between the MODU and the BOP (e.g., the electrical connection between the BOP control panels on the MODU and the BOP on the wellhead is severed or damaged in some way), the BOP is designed to fail-safe close automatically on loss of signal, using stored electrical and hydraulic control power from the BOP battery and accumulators, respectively. In this situation the BOP will seal the well automatically.

9.2.1.3 MODU emergency disconnect

In the event of a serious loss of well control incident where the safety of the MODU and crew are threatened, the MODU emergency disconnect system (EDS) will be activated. This will unlatch the lower marine riser package (LMRP) from the BOP and activate the BOP rams. The EDS is used as a 'last resort' where all other attempts at well control have been unsuccessful and the safety of the MODU and its crew is threatened to an unacceptable level.

9.2.1.4 Failure intervention

In the unlikely event that attempts to activate the BOP from the MODU have failed, and/or the fail-safe close operation of the BOP has malfunctioned, the BOP can be closed via remotely operated vehicle (ROV) hot-stab intervention. Either the ROV on the MODU or an ROV from a separate support vessel can actuate the BOP in this manner. ROV deployment would commence as soon as practicable from the MODU if safe to do so. If an ROV was to be deployed from a support vessel, the IMT would immediately seek to source an ROV and suitable vessel to mobilise to the field and deploy the intervention ROV as soon as practicable. ROV operations would commence to navigate the ROV to the BOP and activate the BOP rams via a hydraulic hot-stab connection on the BOP side panel. This would serve to add hydraulic pressure to the BOP circuit from either the ROV pumps or an external hydraulic source, to enable manual close of the BOP rams to seal the well.

9.2.2 Subsea first response toolkit (SFRT)

If a subsea LOWC was to occur, the site would require a detailed assessment to determine the most suitable intervention methods for the incident. This may be achieved through the use of remotely operated vehicles (ROVs) (supplied by Santos via existing contractual arrangements) and the AMOSC Subsea First Response Toolkit (SFRT). The SFRT includes debris clearance equipment, ancillary tools and subsea dispersant injection (SSDI) equipment (refer to **Section 9.2.5**).

In the event of a loss of well control incident, Santos will mobilise the AMOSC SFRT from Fremantle to Darwin for transhipment to a suitable vessel for transport to and deployment at the incident location. The SFRT is located at Oceaneering's facilities at Jandakot. If required, the equipment would be mobilised via road from Jandakot to Darwin. It is estimated this would take 10 hours to arrange and up to 7 days to load and transport to Darwin, depending on the destination and time of year. A suitable vessel would be acquired by Santos during this timeframe and arrive in Darwin (within 9 days of the call-out). Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day 11–12 from call-out. Specialist personnel to deploy the SFRT will be provided via Santos' contract with Oceaneering and will be available in Darwin within 72 hours (3 days). Vessel specifications are outlined in the Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001).

9.2.3 Relief Well Drilling

Relief well drilling is the primary source control strategy to control a LOWC during drilling and completions activities.

The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

9.2.3.1 Relief well planning

Relief well planning is embedded into the Santos Drilling & Completions Management Process (DCMP). The following industry accepted guidelines have been adopted to assist relief well planning requirements:

- SPE Calculation of Worst Case Discharge Rev 1, 2016: This is used as part of the prospect screening review to generate a credible rate for oil spill modelling.
- United Kingdom Oil and Gas Relief Well Guidelines, Issue 2, 2013: This methodology is used to confirm a well complexity analysis.

All wells drilled during Barossa Development Drilling and Completions activities will be included in a well specific source control plan (SCP). A single SCP will be developed covering all wells in the Barossa development campaign, due to the similarity in well design between all development wells. The SCP is a Santos controlled document and is encompassed in the well operations management plan (WOMP).

The SCP will contain relief well planning information, specifically:

- MODU positioning assessment for relief well drilling locations
- relief well tangible equipment requirements and availability
- relief well trajectory analysis and casing design
- dynamic well kill hydraulic simulation results.

These reports are static reports developed prior to higher-risk campaign-specific activities (drilling and completions activities). While they contain planning that would be relevant to drilling a relief well for any well release (e.g. MODU positioning locations), time-variable information, such as MODU availability, is only assessed for the duration of the campaign.

To ensure Santos has current MODU availability, Santos maintains a register of MODU activity within the region and updates this on a monthly basis. The MODU capability register includes information about:

- MODU name
- MODU contract status (Operator and contract duration)
- current location
- maximum water depth capability
- MODU type (floating vs jack-up; mooring type; MODU Design/Class)
- available drilling envelope
- blowout preventer specifications
- blowout preventer (BOP) /lower marine riser package (LMRP) connector specifications
- mud pumps specifications/capability
- choke and kill line internal diameters
- storage capability (i.e. MDO, base-oil, brine, drill-water, potable water, bulks)
- NOPSEMA safety case (yes/no).

The SCP will also include relief well planning that involves a review of the most recent MODU capability register to identify the most suitable MODU for the well campaign. In the event a suitable MODU is not in Australian waters, or is not predicted to be in Australian waters at the time of the activity, further work will be completed to identify a regionally suitable MODU, along with a mobilisation plan that demonstrates construction of a relief well within the time frame outlined in **Table 9-4** is achievable. Typically, these SCPs are signed 6-8 months prior to spud. Once a MODU is allocated as a potential relief well MODU for a project, the MODU capability register will be annotated as such. As such, any change to the register on a month-to-month basis that affects a preferred MODU will trigger a revision to the SCP. The review will be completed within 4 weeks of identifying the change.

Santos commits to reviewing the Source Control Plan assumptions for relief well MODU availability and verifying that a suitable relief well MODU is either in Australian Waters, or there is a suitably robust plan in place to mobilise one outside of Australia. The activity will not proceed if there is not a least one relief well MODU option that could execute a relief well within the timeframes committed to in **Table 9-4.** In addition, during the activity, if the preferred relief well MODU/s becomes unavailable, work will commence on an update on the SCP to identify a suitable replacement relief well MODU regionally along with any required pre-work (contracting/logistics plans etc.).

In order to facilitate and expedite the use of a regional MODU for relief well drilling an APPEA Memorandum of Understanding: Mutual Assistance is in place. This agreement provides the mechanism to facilitate the transfer of drilling units and well-site services between operators in Australian and Timor-Leste administered waters in order to respond urgently to emergency source control events.

A Safety Case Revision will be required for the relief well MODU to undertake the activity; this cannot be submitted before the event. The Safety Case Revision will be based on existing documents, including the in-force Safety Case for the relief well MODU, if one is available. A Safety Case Revision would be submitted within 14 days from the well incident, however the critical path time allowed for the actual writing of the document is three days. The remaining estimated time would be used for gathering post-event data, mobilising the workforce and conducting a hazard identification. It is not practicable to reduce the critical path days with additional pre-planning as document revision, final review and approval will still be required after completing the hazard identification.

9.2.3.2 Relief well schedule

An indicative relief well drilling schedule is provided in **Table 9-4**. This is based on control of the well by 13 weeks (90 days). This period is based on indicative mobilisation durations, relief well planning and operations. Timelines for the relief well rig being made available at the Barossa location have been estimated in line with the 'Australian Offshore Titleholders Source Control Guideline Rev 0' (APPEA, 2021), Section 13.9. It could take up to 36 days to have a relief well MODU onsite ready to spud.

Long lead item equipment to enable a relief well to be drilled within this timeframe is held in the Santos inventory or has been confirmed to be available at short notice from vendors or other operators in the region.

This timeline has been assessed as ALARP based on the current controls/measures in place; however, Santos is actively working with industry to evaluate measures to improve on the ALARP response time model through the APPEA Drilling Industry Steering Committee Source Control Response Industry (SCRI) Working Group. The SCRI working group is an APPEA Drilling Industry Steering Committee initiative which has been established to drive collaboration and continuous improvement in source control emergency response planning. The Working Group will explore and act on opportunities to align and strengthen the Titleholders' source control emergency response capability through 'mutual aid' initiatives and drive continuous improvement by implementing fit-for-purpose and effective source control emergency response strategies.

Table 9-4: Schedule for mobile offshore drilling unit arriving on site (from time of notification)

LOWC relief well			
Task	**Duration (days)**	**Cumulative Duration (days)**	**Controls**
Event reported and notifications. Begin sourcing of MODU for relief well drilling operations. Concurrently, stand up relief well drilling team and activate relief well specialists.	2	2	+ On-site communications + Active IMT, including Operations Section Chief, Source Control Branch Director and Relief Well Team Lead

LOWC relief well			
Task	**Duration (days)**	**Cumulative Duration (days)**	**Controls**
			+ Stood-up Relief Well Team (as per Source Control Planning and Response Guideline [DR 00 OZ 20001]) + Relief Well Drilling specialist services contract (Wild Well Control) + Regional MODU tracking + APPEA MoU: Mutual Assistance
Relief well MODU confirmed. Contract relief well MODU. Relief well MODU suspends operations, pulls anchors and demobilises non-essential equipment. Concurrently, prepare relief well design and dynamic kill plan.	7	9	+ Active IMT + Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) + Pre-completed campaign specific Source Control Plan complete with relief well study + Relief Well Drilling specialist services contract (Wild Well Control) + Regional MODU tracking + APPEA MoU: Mutual Assistance + Access relief well long lead equipment from inventory or other operators (e.g. casing and wellhead) + Drilling services contracted.
Transit to site (estimated distance of 1,130 nm at approximately 2.5 knots tow speed, using North West Shelf (NWS) for planning purposes). Concurrently, prepare relief well MODU Safety Case Revision and submit to NOPSEMA. Prepare relief well WOMP and submit to NOPSEMA.	19	28	+ Active IMT + Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) + Relief Well Drilling specialist services contract (Wild Well Control)
Arrive on site, run anchors and prepare to spud (additional time added over APPEA estimate due to distance from shore-base, spud loadout size and mud mixing requirements).	8	36	-
Total days before arrival, ready to spud/commence relief well operations	-	**36**	-
Drill and construct relief well and execute dynamic well kill operations	54	90	+ Active IMT + Santos Offshore Source Control Planning and

LOWC relief well			
Task	Duration (days)	Cumulative Duration (days)	Controls
			Response Guideline (DR-00-OZ-20001) + Relief Well Drilling specialist services contract (Wild Well Control)
Total days from notification of LOWC to well kill	**-**	**90**	-

Timelines for rig mobilisation are aligned with the Australian Offshore Titleholders Source Control Guideline (APPEA, 2021), taking into account the additional duration of moving the rig from the southern area of the North West Shelf to the Barossa field, which is located on the northern extent of the Australian EEZ. Timeframes have been calculated along a notional tow path of 1,130 nm at 2.5 knots (19 days). Additional time (8 days) has been allocated once on site compared to the APPEA time model to account for the quantity of materials (bulks, fluids and casing) that are required on board for the relief well design.

The duration for the relief well construction (54 days) is based on a directional relief well with the same large diameter casing as the Barossa development wells. The time also includes an allowance for a contingent liner in the relief well design (which is not known if it will need to be deployed), as well as an allowance for ranging onto the target. This duration is longer than some relief well durations presented for simpler wells on the North West Shelf, but reflects the time required to drill the larger diameter hole sections to a comparatively deeper depth associated with the relief well design.

9.2.4 Capping stack

A Capping Stack provides a temporary means of sealing the well until a permanent well kill can be performed through either a relief well or well re-entry. It is considered a secondary source control measure (refer to **Table 6-4**).

Capping Stack compatibility varies from well to well and can also depend on the extent of the blowout and water depth. Compatibility will also vary according to technical and safety constraints, and damage to an individual well, which would only be known at the time of the spill and assessed via the SFRT and accompanying ROVs.

The installation of a Capping Stack may be applicable for a subsea loss of well control during Barossa Development Drilling and Completions activities using a Semi-submersible MODU where the BOP is present on the seabed. The use of a Subsea First Response Toolkit (SFRT) (**Section 9.2.2**) may be applicable in assisting the installation of a Capping Stack.

A Capping Stack would only be used where there is suitable vertical access over the wellhead and a suitable restricted flow rate was determined. Santos has contracts in place with WWCI and would deploy their Singapore-based Capping Stack as the primary option (another Capping Stack is available from Aberdeen). The Singapore-based Capping Stack would be assembled quayside, tested and then transported via barge to a suitable deployment vessel where it would then be transferred, fastened and then commence its transit to the well site.

The deployment vessel will need to meet the following criteria:

+ require an active heave compensator, capability of lifting minimum of 150 Tonne
+ 500–1,000 m^2 of deck space
+ located within a 4-day sail radius of Singapore.

Additional vessel specifications are outlined in the Santos Offshore Source Control Planning and Response Guideline (DR-00-0Z-20001). In addition, the Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) provides further details on the vessel specification for capping stack deployment, and the process for monitoring vessel availability.

Santos would be responsible for managing the customs and importation issues related to equipment arrival into Australian Waters, obtaining support from WWCI. To ensure access to suitable vessels to deploy the Capping Stack to the incident location, prior to and during the activity, Santos will monitor the availability of Capping Stack capable vessels on a monthly basis through shipbroker reports. This also includes the tracking of current vessel Safety Case status.

However, as an adaptive management measure, as part of the DCMP Assurance Review (described in **Section 9.2.3.1**) Santos commits to verifying that a suitable deployment vessel is available and can meet the criteria defined above. In addition, this check will occur monthly. In the event a suitable vessel is not available, work will commence to identify a suitable vessel further afield, along with identifying any pre-work (contracting/logistics plans etc.) that might be needed to mobilise a vessel from further afield.

In addition, Santos has current contracts with vessels that have similar specifications for various scopes of work with approved Australian Safety Cases. These Safety Cases could be used as a basis of a Safety Case revision if one was required, which could create significant time efficiencies. Santos also has in place a contract with a specialist contractor highly experienced in the Safety Case revision process, to leverage their experience, further reducing the timeframes required to develop a Safety Case revision that meets NOPSEMA's requirements.

The location of these vessels can be tracked through Santos' offshore vessel tracking system accessed via the Santos Emergency Response Intranet page.

9.2.4.1 Capping stack schedule

An indicative Capping Stack schedule is provided in **Table 9-5**. This period is based on indicative mobilisation durations and is subject to weather conditions and availability of specialist personnel.

Table 9-5: Capping stack mobilisation schedule

LOWC Capping Stack timeline		
Task	**Duration (days)**	**Controls**
Event reported – source suitable deployment vessel (with approved safety case) (Santos) Concurrently deploy Capping Stack components from warehouse to quayside (including assembly and testing) (WWCI)	4	+ On-site communications + Active IMT on call including Operations/Drilling Team Lead + WellCONTAINED Logistics Plan + Monthly monitoring of suitable vessels
Capping Stack lifted on to barge, fastened and then tug operations transit to anchored deployment vessel (WWCI)	2	+ Active IMT + Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) + Capping Stack specialist services (Wild Well Control) + WellCONTAINED Logistics Plan + Capping Stack Logistics Methodology
Handover of Capping Stack from WWCI to Santos (WWCI to continue to support via specialist personnel)		
Capping Stack mobilised to incident location by deployment vessel	9	+ Stood-up Source Control Team (as per Santos Offshore Source Control Planning and Response Guideline [DR-00-0Z-20001])

LOWC Capping Stack timeline		
Task	**Duration (days)**	**Controls**
(Santos with support from vessel broker)		+ Capping Stack specialist services contract (Wild Well Control) + WellCONTAINED Logistics Plan
Total days before arrival, ready to commence Capping Stack operations	15	-
Days to installation of Capping Stack (worst case allowing for potential removal of debris and issues due to damaged wellhead, BOP and/or LMRP)	2 to 28 (estimated)	-

9.2.5 Subsea dispersant injection

SSDI has been observed to break-up oil droplets forcing greater entrainment of the oil into the water column below the sea surface (Adams *et al*., 2013). SSDI has additional benefits over surface dispersant application including its ability to reduce volatile organic compounds (VOCs) reaching the surface in the vicinity of a spill, making the area safer for responders (IPIECA, 2015; French-McCay *et al*., 2021) and enabling them to bring the release under control quicker (e.g. via Capping Stack) and reducing the overall volume of hydrocarbons being released into the environment.

SSDI typically requires smaller volumes of dispersant to be used, as it has a higher encounter rate with the hydrocarbons than surface application. SSDI can also be used day and night, whereas surface application via vessel or aircraft can only occur during daylight hours.

The effectiveness of SSDI is influenced by dispersant efficacy on the hydrocarbon, how close to the release the dispersants may be added and the dispersant to oil ratio (DOR). It is assumed the DOR would commence at 1:100 and would be modified based on the results of the effectiveness monitoring, conducted as part of operational water quality monitoring. Research conducted by Brandvik *et al.* (2014) indicated that DORs of 1:50 to 1:100 may be sufficient to cause substantial additional dispersion, particularly if the dispersant is injected close to or into the release point.

Water depth is a further limitation to the effectiveness of SSDI for VOC control; If SSDI use is proposed primarily for safety reasons, shallower depths may not be sufficient to enable VOCs to be reduced to a point which ensures a safe operating environment on the surface (OSRL, 2019). Some research suggests this may be around 500 metres (Adams & Socolofsky, 2005, in: IPIECA, 2015); however, there is currently no definitive recommended minimum water depth for SSDI use. Water depths in the vicinity of the Barossa development operational area range from 220-280 metres.

Therefore, SSDI may be employed as a secondary response strategy for a Barossa LOWC for the purpose of VOC reduction, subject to the outcome of operational NEBA. The effectiveness of VOC reduction would be closely monitored through air quality monitoring as part of the overall dispersant effectiveness monitoring programme (refer to **Section 9.2.5.3**). If VOC reduction is minimal or ineffective, it is likely that SSDI operations would cease.

9.2.5.1 Dispersant selection process

Dispersants should only be used when the risks associated with their use to the environment as a whole have been analysed, and it has been determined that there would be a net environmental benefit from their use. The type of dispersant that will be effective is influenced by the oil type and metocean conditions (Hook and Lee, 2015).

Most of the knowledge on the biological impacts of dispersants has been developed via laboratory experiments (Quigg *et al*., 2021) rather than from in-situ use. This is also the case for those dispersants listed as approved in the National Plan for Maritime Environmental Emergencies

Register of Oil Spill Control Agents (OSCA). Before a dispersant can be considered for use by AMSA, its toxicological impact must be tested on a diverse range of aquatic taxa, including algae, invertebrates and fish (Hook and Lee, 2015). However, this screening process ensures that these compounds have comparatively low toxicity (according to US Environmental Protection Agency criteria; Hemmer *et al*., 2011) and that they are much less toxic than oil (Hook and Lee, 2015).

Of the dispersants listed on the OSCA Register, only Corexit 9500A and 9527 (the latter is only on the transitional acceptance list) have been used in response to a large-scale spill and during subsea application, which was during the Macondo oil spill (Gulf of Mexico) in 2010. Six types of dispersant were used on the Montara oil spill in the Timor Sea in 2009, including Slickgone NS, Corexit 9500, Corexit 9527, Slickgone LTSW, Ardrox 6120 and Tergo R40 (AMSA, 2010). However, the total volumes sprayed equated to 150 m^3 (AMSA, 2010), as opposed to the 7,000 m^3 (4,100 m^3 surface application and 2,900 m^3 subsea application of just Corexit 9500A and 9527) (Quigg *et al*., 2021) used during the Macondo spill.

A detailed oil fate and mass balance assessment completed by French-McCay, *et al*. (2021) on the Macondo spill indicated on average, there was 9% less floating oil during the duration of the release due to subsea dispersant application. This assessment also showed subsea application was increasingly effective over the course of the spill in reducing VOC exposures in the immediate area of the wellhead by up to 27% (French-McCay *et al*., 2021), making source control operations safer for responders.

Despite the considerable amount of research, modelling and experimental work done to study the effects of subsea dispersant application, there is conflicting evidence as to the efficacy of the use of subsea dispersants (Quigg *et al*., 2021). However, NASEM (2020) found no compelling evidence that chemically dispersed oil at low to moderate oil concentrations was any more toxic than oil alone. At high concentrations the combination of oil and dispersant appeared more toxic (Quigg *et al*., 2021), suggesting caution should be applied when considering dispersant application rates and volumes. This also shows the importance of ongoing dispersant effectiveness monitoring (**Section 9.2.5.3**) and its use through the operational NEBA process.

9.2.5.2 Dispersant selection

Chemical dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA) are to be prioritised for use. OSCA listed dispersants are readily available to Santos through AMOSC, OSRL and AMSA. These include Slickgone NS, Slickgone EW, Corexit EC9500A, Corexit 9527 (transitional acceptance) and Finasol 52.

If dispersant types additional to those on the Register of OSCA are required, Santos will use its Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) before application. Finasol OSR 52 has been pre- assessed as low risk using the Santos Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) and is therefore designated as acceptable for use.

The Santos Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure requires the dispersant to be risk assessed and deemed environmentally acceptable. The criteria used for environmental acceptability includes aquatic toxicity, biodegradation and bioaccumulation potential data.

Where sufficient data is available, the chemical is risk assessed using the Offshore Chemical Notification Scheme (OCNS) Chemical Hazard and Risk Management (CHARM) or non-CHARM models depending on the model's applicability criteria. Chemicals that meet the selection criteria belonging to CHARM Colour-band Gold or Silver, or non-CHARM groups D or E are considered environmentally acceptable. According to the OCNS CHARM model, Gold ranked chemicals have a maximum Hazard Quotient (HQ) of <1 and Silver, HQ ≥1 and <30. According to the OCNS non-CHARM model guidelines, the worst case initial OCNS grouping would be group B based on aquatic toxicity data of LC50 or EC50 > 1 to 10 ppm. To obtain a final OCNS grouping of D, the chemical would need to be readily biodegradable (>60% biodegradation in 28 days) and non bioaccumulative (Log Pow <3 or BCF ≤100 and molecular weight ≥700). The best case initial OCNS grouping would be group E based on aquatic toxicity data of LC50/EC50 > 1,000 ppm. The best case final OCNS grouping would remain E with the chemical readily biodegradable and non-bioaccumulative.

If the chemical cannot be rated using the method described above, it would be assigned a pseudo OCNS CHARM or non-CHARM group ranking. Where there is insufficient ecotoxicity data available to either rate the chemical or assign a pseudo ranking, robust justification demonstrating its environmental acceptability shall be provided, based on volume/concentration, receiving marine environment characteristics and ecotoxicity data (aquatic toxicity, biodegradability and/or bioaccumulation data where applicable; i.e. biodegradation and bioaccumulation potential are not applicable to inorganic substances).

During a response, chemical dispersant shall be tested on the released oil at a laboratory as part of the initial oil characterisation (refer **Section 10.6**) as well as through field testing using vessel-based spray systems/ dispersant shake test kits. The DBCA ESC can also advise on the location of AMSA National Plan Dispersant Effectiveness Test Kits, which could be utilised in addition to Santos' dispersant efficacy testing resources.

9.2.5.3 Dispersant effectiveness monitoring

To assess the effectiveness of dispersant application, Santos will use the Industry Recommended Subsea Dispersant Monitoring Plan (API, 2020) to determine the efficacy of subsea dispersant application. These techniques assist in characterising the nature and extent of subsea, aid in the validation and accuracy of plume trajectory models and allow for rapid quantification of data to enable the IMT to make decisions about continuation of dispersant application. The IMT assesses the effectiveness of continued dispersant use against an operational NEBA assessment. This capability is provided by Santos' Dispersant Operational Monitoring Provider (refer to **Appendix K**).

Subsea dispersant injection monitoring includes the following phases:

+ **Phase 1:** Confirmation of dispersant effectiveness near the discharge point and reduction in surface VOCs. This is conducted visually via ROVs and aerial imaging; and via VOC monitoring.
+ **Phase 2:** Characterisation of oil droplet size near plume and dispersed oil concentrations at depth in the water column. This is conducted using a particle size analyser close to the release site and water column monitoring (as per operational water quality monitoring [**Section 10.7**]).
+ **Phase 3:** Detailed chemical characterisation of water samples. This involves characterisation of collected water samples using accredited contract laboratories. The transfer and shipping would be handled using the logistical pathways utilised for operational water quality monitoring (**Section 10.7**).

For a Barossa subsea LOWC, SSDI application is considered a secondary strategy (**Section 6.4**) and is included to reduce VOC exposure to response personnel working close to the well site. It is anticipated that operations in close proximity to the well site would only occur for deployment of the Capping Stack. Capping Stack deployment is only relevant to the situation where a semi-submersible MODU is used. If Capping Stack deployment is selected as a response strategy, SSDI would only be deployed for the length of time taken to deploy the Capping Stack to reduce VOC levels during these operations. SSDI would also only be considered where VOC levels in the vicinity of the wellsite are shown through monitoring to be unacceptable.

Prior to any application of subsea dispersants, an initial ROV survey would be conducted at the release point to determine the nature of the release. This information will inform the potential for Capping Stack deployment, the applicability of subsea chemical dispersion and initial choice of dispersant injection methods (e.g. number of nozzles, nozzle sizes) and DOR. In addition, as per Industry Recommended Subsea Dispersant Monitoring Plan (API, 2020), subsea dispersant effectiveness monitoring should commence prior to the application of any dispersant, to ensure baseline data is captured.

9.2.5.4 Subsea dispersant injection logistics

If a subsea LOWC was to occur, the site would require a detailed assessment to determine the most suitable intervention methods for the incident. This may be achieved through the use of ROVs (supplied by Santos) and the Subsea First Response Toolkit (refer to **Section 9.2.2**), which is stationed in Fremantle and Jandakot and managed by AMOSC. The SFRT includes debris clearance equipment and subsea dispersant equipment, including a dedicated dispersant stockpile (500 m³ of Dasic Slickgone NS) and ancillary equipment (e.g. pumps, flying leads, dispersant wands). Santos can access a suitable vessel for transportation of the subsea dispersant injection system, dispersants and ancillary equipment including ROVs through its contracted vessel providers. As indicated in **Section 9.2.2**, the SFRT vessel and equipment would be infield and commencing operations by day 12.

The volumes of dispersant required will depend on the DOR used at the injection point. It has been assumed that the well release would require a DOR of 1:100. To achieve a DOR of 1:100 that IPIECA-IOGP (2015a) recommend for a flow rate of 20,000 bbl./day, a dispersant pump rate of 22 L/min is required. Scaling this dispersant application rate to align with the maximum credible flow rate for the Barossa subsea LOWC scenario (1,433 m^3/day or 9,015 bbl/day) results in a dispersant pump rate of 9.9 L/min (14.2 m^3/day).

A dispersant budget has been prepared considering the daily / weekly application requirements, daily volume of dispersant arriving in Darwin and balance on hand after each day. The total amount of dispersant required for subsea application is 1,122 m^3, noting application does not commence until day 12.

9.2.5.5 Dispersant supply

Supply stocks sufficient to cover dispersant requirements for the duration of the LOWC are presented in **Table 9-6**.

Santos has a detailed dispersant supply and logistics plan that ensures dispersant requirements can be met for the duration of the worst case LOWC scenario. Dispersant stockpiles are made available via AMOSC membership or AMSA agreement with most supplies within Australia being available within 48 to 55 hours. Santos can supply all required road logistics to meet these timeframes through its contracted logistics provider. Santos can also provide air logistics for all other stockpiles throughout Australia and internationally.

Dispersant availability is checked bi-annually against Santos' worst-case requirements across all operational, project and drilling activities.

Table 9-6: Dispersant supply stock locations and volumes

Source	Stock Location	Volume (m^3)	Type	Total Volume (m^3)
AMSA	Adelaide	10	Slick Gone EW	355
		10	Slick Gone NS	
	Brisbane	10	Slick Gone EW	
		10	Slick Gone NS	
	Townsville	10	Slick Gone EW	
		15	Slick Gone NS	
	Karratha	10	Slick Gone EW	
		10	Slick Gone NS	
	Darwin	10	Slick Gone EW	
		10	Slick Gone NS	

Source	Stock Location	Volume (m^3)	Type	Total Volume (m^3)
	Devonport	10	Slick Gone EW	
		10	Slick Gone NS	
	Fremantle	48	Slick Gone NS	
		52	Slick Gone EW	
	Horne Island	10	Slick Gone NS	
	Melbourne	10	Slick Gone EW	
		10	Slick Gone NS	
	Sydney	45	Slick Gone NS	
		55	Slick Gone EW	
AMOSC	Exmouth	75	Slick Gone NS	761
	Fremantle	8	Slick Gone NS	
		27	Corexit 9500	
		500 (SFRT stockpile)	Slick Gone NS	
	Geelong	75	Slick Gone NS	
		62	Corexit 9500	
	Broome	14	ARDROX 6120	
OSRL (Santos has access up to 50% of SLA stockpile)	Various (Singapore, UK, Bahrain, USA)	50% of SLA = 380†	Slick Gone NS Slick Gone EW Slickgone LTSW Finasol OSR 52 Corexit 9500	380
Total				**1,496**
OSRL Global Dispersant Stockpile (GDS)	Various (Singapore, France, South Africa, USA, Brazil)	5,000†	Slick Gone NS Finasol OSR 52 Corexit 9500	5,000
Total (including additional OSRL GDS stocks)				**6,496**

† Latest numbers as of April 2023. The SLA Equipment Stockpile Status Report and the Global Dispersant Stockpile Status Report (available from the Response Readiness Dashboard) provides the current status of the SLA dispersant stocks.

9.3 Source control implementation guidance

Relief well drilling is the primary source control strategy to control a LOWC during drilling and completions activities.

The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for source control methods.

A high-level summary of source control implementation actions is provided in **Table 9-7**.

Table 9-7: Implementation guidance – loss of well control

	Action	Responsibility	Complete
Initial actions	**Relief well**		
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Relief Well Team Leader	☐
	Notify Santos Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations.	Relief Well Team Leader	☐
	Notify well control service provider personnel for mobilisation.	Relief Well Team Leader and Source Control Branch Director	☐
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MoU.	Source Control Branch Director	☐
	Refine, as necessary, the relief well pre-planning work described in **Section 9.2.3.1**, and have prepared in time to procure equipment and personnel before MODU arrival on location.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	☐
	Deploy equipment and personnel to site to begin spud and drill.	Relief Well Team Leader	☐
	SFRT		
	Activate Subsea First Response Toolkit (SFRT) equipment. Activate Oceaneering personnel for deployment	Designated call-out authority (Incident Commander) Source Control Branch Director	☐
	Contract suitable vessel capable of deploying SFRT equipment	Logistics Section Chief Source Control Branch Director	☐
	Arrange road transport of SFRT equipment from Jandakot to Darwin.	Logistics Section Chief Source Control Branch Director	☐
	Conduct initial ROV survey at the release point to determine the nature of the release, behaviour of the oil, and estimate the oil and gas flow rates.	Operations Section Chief Source Control Branch Director	☐

	Action	Responsibility	Complete
Initial actions	**Capping stack**		
	Consider technical and safety constraints and assess the suitability of a Capping Stack for the incident.	Source Control Branch Director	☐
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Source Control Branch Director	☐
	Notify Santos Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations.	Source Control Branch Director	☐
	Notify Capping Stack service provider of incident for activation of personnel and equipment as per the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Source Control Branch Director	☐
	Contract suitable vessel capable of deploying Capping Stack via freight contractor.	Logistics Section Chief Source Control Branch Director	☐
	SSDI		
	Confirm operational NEBA supports subsea chemical dispersant injection.	Operations Section Chief Incident Commander Environment Unit Leader Planning Section Chief	☐
	If viable and if the Operational NEBA supports SSDI, activate Subsea First Response Toolkit (SFRT) equipment and activate Oceaneering personnel for deployment.	Designated call-out authority (Incident Commander) Source Control Branch Director	☐
	Conduct initial ROV survey at the release point to determine the nature of the release, behaviour of the oil, estimate the oil and gas flow rates and determine DOR for injection.	Operations Section Chief Source Control Team Leader	☐
	Commence dispersant subsea injection adjusting DOR based on real-time monitoring.	Operations Section Chief Source Control Team Leader	☐
	Continue operational monitoring (including operational water quality monitoring and surveillance) near the release point to help determine dispersant effectiveness.	Source Control Branch Director Operations Section Chief	☐

	Action	Responsibility	Complete
	If dispersant application is shown to be effective and approved by the Incident Commander, continue operations.	Source Control Branch Director Operations Section Chief Incident Commander	☐
Ongoing actions	**Relief well**		
	Design relief well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel before MODU arrival on location.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	☐
	Deploy equipment and personnel to site to begin spud and drill.	Relief Well Team Leader	☐
	Monitor progress of relief well drilling and communicate to IMT.	Relief Well Team Leader	☐
	SFRT		
	Arrange equipment to be loaded on to vessel once in Darwin and authorise transit to field.	Logistics Section Chief Operations Section Chief Source Control Branch Director	☐
	Deploy equipment and personnel to site to begin SFRT operations.	Source Control Branch Director	☐
	Capping Stack		
	Take into consideration any feedback from ROV surveys in response planning.	Source Control Branch Director	☐
	Deploy equipment and personnel to site to begin capping process.	Source Control Branch Director	☐
	SSDI		
	Reassess dispersant use, utilising the NEBA process for each operational period.	Planning Section Chief Environment Unit Leader	☐

Table 9-8: Subsea dispersant injection – first strike response timeline

Task	Time from IMT call-out
IMT Source Control Team activated	<24 hours
Suitable SFRT-dispersant injection vessel/s mobilised to Darwin	<9 days
Oceaneering to mobilise personnel to Darwin	<3 days
AMOSC to mobilise SFRT and dedicated dispersant to Darwin	<7 days
Load equipment, steam to site and commence SSDI	<11-12 days
Minimum resource requirements	
+ Suitable vessel and crew + SFRT + Dispersant (with SFRT) + Oceaneering personnel	

9.4 Environmental performance

Table 9-9 indicates the environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-9: Environmental performance – source control

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**
Response Preparedness			
Source control – relief well drilling	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)	The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) is in place and up-to-date during the activity	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)
	Relief Well MODU Availability Register	A Relief Well MODU Availability Register is maintained during the activity through monthly monitoring	Relief Well MODU Availability Register
	Well-specific Source Control Plan[15] developed prior to drilling	Source control plan will identify suitable rig availability for relief well drilling.	Well specific Source Control Plan
	Contract and Equipment Access Agreement with WWCI	Contract and Equipment Access Agreement with WWCI are maintained providing technical support and equipment	Contract with WWCI
	Relief well drilling supplies readily available in Western Australia	Long lead equipment for relief well drilling will be readily available to Santos	Well specific source control plan

[15] A single SCP will be developed covering all wells in the Barossa development campaign, due to the similarity in well design between all development wells (refer to **Section 9.2.3.1**).

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**
	Arrangements for source control emergency response personnel	Arrangements for access to source control personnel are maintained during the activity	Contract/ Memorandums of Understanding for source control personnel
	Suitable relief well MODU confirmed to be technically suitable prior to activity	Activity will not proceed if there is not a least one relief well MODU option that could execute a relief well within the timeframes committed to in **Table 9-4**	Relief Well MODU Availability Register Well specific Source Control Plan
	Regular monitoring of Relief Well MODU Availability Register to ensure preferred MODU remains available throughout the activity	If the preferred MODU becomes unavailable during the activity, Santos will update the SCP to identify a suitable alternative MODU	Relief Well MODU Availability Register Source Control Plan
Source control – BOP Activation	BOP Unit	BOP rams pressure/function tested as per latest edition of API Standard 53 on deployment, and then at regular intervals throughout the drilling and completions activity	BOP rams function test records
		BOP battery and accumulators function tested prior to deployment.	BOP battery and accumulators function test records
	EDS	EDS function tested prior to deployment.	EDS function test records
	ROV hot stab capability	Access to ROV capability for BOP hot-stab intervention maintained with MODU ROV contractor throughout the drilling and completions activity	ROV contractual arrangements
Source control – SFRT	Arrangements to enable access to SFRT equipment and personnel	Maintenance of access to SFRT equipment and personnel	AMOSC SFRT participating member
			OTA Agreement with Oceaneering
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
Source control – Capping Stack	Arrangements to enable access to Capping Stack and trained personnel	Maintenance of access to Capping Stack and personnel	Contract with Capping Stack service provider

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**
	Arrangements in place to monitor availability of vessels capable of transporting Capping Stack	Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Suitable Capping Stack deployment vessel is confirmed to be available prior to activity	Verify suitable Capping Stack deployment vessel is available as part of DCMP Assurance Review	Shipbroker reports Well-specific Source Control Plan DCMP Assurance Review
	Monthly monitoring of shipbroker reports to ensure suitable Capping Stack deployment vessel is available throughout the activity	If a suitable Capping Stack deployment vessel becomes unavailable, Santos will commence work to identify a suitable alternative vessel	Shipbroker reports
	Arrangements to enable timely mobilisation of Capping Stack	Capping Stack mobilised to site and ready to commence deployment by day 15	Capping Stack mobilisation schedule (**Table 9-5**)
	Maintenance of MSAs with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
Source control – SSDI	Arrangements to enable access to dispersants, equipment and personnel	Maintenance of access to dispersant, equipment and personnel through AMOSC, AMSA and OSRL throughout activity	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			AMOSC SFRT Participant
			OTA Agreement with Oceaneering
			OSRL Associate Member Contract and Global Dispersant Supply Supplementary Agreement
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Arrangements to enable fast access to subsea	SFRT and dedicated dispersant stockpile mobilised to site within 12 days	AMOSC SFRT Participant

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**
	application platform and dispersant supply		OTA Agreement with Oceaneering Source Control Planning and Response Guideline
Source control – vessel collision	Vessel Spill Response Plan (SOPEP/SMPEP)	Vessels associated with the activity have a 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	Spill exercise close out reports
Response Implementation			
Source control – BOP Activation	BOP installed in accordance with API Standard 53	BOP is activated manually in accordance with MODU Operator's Emergency Response Plan	Incident log
Source control – relief well drilling	Source Control Branch	Source Control Branch mobilised within 24 hours of being notified of well leak incident	Incident log
	Equipment/Services for Relief Well drilling	Equipment/Services for Relief Well drilling sourced within five days of being notified of well leak incident	Incident log
	Well Control Specialists	Well control specialists mobilised within 72 hours of being notified of well leak incident	Incident log
	Relief Well MODU	MODU for relief well drilling to be on site by Day 36 of being notified of well leak incident	Incident log
	Relief Well	Relief well completed within 90 days of being notified of well leak incident	Incident log
	Source Control Planning and Response Guideline (DR-00-OZ-20001)	Relief well drilling implemented in accordance with the Source Control Planning and Response Guideline (DR-00-OZ-20001) during a well release	Incident log
Source control – SFRT	Access to suitable SFRT vessel	Vessel mobilised to Darwin within 9 days of IMT call-out	Incident Log
	Access to personnel for the deployment of the SFRT	Oceaneering to mobilise personnel to Darwin within 9 days of IMT call-out	Incident Log

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 – Capping Stack	Access to Capping Stack and suitable vessel	Capping Stack to be onsite and ready to commence deployment by day 15 from the start of the release	Incident Log
	Access to trained personnel for the deployment and operation of the Capping Stack and well intervention equipment	Capping Stack trained personnel mobilised to site within 15 days	Incident Log
Source control – SSDI	Mobilisation of SFRT and dedicated dispersant resource requirements for subsea dispersant application	SFRT and dedicated dispersant stockpile mobilised to site within 12 days	Incident Log
	Chemical Dispersant Application Plan	Only chemical dispersants that are listed as approved on the National Plan Oil Spill Control Agent (OSCA) list or evaluated as acceptable as per the Santos Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) are to be used	Incident Log
		Analysis of dispersant amenability provided to IMT within 24 hours of oil delivery to Laboratory	Incident Log
		If dispersant application is approved by the Incident Commander for subsea injection, ROV monitoring of the site will commence to help determine injection method/s	Incident Log IAP

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**
		Prepare operational NEBA to determine if chemical dispersant application is likely to result in a net environmental benefit. NEBA will consider: + forecast spill modelling of oil comparing simulations with and without effect of chemical dispersants + laboratory dispersant efficacy testing results + operational monitoring results (surveillance and shoreline assessment) showing distribution of floating, stranded oil and location of sensitive fauna and habitats + operational water quality monitoring results showing distribution and concentration of subsea oil (once available) + scientific monitoring water sampling results (SMP1) (once available) + consultation with NT Control Agency and/or WA DoT	Incident Log IAP
		NEBA undertaken each operational period by the relevant Control Agency to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	Incident Log IAP
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

10. Monitor and evaluate

Understanding the behaviour and likely trajectory of an oil spill is critical to evaluate the appropriate response strategy. There are a number of methods that can be used to monitor and evaluate, including:

+ vessel surveillance
+ aerial surveillance
+ tracking buoys
+ oil spill trajectory modelling
+ satellite imagery
+ initial oil characterisation
+ operational water quality monitoring.

10.1 Vessel surveillance

Table 10-1 lists the environmental performance outcome, initiation and termination criteria for this strategy.

Table 10-1: Vessel surveillance – environmental performance outcome, initiation and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Notification of a Level 2/3 spill – may be deployed in a Level 1 incident (to be determined by OSC)	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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 + Agreement is reached with Jurisdictional Authorities to terminate the response	

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. 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 pose safety risks.

10.1.1 Implementation guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities to be considered when selecting this strategy. **Table 10-3** has a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to start initial vessel surveillance operations are listed in **Table 10-4**. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-2: Implementation guidance – vessel surveillance

	Action	Consideration	Responsibility	Complete
Initial actions	Notify nearest available Support Vessel to commence surveillance.	Current Santos on hire vessels or Vessels of Opportunity (VOO) can be used. Automatic Identification System (AIS) vessel tracking is available through Emergency Response (ER) intranet page.	On-Scene Commander Operations Section Chief	☐
	Source additional contracted vessels if required for assistance.	Refer to Santos Vessels for Oil Spill Response (7110-650-ERP-0001) for the process for vessel monitoring and guidance on vessel types.	Logistics Section Chief	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms (**Appendix E**) and provide to On-Scene Commander (Level 1 spills) or IMT (Level 2/3 spills).	Photographic images are to be taken where possible and included with surveillance forms. Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	Vessel Observers	☐
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick) to the IMT within 60 minutes of completing vessel surveillance.	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms.	Vessel Master and/or On-Scene Commander	☐
Ongoing actions	Review surveillance information to validate spill fate and trajectory.	-	Planning Section Chief / GIS	☐
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate.	-	Environment Unit Leader	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Surveillance data is useful in updating the Common Operating Picture	Planning Section Chief	☐

Table 10-3: Vessel surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Contracted vessels and vessels of opportunity	Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Availability dependent upon Santos and Vessel Contractor activities.	Vessels mobilised from Darwin, Varanus Island, Exmouth or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.

Table 10-4: Vessel surveillance – first-strike response timeline

<table>
<tr><th colspan="2">Task</th><th>Time from IMT call-out</th></tr>
<tr><td colspan="2">IMT begins sourcing Santos-contracted vessel or VOO for on-water surveillance</td><td><90 minutes</td></tr>
<tr><td colspan="2">VOO on site for surveillance</td><td><48 hours (daylight dependent)</td></tr>
<tr><td colspan="3">Minimum resource requirements</td></tr>
<tr><td colspan="3">One vessel. No specific vessel or crew requirements.</td></tr>
<tr><td colspan="3">Approximate steam time</td></tr>
<tr><td>Deployment location</td><td>Approximate distance to operational area[16] (nautical miles)</td><td>Approximate steam time[17] (hours)</td></tr>
<tr><td>Darwin</td><td>200</td><td>20</td></tr>
<tr><td>Broome</td><td>750</td><td>75</td></tr>
</table>

[16] As measured to geometric centre point of operational area

[17] At average rate of 10 knots

10.2 Aerial surveillance

Table 10-5 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-5: Aerial surveillance – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision -making	
Initiation criteria	Notification of a Level 2/3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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	

Aerial surveillance is used to record the presence and size of the hydrocarbon spill at surface as well as 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.

10.2.1 Implementation guidance

Table 10-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-7 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial surveillance operations are listed in **Table 10-8**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

Santos

Table 10-6: Implementation guidance – aerial surveillance

Action		Consideration	Responsibility	Complete
Initial actions	Contact contracted aviation provider – provide details of incident and request mobilisation to spill site for initial surveillance.	If aviation asset is available near spill location, use where possible to gather as much information about the spill. If aviation asset not available at spill location IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met before deployment. There should be an attempt to obtain the following data during initial surveillance: + name of observer, date, time, aircraft type, speed and altitude of aircraft + location of slick or plume (global positioning system [GPS] positions, if possible) + spill source + size of the spill, including approximate length and width of the slick or plume + visual appearance of the slick (e.g. colour) + edge description (clear or blurred) + general description (windrows, patches etc.) + wildlife, habitat or other sensitive receptors observed + basic metocean conditions (e.g. sea state, wind, current) + photographic/video images.	Operations Section Chief Logistics Section Chief	☐
	Source available Santos Aerial Observers, arrange accommodation/logistics and deploy to Forward Operations/Air base location.	Santos Aerial Observer list available from First-strike Resources on Santos Offshore ER Intranet page.	Operations Section Chief Logistics Section Chief	☐
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected	Flight plan to confirm with OSC that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Section Chief / Aviation Superintendent	☐

	Action	Consideration	Responsibility	Complete
	that two overpasses per day of the spill area are completed.			
	Pre-flight briefing.	-	Aerial Observers Contracted aircraft provider/ pilots	☐
	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna.	Operations Section Chief	☐
	Determine spill extent by completing Aerial Surveillance Log (**Appendix F**) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (**Appendix G**). Take still and/or video images of the slick.	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code.	Aerial Observer	☐
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H**).	-	Aerial Observer	☐
	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT	Where possible, a verbal report via radio/telephone en-route providing relevant information should be considered if the aircraft has long transits from the spill location to base	Aerial Observer Planning Section Chief Operations Section Chief	☐
Ongoing actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Subplan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	Operations Section Chief / Aviation Superintendent Planning Section Chief	☐
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities	-	Logistics Section Chief	☐
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider	-	Planning Section Chief GIS Team Leader	☐

Table 10-7: Aerial surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Rotary-Wing Aircraft & flight Crew	Santos contracted provider/s	2 x contracted (1 x primary + 1 x backup) + additional as required	Darwin Karratha Learmonth Onslow	Wheels up within 1 hour for Emergency Response. Spill surveillance <10 hours (daylight dependent)
Aerial Surveillance Crew	Santos aerial observers AMOSC Industry Mutual aid	7 x Santos staff 5 x AMOSC staff 5 x AMOSC Core Group personnel available Additional trained industry mutual aid personnel	Perth and Varanus Island (VI) (Santos aerial observers) Australia wide	Santos trained personnel – next day mobilisation to airbase <24 hours
Drones and pilots ** secondary response to assist vessel-based surveillance	AMOSC OSRL – Third-Party UAV provider Local WA hire companies	1 x pilot 2 x qualified remote pilots, however response is on best endeavour 10+	Geelong Perth and regional WA	<48 hours OSRL – depending on the port of departure, one to two days if within Australia

Table 10-8: Aerial surveillance – first-strike response timeline

<table>
<tr><th colspan="2">Task</th><th>Time from IMT call-out</th></tr>
<tr><td colspan="2">Aircraft activated for aerial surveillance</td><td><3 hours</td></tr>
<tr><td colspan="2">Aircraft on site for aerial surveillance</td><td><10 hours (daylight dependent)</td></tr>
<tr><td colspan="2">Trained Aerial Observers mobilised to airbase (Darwin)</td><td><24 hours (daylight dependent)</td></tr>
<tr><td colspan="3">Minimum resource requirements</td></tr>
<tr><td colspan="3">+ Santos contracted helicopter and pilots (based in Darwin)
+ Santos trained Aerial Observers</td></tr>
<tr><td colspan="3">Approximate flight time</td></tr>
<tr><td>Airport</td><td>Approximate distance[18] (nm)</td><td>Approximate flight time[19] (hours: minutes)</td></tr>
<tr><td>Darwin</td><td>180</td><td>1:30</td></tr>
<tr><td>Broome</td><td>700</td><td>6:00</td></tr>
</table>

[18] As measured to geometric centre point of operational area

[19] At average flight speed of 120 knots

10.3 Tracking buoys

Table 10-9 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-9: Tracking buoys – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Notification of a Level 2 or 3 spill May be deployed for a Level 1 spill if deemed beneficial by the OSC	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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	

10.3.1 Implementation guidance

Table 10-10 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-11** provides a list of resources that may be used to implement this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. **Table 10-34** lists the environmental performance standards and measurement criteria for this strategy.

Table 10-10: Implementation guidance – tracking buoys

	Action	Consideration	Responsibility	Complete
Initial actions	Organise vessel to mobilise two tracking buoys from MODU.	Personnel and vessel safety is priority. Current Santos on hire vessels or VOOs can be used. AIS vessel tracking is available through ER intranet page.	OSC/Operations Section Chief	☐
	Deploy two tracking buoys at leading edge of slick.	Note deployment details and weather conditions in incident log.	Vessel Master	☐
	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys.	Refer login details of tracking buoy monitoring website on Santos ER intranet site.	OSC Planning Section Chief / GIS	☐
	Use tracking buoy data to maintain Common Operating Picture.	Data tracked online.	Planning Section Chief / GIS	☐
	Relay information to spill fate modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief / GIS	☐
Ongoing actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	Incident Action Plan to provide guidance regarding any additional deployments of tracking buoys.	Planning Section Chief	☐
	Mobilise additional tracking buoys if required from other Santos operations (Santos presently has 12 tracking buoys located on the North West Shelf) or from AMOSC stockpiles.	-	Logistics Section Chief	☐
	Direct the deployment of the tracking buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction.	-	Operations Section Chief	☐
	Deploy tracking buoys.	-	Vessel Master	☐
	Monitor movement of tracking buoys.	-	Planning Section Chief /GIS	☐
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief /GIS	☐

Table 10-11: Tracking buoy resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Tracking buoys	Santos	2	MODU	<2 hours for incident
		2	Darwin	<24 hours to site pending vessel availability
		4 4	VI Dampier	VI/Dampier buoys – 48-72 hours to site pending vessel availability
AMOSC tracking buoys	AMOSC	4	Fremantle	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to **Table 10-12**)
		4	Geelong	

Table 10-12: Australian Marine Oil Spill Centre equipment mobilisation timeframes

	Perth	Darwin	Dampier
Geelong	40 hours / 3,395 km	44 hours / 3,730 km	70 hours / 4,840 km
Perth	NA	48 hours / 4,040 km	19 hours / 1,530
Exmouth	15 hours / 1,250 km	38 hours / 3,170km	7 hours / 555 km
Broome	27 hours / 2,240 km	22 hours / 1,870 km	11 hours / 855 km

Table 10-13: Tracking buoy – first-strike response timeline

Task	Time from IMT call-out
Tracking buoys deployed from MODU	<2 hours
OR	
Tracking buoys deployed from Darwin using vessels of opportunity	24 hours to site pending vessel availability
Minimum Resource Requirements	
+ Two tracking buoys for initial deployment	

10.4 Oil spill trajectory modelling

Table 10-14 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-14: Oil spill trajectory modelling – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision -making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ Spill fate modelling will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or until no longer beneficial to predict spill trajectory and concentrations, OR + As directed by the relevant Control Agency	

Oil spill trajectory modelling uses computer modelling (e.g. OILMAP, SIMAP) to estimate the movement, fate and weathering potential of spills. Santos 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 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.

A particular advantage of spill trajectory modelling is that the transport and weathering of spilled hydrocarbons can be forecast, at all times of the day and night, at any location, and under any type of metocean conditions. By contrast, aerial surveillance and vessel-based monitoring will be constrained to day-time use, and have limits imposed by the operating environment. Aerial surveillance and vessel-based monitoring are, however, essential for model validation, verification and calibration of any modelling or first principal predictions.

10.4.1 Implementation guidance

Table 10-15 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

Table 10-16 provides a list of resources that may be used to implement this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-15: Implementation guidance – oil spill trajectory modelling

	Action	Consideration	Responsibility	Complete
Initial actions	Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos ER SharePoint). Request for three-day forecast trajectory modelling.	-	Environment Unit Leader	☐
	Determine requirement for gas/VOC modelling and request initiation.	Hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Officer Environment Unit Leader	☐
	Operational surveillance data (aerial, vessel, tracking buoys) to be given to modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy.	-	Planning Section Chief /GIS	☐
	Login to the RPS Group data sharing website and maintain connection. Download modelling results.	Data should be stored digitally and backed up on to independent digital storage media. All datasets should be accompanied by a metadata summary and documented quality assurance and control procedures.	Planning Section Chief /GIS	☐
	Place RPS Group modelling data into GIS/Common Operating Picture.	RPS Group 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 change suddenly.	Planning Section Chief /GIS	☐
	If SSDI is considered an applicable strategy for the spill scenario, request modelling provider to model how dispersant addition affects the distribution and concentration of floating oil, subsea oil and shoreline loading.	Planning and Operations to provide inputs for modelled simulation based on potential/planned dispersant operations. Outputs from dispersant addition modelling to inform NEBA.	Planning Section Chief Operations Section Chief	☐
	Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct operational NEBA on proposed response strategies.	-	Environment Unit Leader	☐

	Action	Consideration	Responsibility	Complete
Ongoing actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture.		Planning Section Chief / GIS	☐
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy.	-	Planning Section Chief / GIS	☐

Table 10-16: Oil spill trajectory modelling resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
RPS OST modellers and software	RPS under direct contract to Santos, also available through AMOSC	Daily OSTM reports	Perth – digital	2–4 hours from activation

Table 10-17: Oil spill trajectory modelling – first-strike response timeline

Task	Time from IMT call-out
RPS OSTM activated by IMT	<2 hours
OSTM provided to IMT	<4 hours
Minimum Resource Requirements	
+ Contracted OST modellers and software + OSTM Activation Form	

10.5 Satellite imagery

Table 10-18 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-18: Satellite imagery – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision -making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ Satellite monitoring will continue until no further benefit is achieved from continuing; or as advised by relevant Control Agency.	

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.

Suitable imagery may be available via satellite imagery suppliers. This can be done through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar and visible imagery may both be of value. Availability of satellite images for a specific location will be dependent on several factors including satellite current position, satellite availability/tasking, and weather conditions (cloud cover obscures images).

10.5.1 Implementation guidance

Table 10-19 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-20** provides a list of resources that may be used to implement this strategy. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-19: Satellite imagery implementation guide

Action		Consideration	Responsibility	Complete
Initial actions	Assess requirement for satellite imagery.	-	Planning Section Chief	☐
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery.	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required.	Planning Section Chief	☐
	Assess suitability and order imagery.	-	Planning Section Chief	☐
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation.	-	GIS Team Leader Planning Section Chief	☐

	Action	Consideration	Responsibility	Complete
Ongoing actions	Review surveillance information to validate spill fate and trajectory.	-	Planning Section Chief	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required.	Use surveillance data when updating the Common Operating Picture.	Planning Section Chief	☐

Table 10-20: Satellite imagery resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Satellite Imagery	KSAT – activated through AMOSC MDA – activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	If satellite images are required, Santos to notify provider within 12 hours

10.6 Initial oil characterisation

Table 10-21 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-21: Initial oil characterisation – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision -making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ Oil sample and analysis to terminate once enough data has been collected to profile the oil characteristics throughout weathering and to provide oil for toxicity testing, OR + As directed by the relevant Control Agency	

10.6.1 Overview

Barossa Condensate is a hydrocarbon that has been previously assayed and MDO is a common fuel type with known properties; the general physical and chemical characteristics of these hydrocarbons are known and have been presented in **Appendix A**. Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release.

The composition and physical properties of the hydrocarbon will also evolve over time through weathering processes that change its composition and properties, such as the viscosity, density, water content and pour point. The rate of change of the hydrocarbon properties will affect the likely time-window of opportunities for particular responses and the associated logistical requirements of these responses.

10.6.2 Implementation guidance

Table 10-22 provides guidance to the IMT on the actions and responsibilities for this strategy. **Table 10-23** provides a list of resources that may be used to implement this tactic. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

10.6.3 Oil sampling and analysis

Oil sampling kits are provided by Santos for the purposes of taking spilled oil/ oily water samples, which include procedures for untrained personnel. Initial samples will be taken by the vessel crew using the sampling kits and included procedures. Trained personnel may be deployed to the field at a later time to continue sampling as required as part of ongoing monitoring.

Sampling kits are positioned at Santos strategic locations (refer to **Table 10-23**) and will be mobilised to the required locations when needed. The kits contain all necessary equipment and sampling containers for shipping to a laboratory for analysis.

The Santos Oil and Water Sampling Procedures (7710-650-PRO-0008) defines the sampling protocol and procedures.

Using on-site VOOs, 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

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/mass spectrometry for the purpose of fingerprinting the oil constituents, is to be undertaken. Fingerprinting of the released hydrocarbon potentially allows contamination to be traced back to the source where this is otherwise unclear or in dispute. The Santos Oil and Water Sampling Procedures (7710-650-PRO-0008) outlines the suite of available oil testing and fingerprinting analyses that can be performed by the preferred laboratories. Details of the testing laboratories can also be found within the document.

Ecotoxicology assessment of the oil is to be conducted at an ecotoxicology laboratory following the revised Australian and New Zealand Water Quality Guidelines. The quantity of sample required for analysis will be confirmed by the laboratory but is expected to be in the order of 6 to 10 L. Testing results will provide the concentrations at which toxicity endpoints consistent with revised Australian and New Zealand Water Quality 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 fitted to the data (e.g. by using the Burrlioz software program).

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Table 10-22: Implementation guidance – initial oil characterisation

	Action	Consideration	Responsibility	Complete
Initial actions	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g. for vessel surveillance or tracking buoy deployment.	Operations Section Chief Logistics Section Chief	☐
	Source sampling equipment. Confirm sampling methodology. Confirm laboratory for sample analysis. Develop health and safety requirements/controls.	Refer **Table 10-23** for resource availability. The Santos Oil and Water Sampling Procedures (7110-650-PRO-0008) provide the procedures for sampling.	Environment Unit Leader Safety Officer	☐
	Vessel directed to sampling location.	Sampling of oil at thickest part of slick – typically leading edge.	Operations Section Chief	☐
	Vessel crew to undertake sampling and delivery of samples to Darwin for dispatch to laboratory. Environment Unit Leader to confirm analysis of oil with lab.	Darwin Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Section Chief Environment Unit Leader Logistics Section Chief	☐
Ongoing actions	Continue sample collection post release where oil is available.	Initial monitoring by crew of available vessels – Once mobilised to site Santos scientific monitoring provider to continue sampling of oil in conjunction with operational water quality monitoring.	Operations Section Chief Environment Unit Leader Logistics Section Chief	☐

Table 10-23: Initial oil characterisation – resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Oil sampling kits (full kit)	Santos/AMOSC	1	1 x Darwin	Within 48 hours
Oil sampling kits (rapid kit)	Santos	5	5 x Darwin / Tiwi Islands	Within 24 hours
Bulk oil sampling bottles	Intertek/Santos	As required	Perth	Within 48 hours
Monitoring vessel	Santos contracted vessel providers Vessels of opportunity identified	Availability dependent upon Santos and Vessel Contractor activities. Locations verified	Pending availability and location	Expected within 24 hours Availability dependent upon Santos and vessel contractor activities

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
	through AIS vessel tracking system	through AIS vessel tracking system		
National Association of Testing Authorities (NATA) accredited laboratory/ personnel for analysis	Intertek / ALS / ChemCentre / Leeder Analytical	N/A	Perth	24+ hours

Table 10-24: Initial oil characterisation – first-strike response timeline

Task	Time from IMT call-out
Oil sample collection	<24 hours (daylight dependent)
Oil samples arrive at lab for analysis	<5 days
Minimum resource requirements	
+ One vessel; no special requirements; oil sampling can be done concurrently with other tasks + One oil sampling kit + Sampling jars for bulk oil collection	

10.7 Operational water quality monitoring

10.7.1 Operational water sampling and analysis

Table 10-25 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-25: Operational water quality sampling and analysis – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision -making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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, OR + Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.	

Operational sampling of oil and oil in water will be undertaken at discrete locations, providing visual observations, real-time fluorometry/ dissolved oxygen readings and providing oil and water samples for laboratory analysis. The intent of this sampling is to confirm the distribution and concentration of oil, validating spill trajectory modelling and providing and informing the selection and implementation of other response strategies, including scientific monitoring.

Table 10-26 presents the water quality sampling and analysis plan considerations.

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

10.7.2 Implementation guidance

Refer to **Table 10-27** for the operational water quality sampling and analysis implementation guide. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned. **Table 10-34** lists the environmental performance standards and measurement criteria for this strategy.

Table 10-26: Operational water quality sampling and analysis plan considerations

Considerations for operational water quality sampling and analysis	
Scope of work	The work scope for operational water quality monitoring will be driven by the IMT, confirming objectives for each operational period.
Survey design	The operational water sampling activities will be conducted by experienced environmental scientists and managed through the IMT Incident Action Planning 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 and spill fate modelling. + At each discrete location, sampling will initially be conducted using a conductivity-temperature-depth (CTD) meter along a depth profile which captures the three-dimensional distribution of the oil. The CTD would require fluorometry and dissolved oxygen sensors as part of the sensor package to record the presence of oil (fluorometry) and the activity of hydrocarbon degrading bacteria (dissolved oxygen). Fluorometers appropriate to the hydrocarbon type will need to be selected. + The CTD would help inform the depth at which water samples would be taken; and in the case of incidents where dispersants are approved for use, may inform the water sampling locations for subsea dispersant efficacy monitoring (using API (2020) Technical Report 1152) methods. + Where surface oil is present in shallow water (<5 m) sampling should involve a depth profile from the seabed to surface waters. + For a subsea release or where surface oil is present in deeper water (>5 m) sampling should involve a depth profile ensuring 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. + Oil and oil in water samples will be replicated at each site to allow intra-site variability to be assessed and appropriate quality assurance and control samples incorporated into replicates. + Santos will coordinate transportation of samples from the sampling location to the laboratory. Samples will be accompanied with a completed Chain of Custody form. + Water samples also to be provided to an independent National Association of Testing Authorities (NATA) accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons.
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.

Considerations for operational water quality sampling and analysis	
	+ Analysis of oil properties following laboratory evaluation. + A final report is to be prepared detailing all data collected on oil properties throughout the monitoring program including relevant interpretation.

Table 10-27: Implementation guidance – operational water quality sampling and analysis

Action		Consideration	Responsibility	Complete
Initial actions	Activate Santos Monitoring Service Provider for Operational Water Quality Monitoring.	Refer to **Appendix K** for activation guidance	Environment Unit Leader	☐
	Obtain spill trajectory modelling and provide to Monitoring Service Provider.	-	Environment Unit Leader Planning Section Chief GIS Support	☐
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring. Plan to also consider oil characterisation sampling (**Section 10.6**)– Monitoring Service Provider to take over this sampling once mobilised.	Sites to be selected using oil spill trajectory modelling and distribution of oil from surveillance tactics. Refer **Table 10-26** for considerations for Sampling and Analysis Plan.	Monitoring Service Provider Environment Unit Leader	☐
	Develop health and safety plan including potential exposure to volatile gases/VOCs.	Refer Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016).	Monitoring Service Provider Safety Officer	☐

Action		Consideration	Responsibility	Complete
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment.	-	Monitoring Service Provider	☐
	Organise vessels, accommodation and transport requirements to mobilise monitoring team/s to site.	Monitoring Service provider to outline requirements in resource request form.	Logistics Section Chief	☐
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with OSC and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.	-	Monitoring Service Provider On-Scene Commander Operations Section Chief Environment Unit Leader Logistics Section Chief	☐
Ongoing actions	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions.	-	Planning Section Chief GIS Support Environment Unit Leader	☐

Table 10-28: Operational water quality sampling and analysis – resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Water quality monitoring personnel	Monitoring Service Provider	Approx. 6 (based on capability reports)	Perth-based	Personnel and equipment within 120 hours from IMT call out
Water quality sampling equipment and water quality meters	Third-party suppliers via Monitoring Service Provider	Multiple providers	Australia based	
Contracted water quality monitoring vessels	Santos Contracted Vessel Providers	Availability dependent upon Santos and Vessel Contractor activities; suitable vessels identified through AIS Vessel Tracking	Locations verified through AIS Vessel Tracking Software	<72 hours – pending vessel availability

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Table 10-29: Operational water quality sampling and analysis – first-strike response timeline

Task	Time from IMT call-out
IMT activates monitoring service provider.	<4 hours
Operational water quality monitoring personnel, equipment and vessel deployed to spill site.	<120 hours
Minimum resource requirements	
+ Water quality monitoring vessel/s – refer Santos Offshore ER Intranet and Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) for vessel specification, if a vessel charter is needed. + Water quality monitoring team (through monitoring service provider). + Water quality monitoring equipment (through monitoring service provider).	

10.7.3 Continuous fluorometry surveys

Table 10-30 provides the environmental performance outcome, initiation criteria, termination criteria and other key aspects for this strategy.

Table 10-30: Continuous fluorometry surveys – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Level 2/3 spill	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ Continuous fluorometry surveys will continue for 24 hours following control of the source provided oil is no longer detectable, OR + As directed by the relevant Control Agency.	

In addition to operational water sampling and sensor deployment at discrete locations, a continuous fluorometry survey(s) may be run across the expected slick/plume extent, as well as vertically through the water column. This allows a far greater area of coverage than discrete sampling, aiding in the mapping of entrained and dissolved oil movement.

Continuous fluorometry surveys are also used to evaluate the effectiveness of dispersant application by detecting changes in the distribution of oil before and after the application of dispersants whether that be on surface on subsea.

Subsurface gliders containing fluorometers built into the body of the glider may be used for this monitoring and would be preferential for monitoring a continuous subsea release (subsea LOWC from all locations). This will allow continuous monitoring of entrained oil covering a large area and will provide near real-time three-dimensional data on the distribution of entrained oil to enable decision-making within the IMT. Similarly, other sources of monitoring data (e.g. spill fate modelling) can be used in near real-time to inform the path of the subsurface glider. Subsurface gliders are particularly suited to subsea releases where oil may be distributed below surface layers.

Fluorometers towed behind vessels will be used as an alternative or complementary approach for a subsea release and would be preferred for surface spills and to monitor oil distribution through the water column.

10.7.4 Implementation guidance

Table 10-31 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-32** provides a summary of resources that may be used to implement this strategy. **Table 10-33** details the minimum first-strike requirements to be mobilised on activation. The Incident Commander is ultimately responsible for the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-34 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-31: Continuous fluorometry surveys – implementation guidance

Action		Consideration	Responsibility	Complete
Initial actions	Activate Monitoring Service Provider and engage to provide fluorometry services (personnel and equipment) as part of Operational Water Sampling and Analysis – refer **Table 10-27** for actions.	-	Monitoring Service Provider Environment Unit Leader	☐
	Activate OSRL monitoring and determine availability of subsea gliders and towed fluorometry equipment.	OSRL can provide specialist technical advice on operation of towed fluorometers. Consider: Engaging OSRL for review and input into monitoring action plan for towed fluorometry.	Incident Commander Environment Unit Leader	☐
	Determine suitability of subsea gliders for monitoring.	Subsurface gliders containing fluorometers built into the body of the glider may be used for this monitoring and would be preferential for monitoring a continuous subsea release (well leak scenario).	Environment Unit Leader	☐
	If gliders and pilot/s available and suitable for incident, engage provider to develop Monitoring Action Plan.	Arrange a joint meeting with spill modelling provider and OSRL/glider operator to develop monitoring design and ongoing data transfer protocols to meet objective of model validation.	Environment Unit Leader	☐
	Source vessels and other logistics to support monitoring.	-	Logistics Section Chief Operations Section Chief	☐
	Conduct monitoring as per monitoring action plan with deployment area guided by other operational monitoring studies.	The scope of monitoring will be dictated by the response strategies being employed. Where dispersant application is being undertaken, fluorometry surveys will have to be coordinated with application activities so subsea oil distribution can be assessed before and after dispersant addition to determine effectiveness. Appendix F of CSIRO oil spill monitoring handbook (CSIRO, 2016) provides standard operating procedures using fluorometry equipment.	Operations Section Chief Planning Section Chief Environment Unit Leader	☐

Action		Consideration	Responsibility	Complete
Ongoing actions	Provide daily data reports and spatial outputs IMT.	-	Monitoring Provider	☐
	Monitoring results to be incorporated into Common Operating Picture.	-	Planning Section Chief GIS Support	☐

Table 10-32: Continuous fluorometry surveys – resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Towed fluorometers	OSRL	Towed Fluorometers: 7 Turner C3 fluorometers globally	4 in Southampton, 2 in Singapore and 1 in Fort Lauderdale	<72 hours
Glider mounted fluorometers	OSRL	Subsea glider: Qty. subject to availability from OSRL contractor – one engineer from OSRL contractor to deploy and operate the Glider	Gliders based in Australia (Perth, Sydney, Brisbane) OSRL towed fluorometers out of Singapore, Southampton and Fort Lauderdale	<120 hours dependent upon availability
Vertical particle size analyser – Sequoia LISST 100x	Monitoring Service Provider	1	Perth	<72 hours
Water quality monitoring personnel to operate towed fluorometers	Monitoring Service Provider	Approx. 6 (based on capability reports)	Perth-based	<72 hours
Glider (remote) pilot/s and deployment crew	Third-party provider via OSRL	Subsea glider: Qty. subject to availability from OSRL contractor – one engineer from OSRL contractor to deploy and operate the glider	Perth-based pilot and deployment crew	<72 hours dependent upon availability

Table 10-33: Continuous fluorometry surveys – first-strike response timeline

Task	Time from IMT call-out
IMT activates OSRL and Monitoring Service Provider.	<4 hours
Monitoring Service Provider water quality monitoring personnel deployed to site.	<120 hours
Towed fluorometers deployed to site.	<120 hours
Glider and pilot/s and deployment crew deployed (if gliders available and appropriate).	<120 hours (if gliders available and appropriate)
Minimum resource requirements	
+ Water quality monitoring vessel/s – refer Santos Offshore ER Intranet for vessel specification. + Water quality monitoring team (through monitoring service provider). + OSRL towed fluorometer (Turner C3) + Particle size analyser.	

10.8 Environmental performance

Table 10-34: Environmental performance – monitor and evaluate

Environmental performance outcome	Implement 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 – vessel and aerial surveillance	**Response Preparedness**		
	Maintenance of Master Services Agreements (MSAs) with multiple vessel providers	Santos maintains MSAs with multiple vessel providers as specified in **Table 10-3**.	MSAs with multiple vessel providers
	MSA with aircraft supplier	MSA in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos trained Aerial Observers	Santos 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 UAV providers	Maintenance of contract for access to UAV providers	List of certified UAV providers AMOSC Participating Member contract OSRL Associate Member contract
	Aircraft charter companies for fauna observations	Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
	Response Implementation		
	Vessel surveillance	Minimum first-strike resource requirements mobilised in accordance with **Table 10-4**	Incident log
		Daily observation reports submitted to IMT until termination criteria are met	Incident log
	Vessels and aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos' 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' 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' Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance	Minimum first-strike resource requirements mobilised in accordance with **Table 10-8**	Incident log
		Following initiation two passes per day of spill area by observation aircraft provided	Incident log; Incident Action Plan
		Trained Aerial Observers mobilised to airbase (Darwin) within 24 hours (daylight dependent)	Incident log

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		Flight schedules are maintained throughout response	Incident Action Plan
		Observers completed aerial surveillance observer log following completion of flight	Aerial Observer Logs
Monitor and Evaluate – tracking buoys	**Response Preparedness**		
	Tracking buoys available	Maintenance of 12 tracking buoys throughout the activity	Computer tracking software Tracking buoy tests
	Response Implementation		
	Tracking buoy mobilisation	Minimum requirements mobilised in accordance with **Table 10-11**	Incident log
Monitor and Evaluate – 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
		Access to additional spill modelling capability to ensure redundancy.	Membership in place with OSRL
	Response Implementation		
	Oil spill modelling	Oil Spill Modelling provider will be contacted immediately (within two hours) upon notification of a Level 2 or 3 spill	Incident log
		Modelling delivered to IMT within two hours of request to service provider	Incident log
Monitor and Evaluate – satellite imagery	**Response Preparedness**		
	Satellite imagery	Satellite imagery and analysis accessed through third party provider activated through AMOSC and/or OSRL	AMOSC Participating Member contract, OSRL Associate Member contract
	Response Implementation		
	Satellite imagery	Data incorporated into Common Operating Picture and provided to spill modelling provider	Incident log; Incident Action Plan

Environmental performance outcome	Implement 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 – oil characterisation and operational water quality 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 as per **Table 10-23**	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Entrained oil monitoring equipment and services	Maintenance of arrangements to enable access to fluorometry services throughout activity	Arrangement with provider of fluorometry equipment
	Water quality monitoring vessels	Maintenance of vessel specification for Water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil sampling kit pre-positioned at Darwin	Evidence of deployment to site
	Response Implementation		
	Initial Oil Characterisation	Minimum requirements mobilised in accordance with **Table 10-24**	Incident log
		Oil samples sent to laboratory for initial fingerprinting	Incident log
		If applicable (not MDO), oil samples sent to laboratory for dispersant amenability	Incident log
		Oil samples collected to be sent for laboratory ecotoxicity testing of oil	Incident log
		90, 95, and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum five species' tests) within 24 hours of receiving all results	Ecotoxicity report from environmental contractor
	Operational water quality monitoring	IMT activates monitoring service provider within four hours	Incident log
		Operational water quality sampling and analysis	Incident log

Environmental performance outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		surveys mobilised within 120 hours from IMT call-out	
		Fluorometry surveys mobilised within five days of initiation	Incident log
		Daily report including fluorometry results provided to IMT	Incident log

11. Mechanical dispersion

Table 11-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 11-1: Mechanical dispersion – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion	
Initiation criteria	Operational monitoring identifies thin oil patches at sea surface that are not naturally dissipating in sea surface and is posing risks to wildlife and shorelines by remaining on the surface	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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	

11.1 Overview

This response strategy assists with the natural dispersion process; creating mixing through physical agitation by using a vessel's propellers and wake, which encourages the oil to break into smaller particle sizes that are more easily biodegraded. The two common activities associated with mechanical dispersion are:

+ manoeuvring a vessel through the slick, using propeller wash and vessel wake to create mixing in the water body
+ spraying water from the fire hose of a vessel and moving the vessel through the water body to create additional mixing and breakup of the slick.

11.2 Implementation guidance

Table 11-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 11-3** provides a list of resources that may be used to implement this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

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Table 11-2: Implementation guidance – mechanical dispersion

	Action	Consideration	Responsibility	Complete
Initial actions	The operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations.	Water depth and sea state. Possible impacts to sensitive shorelines and/or wildlife. This activity is to be conducted during daylight hours only and requires a safety plan to be developed prior to implementation.	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	Safety Officer to develop a safety plan for the activity with respect to potentially dangerous gases and VOCs (including applicable controls).	-	Operations Section Chief Safety Officer	☐
	Notify vessel-based responders to trial mechanical dispersion.	-	Operations Section Chief	☐
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Section Chief for inclusion in operational NEBA.	-	Vessel Master/s Santos AMOSC Core Group Responders	☐

Table 11-3: Mechanical dispersion resource capability

Equipment type/personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Vessels undertaking other activities Vessel(s) can be specifically contracted for the strategy if required (refer to Santos Vessel Requirements for Oil Spill Response document [7710-650-ERP-0001])	Santos contracted vessel providers	Availability dependent upon Santos and Vessel Contractor activities.	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Varies subject to availability and location.

11.3 Environmental performance

Table 11-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 11-4: Environmental performance – mechanical dispersion

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion		
Response strategy	**Control measures**	**Performance standard**	**Measurement criteria**
Mechanical dispersion	**Response preparedness**		
	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

12. Oiled wildlife

N.B.: the NT Control Agency and WA DoT are the Control Agencies, and the NT Department of Environment, Parks and Water Security (DEPWS) and WA Department of Biodiversity, Conservation and Attractions (DBCA) are the Jurisdictional Authorities for oiled wildlife response within NT and WA State waters, respectively. Santos and AMSA are the Control Agencies for oiled wildlife response within Commonwealth waters from facility and vessel spills respectively.

Table 12-1: Oiled wildlife response – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement tactics in accordance with the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife
Initiation criteria	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill
Termination criteria	+ 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

12.1 Overview

The short-term effects of hydrocarbons on wildlife may be direct such as the external impacts from coating or internal effects from ingestion and inhalation. Oiled wildlife response (OWR) includes wildlife surveillance/reconnaissance, wildlife hazing, pre-emptive capture and the capture, cleaning, treatment, and rehabilitation of animals that have been oiled. In addition, it includes the collection, post-mortem examination, and disposal of deceased animals that have succumbed to the effects of oiling.

Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat, impacts to food sources, and impacts to reproduction. An assessment of such impacts is covered in Section 7.5.6 of the EP and post-spill via scientific monitoring (**Section 14**).

Table 12-2 provides guidance on the designated Control Agency and Jurisdictional Authority for OWR in Commonwealth and Territory/State waters. For a petroleum activity spill in Commonwealth waters, Santos act as the Control Agency and will be responsible for the wildlife response. The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) will be referred to for guidance for coordinating an OWR when Santos is the Control Agency and for the OWR first-strike response, otherwise the relevant Territory/State OWR Plan will be referred to, as described below.

12.1.1 Northern Territory Waters and Shorelines

The NTOWRP (AMOSC, 2019) is the key plan for OWR in the NT and provides operational OWR guidance during an incident resulting from a marine based hydrocarbon spill due to petroleum activities within the NTOWRP area of operation. The NTOWRP is primarily designed to be utilised by the Titleholder as an operational OWR plan, but the plan also aims to provide operational guidance to any relevant government and non-government agencies located throughout the NTOWRP area of operation. The plan was developed by AMOSC and was commissioned by Shell Australia, ConocoPhillips and INPEX, and is consistent with regional OWR plans produced by AMOSC, DBCA (WA) and the Department for Environment and Water (DEW), South Australia (SA) (AMOSC, 2019).

The Parks and Wildlife Commission of the Northern Territory (PWC) is the Territory Government agency responsible for administering the *Parks and Wildlife Commission Act 2013*, which has provisions for the protection, conservation and sustainable use of wildlife. For Level 1 spills in Territory waters, Santos will be the Control Agency, including for wildlife response. For Level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until the relevant NT Control Agency is activated as the lead agency for OWR and a formal handover occurs. Following formal handover, Santos will function as a support organisation for the OWR and will be expected to continue to provide planning and resources as required when requested by the relevant NT Control Agency for OWR.

12.1.2 WA Waters and Shorelines

The key plan for OWR in WA is the WA Oiled Wildlife Response Plan (WAOWRP) (DBCA, 2022a). The WAOWRP establishes the framework for preparing and responding to potential or actual wildlife impacts during a spill and sets out the management arrangements for implementing an OWR in conjunction with the SHP-MEE. It is the responsibility of DBCA to administer the WAOWRP under the direction of the WA DoT (**Table 12-2**). The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) is consistent with and interfaces the WAOWRP and WA Oiled Wildlife Response Manual (WA OWR Manual) (DBCA, 2022b).

If a spill occurs in WA State waters or enters State waters, DBCA is the Jurisdictional Authority for wildlife, and for level 2/3 spills, will also lead the oiled wildlife response under the control of the WA DoT. DBCA is the State Government agency responsible for administering the *Biodiversity Conservation Act (WA) 2016* (BC Act), which has provisions for authorising activities that affect wildlife.

For level 1 spills in WA State waters, Santos will be the Control Agency, including for wildlife response. It is however also an expectation that for Level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until DBCA is activated as the lead agency for wildlife response and formal handover occurs. Following formal handover, Santos will function as a support organisation for the OWR and will be expected to continue to provide planning and resources as required.

In this section, the WA Oiled Wildlife Response Plan (WAOWRP) (DBCA, 2022a) and WA OWR Manual (DBCA, 2022b) has been used to guide the OWR planning. There is general support across industry to adopt the WAOWRP for use across Australia in the future. Meanwhile, the Northern Territory Oiled Wildlife Response Plan (NTOWRP) (AMOSC, 2019) will be used to provide OWR operational guidance during an incident in NT waters and shorelines.

Table 12-2: Jurisdictional and Control Agencies for oiled wildlife response

Jurisdictional boundary	Spill source	Jurisdictional Authority for OWR	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel	DCCEEW	AMSA		Western Australia Oiled Wildlife Response Plan (WAOWRP) Western Australia Oiled Wildlife Response Manual
	Petroleum activities		Titleholder		
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	DBCA	WA DoT[20]		
	Petroleum activities		Titleholder	WA DoT	
	Vessel		Vessel	NT IMT	

[20] If an OWR is required in WA State waters, the DBCA is responsible for the administration of the Western Australian Oiled Wildlife Response Plan (WAOWRP) under the direction of the WA DoT.

Jurisdictional boundary	Spill source	Jurisdictional Authority for OWR	Control Agency		Relevant documentation
			Level 1	Level 2/3	
Northern Territory (NT) waters (territorial sea baseline to three nautical miles and some areas around offshore atolls and islands)	Petroleum activities	Department of Environment, Parks and Water Security (DEPWS)	Titleholder[21]	NT IMT[22]	Northern Territory Oiled Wildlife Response Plan (NTOWRP)
International waters[23]	Vessel	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		
	Petroleum activities				

12.2 Wildlife priority protection areas

For planning purposes, determination of wildlife priority protection areas is based on stochastic modelling of the worst-case spill scenarios, the known presence of wildlife, and in consideration of the following:

+ Presence of high densities of wildlife, threatened species, and/or endemic species with high site fidelity
+ Greatest probability and level of contact from floating oil and/or shoreline accumulation
+ Shortest timeframe to contact.

The moderate exposure zone of a potential Barossa Development Drilling and Completions spill release does not include any shoreline contact however it encompasses a large area of the Timor Sea. There is some evidence that foraging aggregations of seabirds, marine mammals and turtles occur within the Timor Sea (Lavers *et al.* 2014, Thums *et al*. 2017, Bouchet *et al*. 2020). There is however generally a paucity of data for this region with the exact location and any seasonal variation for such foraging aggregations remaining largely unknown, although they are expected to be associated with banks and shoals.

Bouchet *et al*. (2020) suggested that the Oceanic Shoals AMP is a reservoir of biodiversity comparable to other documented offshore oceanic hotspots and is a possible distant foraging destination for sea turtles, and possible breeding and /or nursing ground for a number of cetacean species. Thums *et al*. (2017) determined that flatback turtle (*Natator depressus*) travel to foraging grounds on the mid-Sahul Shelf in the Timor Sea and distribution modelling showed that they preferred foraging in waters 60 to 90 m deep in association with complex, benthic geomorphology (banks, shoals, terraces, deep holes and valleys) thought to support a high abundance of sessile invertebrates. Levers *et al*. (2014) developed species distribution models for 21 seabird species (including both breeding and non-breeding migrants) based on at-sea survey observations and oceanographic variables and their results indicated many seabird hotspots in the Timor Sea.

[21] Titleholder will be the control agency but will request approval of IAPs from the NT IC.

[22] NT IMT will be the control agency but will be supported by the titleholder (additional support from AMOSC if required).

[23] As per AMSA (2017b), Coordination of International Incidents: Notification Arrangements Guidance NP-GUI-007.

12.3 Magnitude of wildlife impact

Given the distribution and behaviour of wildlife in the marine environment, a spill which only impacts Commonwealth offshore waters is likely to result in limited opportunities to rescue wildlife. During a five-day rapid at sea survey for megafauna conducted during the 2009 Montara oil spill, a high level of diversity and abundance of species were reported within the oil spill region in the Timor Sea, including ~2,800 birds, 462 cetaceans, 25 turtles and 62 sea snakes. Despite the large numbers of wildlife observed only one dying Common Noddy (*Anous stolidus*) and one dead Horned Sea Snake (*Acalyptophis peronii*) were observed and recovered at sea, in spite of the survey covering a distance of 1,238 km and a total survey area of 99,040 ha (Watson *et al*. 2009). For offshore spills that do not result in shoreline contact, continued wildlife reconnaissance for rescue opportunities, carcass recovery, sampling of carcasses that cannot be retrieved and scientific monitoring are likely to be the focus of response efforts. In contrast, a spill which results in shoreline accumulation is likely to result in greater opportunities to rescue wildlife.

Modelling results from the credible spill scenarios for the Barossa development show no shoreline accumulation at any exposure value. Spill modelling for the LOWC (subsea) scenario (129,000 m^3 of Barossa Condensate) predicts floating oil at 10-25 g/m^2 to spread a maximum distance of 162 km (RPS, 2019).

The WAOWRP (DBCA, 2022a) provides a guide for rating wildlife impacts based on a set of criteria outlined in **Table 12-3**, this guide has been used here for planning purposes to predict the potential wildlife impacts associated with the worst-case spill scenario. The overall impact assessment (low, medium or high) then corresponds with projected OWR personnel requirements specified in the WAOWRP (DBCA, 2022a) and demonstrated by Santos in **Appendix I**.

Although most of the condensate at the sea surface is predicted to evaporate (RPS, 2019) there is still potential for wildlife surface exposure, especially given the duration of the spill. There is also evidence that wildlife foraging aggregations occur in the Timor Sea that are most likely associated with banks and shoals, although their exact locations and seasonality remain largely unknown. In consideration of this, and because the consequences of wildlife exposure to entrained condensate are unknown, a precautionary approach was used and high wildlife impacts were predicted (using the WAOWRP [DBCA, 2022a] *Guide for Rating the Wildlife Impact of an Oil Spill* [**Table 12-3**]) for a worst-case spill scenario associated with Barossa drilling and completion activities.

Table 12-3: WAOWRP Guide for rating the wildlife impact of an oil spill (DBCA, 2022)

Wildlife Impact Rating	Low	Medium	High
What is the likely duration of the wildlife response?	< 3 days	3-10 days	>10 days
What is the likely total intake of animals?	< 10	11-25	>25
What is the likely daily intake of animals?	0-2	2 to 5	>5
Are threatened species, or species protected by treaty, likely to be impacted, either directly or by pollution of habitat or breeding areas?	No	Yes – possible	Yes – likely
Is there likely to be a requirement for building primary care facility for treatment, cleaning and rehabilitation?	No	Yes – possible	Yes – likely

12.4 Implementation guidance

Refer to Section 6 of the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for guidance on the tasks and responsibilities that should be considered when implementing an OWR when Santos is the Control Agency or prior to formal hand over to the relevant Control Agency. The OWR First Strike Implementation Guide within the Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) includes:

+ Record keeping;

- Situational awareness;
- Activation of Santos IMT Wildlife Branch;
- Notifications;
- Santos Oiled Wildlife Rapid Assessment Teams (RATs);
- Wildlife Reconnaissance;
- Mobilisation of required resources;
- Handover to external Control Agency (if relevant).

The OWR first strike plan will focus on notifications, wildlife reconnaissance and response preparation (refer to Section 6.1 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]). Refer to **Table 12-4** for an indicative timeframe for the OWR first strike response and **Appendix I** for resource capability. Preventative actions, such as hazing, along with capture, intake and treatment require a higher degree of planning, approval (licences) and skills and will be planned for and carried out under the wildlife portion of the IAP (refer to Section 6.2 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]).

Table 12-4: Oiled wildlife response – first-strike response timeline

<table>
<tr><th>Task</th><th>Time from oiled wildlife contact (predicted or observed)</th></tr>
<tr><td>IMT notifies regulatory authorities and AMOSC of oiled wildlife / potential for contact</td><td><2 hours</td></tr>
<tr><td>Mobilise Santos personnel for oiled wildlife reconnaissance
this will be already occurring through Aerial Observer mobilisation</td><td><24 hours</td></tr>
<tr><td>Mobilisation of AMOSC oiled wildlife equipment and industry OWR team to forward staging area</td><td><48 hours</td></tr>
<tr><td colspan="2">Minimum resource requirements</td></tr>
<tr><td colspan="2">The requirements for oiled wildlife response will be situation specific and dependent upon reconnaissance reports.
<u>First strike resources</u>:
+ Reconnaissance platforms (Refer to Santos Oiled Wildlife Framework Plan (7700-650-PLA-001 and Appendix I)
6 x trained industry oiled wildlife response team personnel (AMOSC staff & contractors/ AMOSC Industry OWR group)
<u>Additional resources:</u>
+ Refer to Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
+ Refer to Appendix I for information on OWR capability and equipment</td></tr>
</table>

12.5 Environmental performance standards

Table 12-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-5: Environmental performance – oiled wildlife response

<table>
<tr><th>Environmental performance outcome</th><td colspan="3">Implement tactics in accordance with Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife</td></tr>
<tr><th>Response strategy</th><th>Control measures</th><th>Performance standards</th><th>Measurement criteria</th></tr>
<tr><td></td><td colspan="3">Response preparedness</td></tr>
</table>

Environmental performance outcome	Implement tactics in accordance with Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Oiled wildlife response	Maintenance of access to oiled wildlife response equipment and personnel	Maintenance of access to oiled wildlife response equipment and personnel through Santos, AMOSC, AMSA National Plan and OSRL throughout activity	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)	Santos Oiled Wildlife Response Framework (7700-650-PLA-0017) provides guidance for coordinating an OWR when Santos is the Control Agency and outlines Santos' response arrangements	Santos Oiled Wildlife Response Framework Plan
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Labour hire onboarding procedure (for low skilled shoreline clean-up- personnel)	Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Maintain Santos personnel trained on OWR and positioned at Perth and VI	Santos personnel trained in OWR	Training records
	Response implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 12-4** unless directed otherwise by relevant Control Agency	Incident log
	OWR managed in accordance with the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)	Prepare operational NEBA to determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Oiled Wildlife Response sub-plan developed to provide oversight and management of OWR operations.	Records indicate IAP Wildlife Plan prepared before OWR operations commencing

13. Waste management

Table 13-1 lists the environmental performance outcome, initiation and termination criteria for this strategy.

Table 13-1: Waste management – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using and recycling waste where possible	
Initiation criteria	Response activities that will be generating waste have been initiated	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	+ 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	

13.1 Overview

The implementation of some spill response strategies will generate solid and liquid waste that will require rapid management, storage, transport and disposal. It is important that waste is collected and removed efficiently to ensure waste management does not create a bottleneck in response operations.

The type and amount of waste generated during a spill response will vary depending on the spill type/characteristics, volume released, and response strategies implemented. To account for this potential variability, waste management (including handling and capacity) needs to be scalable to allow a continuous response to be maintained.

The worst-case oil spill modelling conducted for the Barossa project predict no beaching of surface oil for MDO or Barossa condensate. Potential waste management requirements are therefore likely to be limited to oiled wildlife response and water quality monitoring activities. Significant volumes of waste from the applicable response activities for this OPEP are not anticipated due to the propensity of MDO and Barossa condensate to disperse naturally.

Where Santos is the Control Agency, or at the request of the designated Control Agency, Santos will engage its contracted Waste Service Provider (WSP) to provide sufficient waste receptacles to store collected waste and manage oily waste collection, transport and disposal associated with spill response activities. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to licensed waste management facilities. All transport will be undertaken via controlled-waste-licensed vehicles and in accordance with the *Waste Management and Pollution Control Act 1998* (NT). Santos' Oil Pollution Waste Management Plan (BAA-201_0027) provides detailed guidance to the WSP in the event of a spill.

13.2 Implementation guidance

Table 13-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-2: Implementation guidance – waste management

	Action	Consideration	Responsibility	Complete
Initial actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Incident Response Telephone Directory (SO-00-ZF-00025.020) for contact details.	Logistics Section Chief	☐
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations.	It is better to overestimate volumes and scale back resources then to underestimate waste volumes.	Logistics Section Chief Planning Section Chief	☐
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established.	Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through the NT Department of Environment, Parks and Water Security (DEPSW) via the NT Environment Protection Authority.	Logistics Section Chief Planning Section Chief Environmental Unit Leader	☐
	For each receival location indicate the anticipated: + material types + material generation rates + material generation quantities + commencement date/time + anticipated clean-up duration + receptacle types required + logistical support requirements + any approvals required from Ports, Local Governments, Landowners, State Government Agencies (Refer to Oil Pollution Waste Management Plan (BAA-201_0027)).	Consider facilities for waste segregation at source.	Logistics Section Chief Planning Section Chief	☐
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP.	Waste management should be done in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT); WA DoT Waste Management Guidelines (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	Logistics Section Chief (or delegate) Planning Section Chief WSP location Responsible Person or Operations Supervisor	☐

	Action	Consideration	Responsibility	Complete
	Mobilise waste management resources and services to agreed priority locations.	-	WSP location Responsible Person or Operations Supervisor Logistics Section Chief	☐
Ongoing actions	Provide ongoing point of contact between IMT & WSP.	If NT IMT is the Control Agency then the NT IMT shall advise the point of contact between them and the WSP. If WA DoT is the Control Agency, the Deputy Waste Management Coordinator shall be the point of contact between WA DoT and the WSP.	Logistics Section Chief	☐
	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate if any non-compliance is anticipated or detected. Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT); DoT Waste Management Guidelines (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	WSP location Responsible Person or Operations Supervisor	☐
	Ensure records are maintained for all waste management activities, including but not limited to: + waste movements (e.g. types of receptacles, receival points, temporary storage points, final disposal locations) + volumes generated at each site (including total volume and generation rates) + types of waste generated at each site + approvals obtained (as required).	-	WSP location Responsible Person or Operations Supervisor	☐

13.3 Waste approvals

Site clean-up and removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (BAA-201_0027); and where relevant, the *Waste Management and Pollution Control Act 1998* (NT), the WA DoT Waste Management Guidelines and the respective Port, Port Operator and/or Ship Owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through the NT EPA or WA Department of Water and Environment Regulation (DWER).

The DEPWS administers the *Waste Management and Pollution Control Act 1998* (NT) and DWER administers the *Environmental Protection Act 1986* (WA). The EPA is the relevant regulatory Authority for waste management approvals in the NT and DWER is the relevant authority in WA. The Santos Oil Pollution Waste Management Plan (BAA-201_0027) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

13.4 Waste service provider capability

Detailed guidance on Santos' WSP responsibilities for spill response waste management is provided in the Santos Oil Pollution Waste Management Plan (BAA-201_0027).

Key responsibilities of the WSP include:

+ Maintain emergency response standby preparedness arrangements, including:
  - Have access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos 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.
  - Participate in exercises undertaken by Santos.
+ Maintain ability to assist in the Control Agency's IAP and Waste Management Sub-plan process as required.
+ Mobilise resources to waste collection points identified 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.
+ 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 Resource requirements

Based on the worst-case credible spill scenarios for Barossa Development Drilling and Completions activities, Santos does not anticipate that large volumes of waste will be generated. The potential types and total volumes of waste anticipated for each response option are provided in **Table 13-3**.

Table 13-4 summarises the waste storage, treatment and disposal options available to manage waste associated with the spill response options.

Given that large volumes of a waste are not anticipated, storage space on spill response vessels is anticipated to be adequate. However, as soon as the details of an actual spill are available, waste management arrangements to allow a continuous response to be maintained should be reviewed.

The waste products are likely to be transported by vessel from the response location to Darwin Port. Waste will be transported from Darwin Port to licensed waste disposal facilities by a dedicated waste contractor. Santos has existing service agreements with a WSP which include the provision of waste management services during a spill response. Transport to the licensed waste management facilities would be undertaken via controlled-waste-licensed vehicles and in accordance with the *Waste Management and Pollution Control Act 1998* (NT).

Table 13-3: Waste types and volumes anticipated during a Barossa Development Drilling and Completions spill response

Spill response option	Oily liquid waste	Solid liquid waste	PPE and consumables
Monitor and evaluate	None	None	< 1 m^3/day
Mechanical dispersion	None	None	< 1 m^3/day
Wildlife response	< 1 m^3/day	< 1 m^3/day	< 3 m^3/day

Table 13-4: Spill response waste storage, treatment and disposal options

Waste category	On-site storage	Treatment/disposal option
Liquid waste (e.g. recovered oil/water mixture)	Holding on vessels, oil drums, tanks, oil barges and flexible bladders	Recovery (e.g. thermal desorption or fixation process) and recycling Incineration Landfill
Solid waste – PPE and consumables (e.g. oily gloves)	Lined skips, oil drums, industrial waste bags, plastic rubbish bags	Recovery (e.g. thermal desorption or fixation process) and recycling Incineration Landfill
Oiled wildlife response	Industrial waste bags, plastic rubbish bags	Incineration Landfill

13.7 Environmental performance

Table 13-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-5: Environmental performance – waste management

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using 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 WSP for emergency response services
	Response implementation		
	Implement Oil Pollution Waste Management Plan (BAA-201_0027)	WSP to appoint a Project Manager within 24 hours of activation	Incident log
		WSP shall track all wastes from point of generation to final destination	Waste tracking records
		WSP to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports

14. Scientific monitoring

Table 14-1: Scientific monitoring – environmental performance outcome, initiation criteria and termination 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	
Initiation criteria	Refer to individual Receptor SMPs (**Appendix J**)	
Applicable hydrocarbons	**MDO**	**Barossa Condensate**
	✓	✓
Termination criteria	Refer to individual SMPs (**Appendix J**)	

Oil spill scientific monitoring is the principal tool for detecting and quantifying environmental impact and recovery to sensitive receptors from an oil spill. Santos is required to have an oil spill SMP in place for Petroleum activities in Territory/State and Commonwealth waters.

Santos will activate and implement scientific monitoring in Territory/State and Commonwealth waters for hydrocarbon spills in line with its SMPs unless directed otherwise by the relevant Control Agency/s.

14.1 Objectives

The overarching objective of Santos' SMPs is to provide guidance to staff, consultants and contractors in developing monitoring 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 J**.

14.2 Scope

Santos will implement its SMPs, as applicable, for Barossa Development Drilling and Completions activity oil spills across both Territory/State and Commonwealth waters. For oil spills that contact NT shorelines, Santos will liaise directly with the NT IMT and provide all of the required support to implement scientific monitoring on NT shorelines. In the event that control of scientific monitoring in State waters is taken over by WA DoT under advice from the State Environmental Scientific Coordinator, Santos will follow the direction of WA DoT and provide all necessary resources (monitoring personnel, equipment and planning) to assist as a supporting agency.

14.3 Relationship to operational monitoring

Operational monitoring (**Section 10**) is monitoring undertaken to obtain information which will provide situational awareness and assist in the planning and execution of the oil spill response.

Scientific monitoring activities have different objectives to operational monitoring, which influences the monitoring methods likely to be used, the degree of scientific rigour required to meet the monitoring objectives, and the scope of studies. Scientific monitoring may occur in parallel to operational monitoring and is typically conducted over a wider study area, extending beyond the spill footprint. It is also typically conducted over a longer time period, extending beyond the spill response.

Scientific monitoring is designed to provide data for short-term and longer-term environmental effects assessment. This is typically required to be quantitative in nature and appropriate for statistical analyses. However, these two types of monitoring are related, and Operational Monitoring outputs typically inform the final design of the related SMP.

14.4 Scientific monitoring plans

Owing to the diverse nature of sensitive receptors that could be contacted by an oil spill and the different techniques and skillsets required to monitor impact and recovery to these receptors, there are a number of Oil Spill Scientific Monitoring Plans relevant to Barossa Development Drilling and Completions activities (**Table 14-2**). These are detailed further in **Appendix J**; each SMP has corresponding objectives, initiation/termination criteria, methodologies, baseline data sources and analysis and reporting requirements, noting that in a response controlled by the relevant Control Agency, the methodology, termination criteria and analysis/reporting requirements may differ.

Table 14-2: Oil spill scientific monitoring plans relevant to Barossa Development Drilling and Completions activities

Study	Title
SMP1	Marine water quality
SMP2	Marine sediment quality
SMP3	Shorelines and coastal habitats – sandy beaches and rocky shores
SMP4	Shorelines and coastal habitats – mangroves
SMP5	Shorelines and coastal habitats – intertidal mudflats
SMP6	Benthic habitats
SMP7	Seabirds and shorebirds
SMP8	Marine megafauna (incl. Whale sharks and mammals)
SMP9	Marine reptiles
SMP10	Seafood quality
SMP11	Fish, fisheries and aquaculture
SMP12	Whale sharks

14.5 Baseline monitoring

Baseline monitoring provides information on the condition of ecological receptors before, or spatially independent of (e.g. if used in control chart analyses), a spill event and is used for comparison with the post-impact scientific monitoring where required. This is particularly important for scientific monitoring where the ability to detect changes between pre-impact and post-impact conditions is necessary.

In the event of a spill to marine or coastal waters, reactive pre-impact monitoring should, where practicable, be implemented to gather additional data on the current state of the environment.

Santos periodically reviews the status, availability and suitability of existing baseline data sources related to key environmental sensitivities in its areas of operations. **Appendix L** provides further information on Santos baseline data reviews and outlines a baseline date assessment conducted on high priority areas for scientific monitoring in the event of an oil spill associated with Barossa Development Drilling and Completions activities.

14.6 Monitoring service providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos by contracted monitoring service providers (MSPs) and applies to the implementation of SMPs 1 to 12 (**Table 14-2**Table 14-2). These services are provided by Santos' Monitoring Service Provider. **Appendix L** provides further information regarding the Monitoring Service Provider's capability and assurance arrangements.

For whale sharks, scientific monitoring of whale sharks (SMP12) along the Ningaloo Coast and north-west Australian coastline will be undertaken. Santos has historically and currently supports research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef conducted by Australian Institute of Marine Science. 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.

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

+ 24/7 monitoring support accessed through 24-hour 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 Advisers 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
+ participation in audits, workshops, drills and exercise to facilitate readiness.

Appendix L provides an overview of Santos' processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1–11 are fit-for-purpose to meet the worst-case first-strike monitoring requirements associated with the Barossa Development Drilling and Completions activities.

14.7 Activation

The SMP Activation Process is outlined in **Appendix K.** SMPs are activated as per the initiation criteria for each as outlined in **Appendix J**. The SMP Activation Form is available on the Santos ER SharePoint and Environment Unit Leader folder.

The Santos IMT Environment Unit Leader with support from Environment Unit members is responsible for activating the primary MSP. The Santos Environment Unit will assist the MSP Monitoring Coordination personnel and relevant Technical Advisers 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 Unit Leader will feed back to the IMT for approval. Mobilisation times for the minimum resources that are required to commence initial scientific monitoring operations are listed in **Table 14-3.**

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

Table 14-3: Scientific monitoring – first-strike response timeline

Task	Time from activation
Santos IMT approve initial monitoring plan	<48 hours
Santos to mobilise sampling platforms to deployment location	<120 hours (72 hours from monitoring action plan approval)*

Task	Time from activation
SMP teams and monitoring equipment mobilised to deployment locations	<120 hours (72 hours from monitoring action plan approval)*
Minimum resource requirements	
Initial resourcing requirements will be dependent upon the number of SMPs activated and the requirement for post-spill baseline data to be collected. First-strike personnel requirements for scientific monitoring field teams at SMPAs are presented in **Appendix L**. + Suitable vessels for on-water monitoring or transfer of personnel to remotes areas/islands + Vehicle/s as required + Helicopter for aerial surveys as required + Scientific monitoring personnel for first-strike teams (refer to **Appendix L**) + Scientific monitoring equipment as detailed in the relevant SMP	

* Refer to further details of the response timeframes in **Appendix K**.

14.8 Environmental performance

Table 14-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-4: Environmental performance – scientific monitoring

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		
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 combined EMBA	Regular review of baseline data	Baseline data review report
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil sampling kits located at Darwin	Evidence of deployment to site
	Response implementation		
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAP and subsequent IAPs; and if any criteria	Incident Action Plan and Incident log

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		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		are met, relevant SMPs will be activated	
		If any SMPs are activated, the subsequent activation of MSP is to follow the activation as per the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident log
		MSP shall commence activation process within 30 mins of initial notification form being received from Santos	MSP records
		Santos personnel to support MSP through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident log and Monitoring Service Provider records
	Mobilisation of minimum requirements for initial scientific monitoring operations	Minimum requirements mobilised in accordance with **Table 14-3**	Incident log

15. 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. This decision will be made with consideration of:

+ the efficacy and benefit of current response options
+ any potential for additional pollution
+ any potential for additional environmental damage caused by further clean-up efforts
+ an assessment of prevailing weather conditions that can increase risk to response teams or increase the efficacy in weathering hydrocarbon.

An operational 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 will:

+ 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
+ investigate the cause of the incident and report to relevant authorities
+ assess long-term environmental monitoring requirements.

16. References

Adams, E. E. & Socolofsky, S. A. (2005), Review of Deep Oil Spill Modelling Activity Supported by the DeepSpill JIP and Offshore Operators Committee. December 2004, revised 2005.

Adams, E.E., Socolofsky, S.A., Boufadel, M. (2013). Comment on ''Evolution of the Macondo Well Blowout: Simulating the Effects of the Circulation and Synthetic Dispersants on the Subsea Oil Transport''. Environ. Sci. Technol. 47 (20). http:// dx.doi.org/10.1021/es4034099 (11905–11905).

American Petroleum Institute (API) (2018) Standard 53: Well control equipment systems for drilling wells.

American Petroleum Institute (API). 2020. Industry Recommended Subsea Dispersant Monitoring Plan. Version 1.0. API Technical Report 1152. Accessed 19 April 2023 https://www.oilspillprevention.org/-/media/Oil-Spill-Prevention/spillprevention/r-and-d/dispersants/api-1152-e1-industry-recommended-subsea.pdf

Australian Marine Oil Spill Centre (AMOSC) (2021), AMOSPlan Section III 2021 – Australian Industry Cooperative Oil Spill Response Arrangements. Accessed 19 April 2023 https://amosc.com.au/wp-content/uploads/2021/10/amosplan-2021.pdf.

Australian Maritime Safety Authority (AMSA) (2010). Response to the Montara wellhead platform incident, Report of the incident analysis team March 2010, Accessed 19 April 2023 https://www.amsa.gov.au/file/2425/download?token=e-s0BHkQ.

AMSA (2015). Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities. Prepared by the Australian Maritime Safety Authority, January 2015

AMSA (2017a). Australian Government Coordination Arrangements for Maritime Environmental Emergencies. Prepared by the Australian Maritime Safety Authority, October 2017.

AMSA (2017b). NP–GUI–007: National Plan coordination of international incidents: notification arrangements guidance. Prepared by the Australian Maritime Safety Authority, October 2017. Accessed 20 September 2023 - https://www.amsa.gov.au/marine-environment/national-plan-maritime-environmental-emergencies/np-gui-007-national-plan

AMSA (2017c). National Plan: Coordination of Domestic Cross-Border Incidents. Guidance Note NP-GUI-023. Prepared by the Australian Maritime Safety Authority. Version 1, updated March 2022. Accessed 19 April 2023 - https://www.amsa.gov.au/sites/default/files/np-gui-023-coordination-domestic-cross-border-incidents.pdf

AMSA (2020). National Plan for Maritime Environmental Emergencies. Australian Maritime Safety Authority, Canberra, Australian Capital Territory. Accessed 19 April 2023 - https://www.amsa.gov.au/sites/default/files/amsa-496-national-plan.pdf

Australian Maritime Safety Authority (AMSA) (2021a), Offshore petroleum industry advisory note; Advisory note for the offshore petroleum industry on environmental plans and oil pollution emergency plans, Accessed 20th May 2022 - https://www.amsa.gov.au/safety-navigation/navigating-coastal-waters/offshore-activities/offshore-petroleum-industry-advisory

AMSA (2021a), National Response Team Policy (NP-POL-002), 02 March 2021, Accessed 19 April 2023 - https://www.amsa.gov.au/national-response-team-policy.

Australian Petroleum Production and Exploration Association (APPEA) Limited (2021). Australian Offshore Titleholders Source Control Guideline. Rev 0 (approved). June 2021.

Bouchet, P. J., Letessier, T. B., Caley, M. J., Nichol, S. L., Hemmi, J. M., and Meeuwig, J. J. (2020). Submerged carbonate banks aggregate pelagic megafauna intropical Australia. Front. Mar. Sci. 7, 530. doi: 10.3389/fmars.2020.00530

Brandvik, P. J., Johansen, Ø., Farooq, O., Angell, G. and Leirvik, F. (2014). Subsurface oil releases - Experimental study of droplet distributions and different dispersant injection techniques Version 2. A scaled experimental approach using the SINTEF Tower basin. SINTEF report no. A26122. Trondheim, Norway.

CSIRO (2016). Oil Spill Monitoring Handbook. CSIRO Publishing.

Department of Biodiversity, Conservation and Attractions (DBCA) (2022a). Western Australian Oiled Wildlife Response Plan (WA OWRP) for Maritime Environmental Emergencies. Accessed 19 April 2023 at https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

DBCA (2022b). Western Australian Oiled Wildlife Response Manual. Accessed 19 April 2023 at https://www.dpaw.wa.gov.au/management/marine/marine-wildlife/marine-wildlife-response?showall=&start=2

European Maritime Safety Agency (EMSA) (2010). Manual on the Applicability of Oil Spill Dispersants. Version 2.

French McCay, D., Crowley, D. (2018). Sensitivity Analysis for Oil Fate and Exposure Modelling of a Subsea Blowout – Data Report. Prepared for American Petroleum Institute. API Project 2015-110161.

French-McCay, P., Jayko, K., Li, Z., Spaulding, M., Crowley, D., Mendelsohn, D., Horn, M., Isaji, T., Kim, Y.H., Fontenault, J., Rowe, J. (2021). Oil fate and mass balance for the Deepwater Horizon oil spill, Marine Pollution Bulletin. No. 171. October 2021, 112681

Hemmer, M.J., Barron, M.G. And Greene, R.M. (2011) Comparative toxicity of eight oil dispersants, Louisiana sweet crude oil (LSC), and chemically dispersed LSC to two aquatic test species. Environmental Toxicology and Chemistry, 30 (10), 2,244–52.

Hook, S. and Lee, K. (2015). Risk analysis of chemical oil dispersants on the Australian register. APPEA Journal 2015.

International Petroleum Industry Environmental Conservation Association (IPIECA) 2015, Dispersants: Surface application- Good practice guidelines for incident management and emergency response personnel. IPIECA-IOGP Report 532.

ITOPF (2022). ITOPF Members Handbook 2022. Prepared by International Tanker Owners Pollution Federation Ltd. Accessed 19 April 2023 - https://www.itopf.org/knowledge-resources/documents-guides/itopf-handbook/

Lavers, J. L., Miller, M. G. R., Carter, M. J., Swann, G., & Clarke, R. H. (2014). Predicting the Spatial Distribution of a Seabird Community to Identify Priority Conservation Areas in the Timor Sea. Conservation Biology, 28(6), 1699–1709. http://www.jstor.org/stable/24482133

McKinney, K. and Caplis, J. (2017) Evaluation of Oleophilic Skimmer Performance in Diminishing Oil Slick Thicknesses. International Oil Spill Conference Proceedings: May 2017, Vol. 2017, No. 1, pp. 1366-1381.

NASEM (National Academies of Sciences, Engineering, and Medicine). (2020). The Use of Dispersants in Marine Oil Spill Response. The National Academies Press, Washington, DC, 340 pp., Accessed 19 April 2023 – https://www.nap.edu/catalog/25161/the-use-of-dispersants-in-marine-oil-spill-response

NOAA. (2013). Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments. Accessed 19 April 2023 - https://response.restoration.noaa.gov/sites/default/files/Characteristics_Response_Strategies.pdf

National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (2018), At a glance – Oil spill dispersants, July 2018, [Internet, available: <https://www.nopsema.gov.au/sites/default/files/documents/2021-03/A626267.pdf>].

Northern Territory Government. 2021. Territory Emergency Plan. Accessed March 2023, available: https://pfes.nt.gov.au/sites/default/files/uploads/files/2021/NTES_Territory_Emergency_Plan_2021.pdf

Oil Spill Response Limited (OSRL) (2019), Technical Information Sheet: Global Dispersant Stockpile.

Quigg, A., Farrington, J., Gilbert, S., Murawski, S., and John, V. (2021). A Decade of GoMRI Dispersant Science: Lessons Learned and Recommendations for the Future. Oceanography, Vol.34, No.1

RPS (2016). Barossa Field Appraisal Drilling: Hydrocarbon Spill Modelling Study, Report No.: Q0384, Rev 1, 8 May 2016.

RPS (2019a). COP Barossa Development: Condensate Well Blowout Modelling Study, Report No.: MAQ0846J, Rev 2, 21 October 2019.

RPS. (2019b). Inpex VOC & SSDI Modelling: Near-field to far-field investigation stages. Report prepared for INPEX.

Thums, M., Waayers, D., Huang, Z., Pattiaratchi, C., Bernus, J., & Meekan, M. (2017). Environmental predictors of foraging and transit behaviour in flatback turtles *Natator depressus*. Endangered Species Research, 32(1), 333-349. https://doi.org/10.3354/esr00818

Venn-Watson S, Colegrove KM, Litz J, Kinsel M, Terio K, Saliki J, *et al.* (2015) Adrenal Gland and Lung Lesions in Gulf of Mexico Common Bottlenose Dolphins (*Tursiops truncatus*) Found Dead following the Deepwater Horizon Oil Spill. PLoS ONE 10(5): e0126538. https://doi.org/10.1371/journal.pone.0126538

Western Australian (WA) Department of Transport (DoT) (2015). Oil Spill Contingency Plan. Prepared by the WA Department of Transport, January 2015.

WA DoT. (2021). State Hazard Plan – Marine Environmental Emergencies (MEE). Department of Transport, Perth, Western Australia. Accessed 19 April 2023 - https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_StateHazardPlanMaritimeEnviroEmergMEE.pdf

WA DoT (DoT). (2020). Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements. Accessed 19 April 2023 at https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf

Watson, J.E.M., Joseph, L.N. and Watson, A.W.T. 2009. A rapid assessment of the impacts of the Montara field oil leak on birds, cetaceans and marine reptiles. Prepared on behalf of the Department of the Environment, Water, Heritage and the Arts by the Spatial Ecology Laboratory, University of Queensland, Brisbane.

Wilkin SM, Rowles TK, Stratton E, Adimey N and others (2017) Marine mammal response operations during the Deepwater Horizon oil spill. Endang Species Res 33:107-118. https://doi.org/10.3354/esr00811

DPaW and AMOSC. (2014). Pilbara Region Oiled Wildlife Response Plan (WA OWRP). Accessed 19 April 2023 at https://www.dpaw.wa.gov.au/images/documents/conservation-management/marine/wildlife/PROWRP_20141103.pdf

Appendix A Hydrocarbon characteristics and behaviour

Marine diesel oil (MDO)

MDO properties (**Table A-1**) classify it as Group II oil (light-persistent) according to the AMSA (2015) and ITOPF (2022) classifications. In the marine environment, a 5% residual of the total quantity of MDO spilt will remain after the volatilisation and solubilisation processes associated with weathering. For full details on the properties of MDO, see 7.5.3 of the Barossa Development Drilling and Completions EP (BAD-200-0003).

In summary, in the marine environment MDO will behave as follows:

+ Diesel will spread rapidly in the direction of the prevailing wind and waves;
+ In calm conditions evaporation is the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance;
+ Has a strong tendency to entrain into the upper water column (0 m–20 m) (and consequently reduce evaporative loss) in the presence of moderate winds (>10 knots) and breaking waves. However, it re-surfaces when the conditions calm.
+ The evaporation rate of MDO will increase in warmer air and sea temperatures such as those present around the area; and
+ Diesel residues usually consist of heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (Boiling point (BP) < 180°C); a further 34.6% should evaporate within the first 24 hours (180°C < BP < 265°C); and an additional 54.4% should evaporate over several days (265°C < BP < 380°C). Approximately 5% (by mass) of MDO will not evaporate though will decay slowly over time.

Table A-1: Properties of MDO (RPS, 2016)

Hydrocarbon type	Density (kg/m^3)	Dynamic viscosity at 25 °C (cSt)	API	Wax content (%)	Pour point °C	Asphaltene (%)
MDO	829 (@25 °C)	4.0	37.6	0.05	−14	0.05

Barossa Condensate

Barossa condensate is characterised by a low viscosity and is considered a Group I oil (non-persistent) hydrocarbon, as per the grouping classification presented by AMSA (2015). If spilt on the sea surface, the condensate would rapidly spread and thin out resulting in a large surface area of hydrocarbon available for evaporation. The volatile component of Group I oils (non-persistent) tend to dissipate through evaporation within a few hours (ITOPF, 2022). Based upon the Barossa condensate assay, up to 57% of the hydrocarbon would evaporate over the first few hours or day, with up to 79% evaporated after a few days when on the sea surface, depending on weather conditions, sea state and time of year. Only 7% of the condensate is considered persistent, which would eventually breakdown due to the decay (RPS, 2019). Physical characteristics of Barossa condensate are summarised in **Table A-2**.

The fate of the condensate will depend greatly on the proportion that reaches the surface after rising through the water column (RPS, 2019). Condensate at surface will be subject to atmospheric weathering and will be transported by prevailing currents and wind. Condensate that entrains or dissolves in the water column will be transported by prevailing current and hence, will follow a different path. Condensate in the water column will also be subject to different weathering processes in comparison to floating condensate. Hence, discharge conditions (which affect droplet size distributions and rise times) will have a strong influence on exposure risks for surrounding resources (RPS, 2019).

Table A-2: Properties of Barossa Condensate (RPS, 2019)

Hydrocarbon type	Density at 16 °C (kg/m^3)	Viscosity at 10 °C (cSt)	API	Component	Volatile (%)	Semi-Volatile (%)	Low volatility (%)	Residual (%)
				BP (ºC)	<180	180-265	265-380	>380
Barossa Condensate	782	1.35	50.6	% of total	57	22	14	7

Figure A-1 provides the predicted weathering and fates of surface condensate for the largest sea surface swept area at the moderate exposure value. The graph shows that condensate on the sea surface is expected to evaporate rapidly (RPS, 2019).

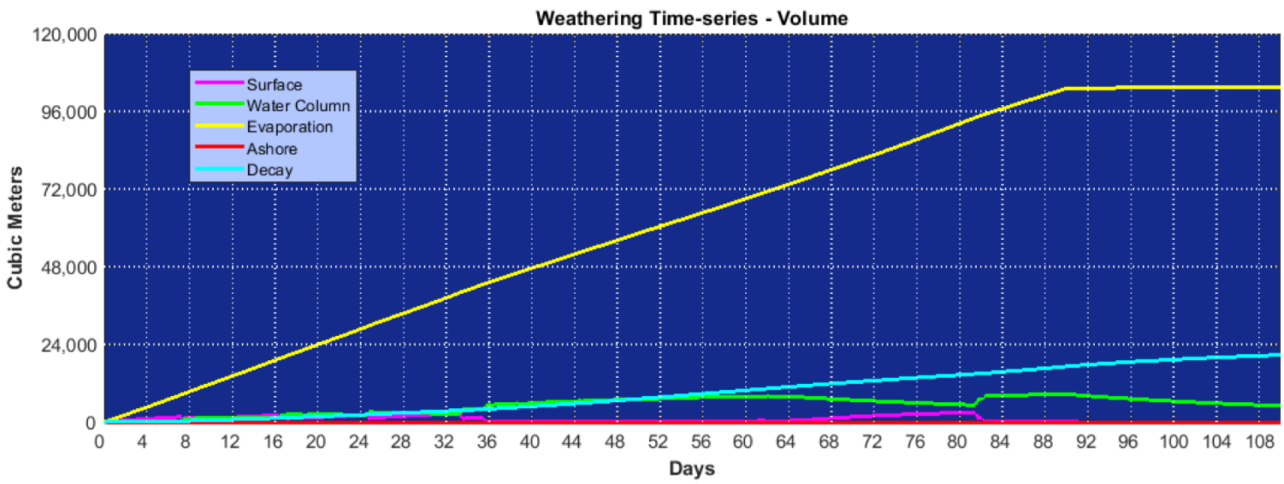


Figure A-1: Predicted weathering and fates graph for the trajectory with the largest sea surface swept area at the 10 g/m^2 exposure value (RPS, 2019)

Appendix B Oil Spill Response ALARP Framework & Assessment

ALARP Assessment Framework

Rationale

As part regulatory approval requirements for petroleum activities, the EP and/or Oil Pollution Emergency Plan (OPEP) must demonstrate that through the implementation of all reasonable control measures, environmental risks have been reduced to a level that is As Low As Reasonably Practicable (ALARP).

With respect to hydrocarbon spill risk and response planning, this includes an assessment to demonstrate that the oil spill response control measures are reducing risk to a level that is ALARP.

This ALARP Assessment Framework provides a process to facilitate the identification of all existing and potential spill response control measures, the selection or rejection of which are supported by reasoned arguments.

Guidance documents

Guidance documents used in the preparation of this framework include:

+ Oil Spill Risk Assessment and Response Planning Procedure SO-91-II-20003;
+ NOPSEMA Guidance Note ALARP N-04300-GN0166, 1 August 2022;
+ NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020;
+ NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721, 16 December 2022;
+ NOPSEMA Guidance Note Risk Assessment GN0165, 24 June 2020; and
+ NOPSEMA Oil Pollution Risk Management GN1488, 7 July 2021.

Overview

The ALARP Assessment Framework uses activity-specific information to systematically assess existing and potential control measures and ensure that all practicable control measures are identified and documented.

When selecting controls to reduce risk is it good practice to apply a preferential order; elimination, substitution, prevention, reduction and mitigation. In the context of this ALARP Assessment Framework for oil spill response, all control measures are response strategies to reduce the impacts of an unplanned event that has already occurred. All source control response measures may be classed as 'reduction' in the hierarchy of controls with all other response measures classed as 'mitigation'.

The ALARP Assessment Framework is shown in **Figure B-1.**

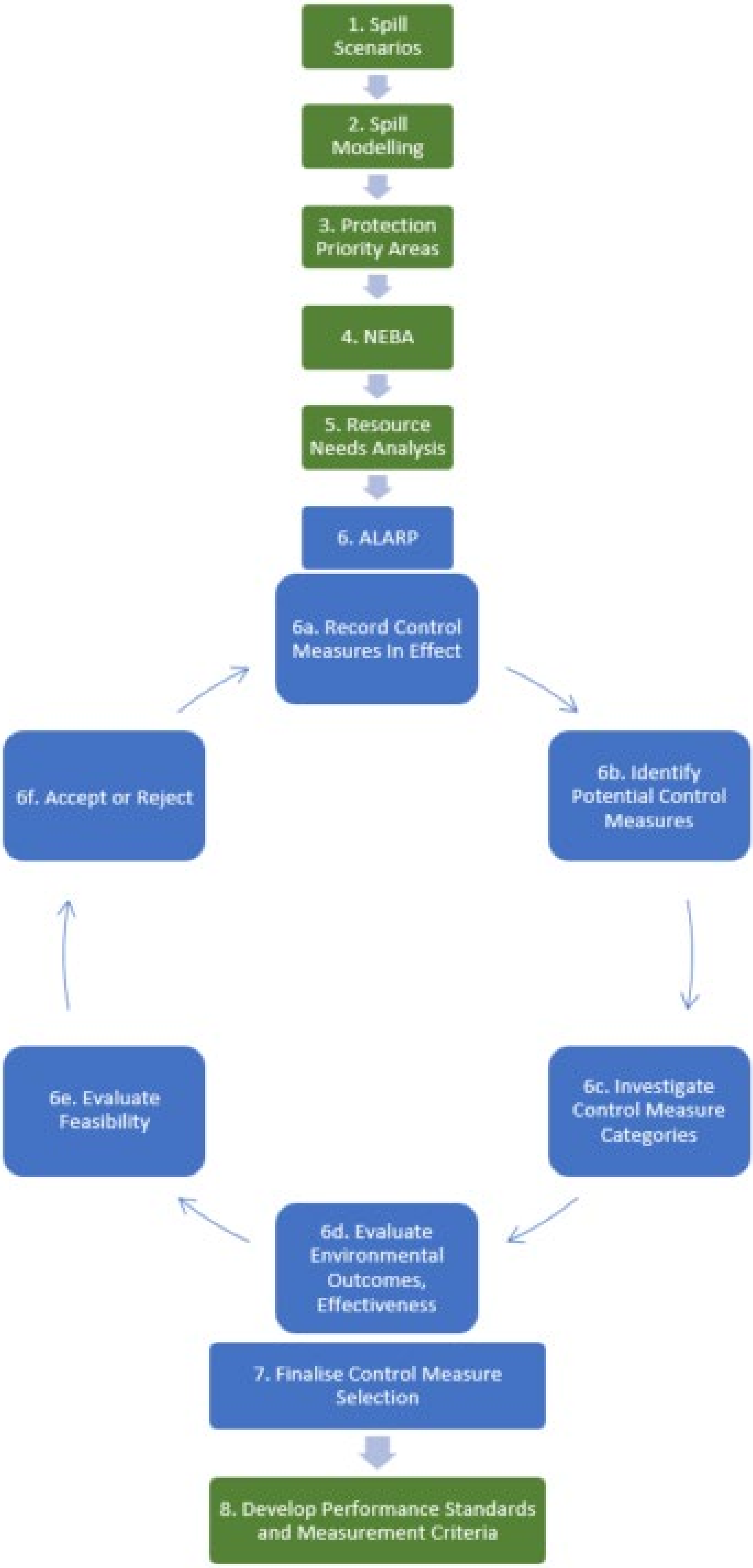


Figure B-1: ALARP Assessment Framework

In **Figure B-1**, Steps 1 to 5 (in GREEN) denote input information into the ALARP Assessment Framework. This information comprises:

1. **Spill Scenarios**: This step will involve assessing all possible spill scenarios from the activity and identifying the worst-case credible scenarios as a basis for pollution response planning.
2. **Spill Modelling**: A quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.
3. **Protection Priority Areas**: The Environment that may be Affected (EMBA) is the largest area within which impacts from hydrocarbon spills associated with the activity could extend. The EMBA is predicted using spill modelling results from Step 2. Protection Priority Areas are locations of high ecological value within the EMBA that would be targeted in response. Selection of Protection Priority Areas is detailed in the Oil Spill Risk Assessment and Response Planning Procedure SO-91-II-20003
4. **NEBA**: Net Environmental Benefit Analysis (NEBA) is used to select the most effective response strategies to protect the Protection Priority Areas identified in Step 3.
5. **Resource Needs Analysis**: For the response strategies identified through NEBA, the worst-case resource, timing, and location requirements are determined, using quantitative spill modelling information where applicable. An Implementation Guidance is then developed to detail what arrangements and actions are required to be initiated by the Incident Management Team (IMT) to meet the incident requirements up to a worst-case incident.

Through the development of the Implementation Guidance, it may be possible to identify resource, timing and location requirements that could be improved. These areas of improvement should be noted in the ALARP so that additional, alternative or improved control measures can be considered in this context.

A detailed ALARP Assessment Framework for the evaluation of control measures is shown in **Figure B-1**, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in **Table B-1**.

+ 6a - Record Control Measures In Effect: The spill response control measures currently in place for Santos Offshore are listed here. The environmental outcomes and effectiveness of the in-effect control measures are noted, using the Resource Needs Analysis to assess whether there are any areas of improvement. Environmental outcomes include potential harmful effects of control measures.
+ 6b - Identify Potential Additional Control Measures: Potential control measures are identified, with a focus on any control measures that address areas of improvement identified in Step 6a.
+ 6c - Investigate Control Measure Categories: In-effect and potential control measures from Steps 6a and 6b are classified as either additional, alternative or improved, and as either people, system, equipment or procedures. This step serves as a prompt to ensure that potential control measures from all categories are explored.
+ 6d - Evaluate Environmental Outcomes, Effectiveness: The environmental outcomes and effectiveness are assessed for all control measures identified and described through Steps 6a, b, and c.
+ 6e - Evaluate Feasibility: Time, cost and effort required for implementation are assessed for all control measures identified and described through Steps 6a, b, and c.
+ 6f - Accept or Reject: The potential control measure will be accepted or rejected on the basis of environmental outcomes and effectiveness described in Step 6d and whether cost is grossly disproportionate, as described in Step 6e.

When evaluating potential control measures, implementation plans of in-effect control measures are carefully considered to ensure that any accepted control measures will equal or improve Santos capacity to meet resource needs. Potential control measures are also considered within the context of current Santos response arrangements to determine if synergies or resource conflicts might occur.

As control measures are evaluated for selection or rejection, they can be compared with industry good practice to ensure that all practicable control measures were implemented. Where unique circumstances exist and further analysis is required, a different evaluation technique may be used, such as technical analysis, detailed cost benefit analysis or combination of approaches.

New information on risks, impacts and response strategies obtained through analysis of operations, exercises and scheduled documentation reviews can be incorporated into the ALARP Assessment Framework cycle in a process of continual improvement.

In **Figure B-1**, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

7. Finalised Control Measure Selection: Outputs from the ALARP Assessment shown in Step 6 comprise finalised control measures (in BLUE).
8. Develop Performance Standards and Measurement Criteria: For each control measure finalised in Step 7, performance standards and measurement criteria are then developed and documented in the OPEP (in GREEN).

Performance standards for all accepted control measures should be written to enable the operator to measure, monitor and test effectiveness. Only the key aspects of any given control will require performance standards and these may include the various measures of effectiveness; functionality, availability, reliability, survivability, dependency and compatibility. Parameters set in the performance standard should be 'SMART'; specific, measurable, appropriate, realistic and timely.

Corrective action based on deviations or trends in performance should be taken by amending either the performance standard or the control measure, as appropriate.

Criteria and definitions

Standardised criteria and definitions are used to bring consistency to the ALARP assessment across diverse activities and response strategies. Criteria and definitions are shown in **Table B-1**.

Table B-1: Criteria and definitions of ALARP Assessment Framework

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721, December 2022
Control Measure Category	A range of different types of controls generally provide effective protection as they provide independence and multiple layers of protection. The OPGGS(S) Regulations refer to technical and 'other' controls where technical control measures involve hardware like shutdown valves and alarms. 'Other' control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: People – personnel

Column	Description
	System – organisation, information/communications, support facilities, training/ competency Equipment – equipment Procedures – doctrine Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using the following six criteria. **Functionality** + The functional performance of a control measure is what it is required to do. How does the control perform in order to achieve the required risk reduction? **Availability** + Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. **Reliability** + The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do with the probability that the system will function correctly and is usually measured by the mean time between failure. **Survivability** + Whether or not a control measure is able to survive a potentially damaging event such as fire or explosion is relevant for all control measures that are required to function after an incident has occurred. + To achieve their purpose, oil spill response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. **Dependency** + The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the failure of others, then the control measures are not independent, and it may not be appropriate to count such measures as separate. + Several control measures are reliant on equipment, people and vessels, hence have high dependence. **Compatibility** + Whether or not a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020
Feasibility	Feasibility describes the time, cost and/or effort required to implement the Control Measure.
Accept/ Reject	Outcome of assessment and key reasons for the decision

ALARP assessment summary
Source Control
The Control Measures in place for emergency BOP activation represent industry best practice and are considered to reduce the timeframe for BOP activation to ALARP in the context of a LOWC incident. The use of a BOP is considered to be an effective source control and the emergency BOP activation procedures ensure timely activation of the BOP. No additional or alternative control measures were identified. The Control Measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable in the context of the risk of an uncontrolled well leak from a production well. Potential Control Measures were identified and assessed by the Santos WA Drilling & Completions Department representatives. The drilling of a relief well is considered to be an effective control and relief well planning conducted in the area has demonstrated that relief well drilling within 90 days can be implemented using the MODU, equipment and specialist personnel that Santos has arrangements to gain access to. Santos has arrangements in place to enable access to a Capping Stack as a secondary source control strategy and would only be used where there is suitable vertical access over the wellhead. These arrangements also include trained personnel for the mobilisation, deployment and operation of the Capping Stack. Limiting factors for the deployment of a Capping Stack involve safety and technical constraints, metocean conditions, location of Capping Stacks and access to a suitable Capping Stack capable vessel. Santos assessed the feasibility of maintaining its own Capping Stack and having suitable deployment vessel/crew on standby to deploy a Capping Stack. Given the low likelihood of a blowout event, the significant upfront costs involved and the presence of a more effective primary control strategy (relief well drilling) the costs are considered disproportionate to the level of risk reduction. Fifteen additional/alternative/improved Control Measures were identified and assessed. One additional Control Measures were accepted as reasonably practicable. Accepted Control Measure was: + Pre-purchase of relief well drilling supplies. Fourteen Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Have dedicated BOP Intervention vessel equipped with ROV tooling package in field. + Purchase and maintain own Capping Stack in Darwin. + Incentivise a vendor to set up a Capping Stack in Darwin. + Purchase and maintain own Capping Stack and have suitable deployment vessel/crew on standby with pre-approved Safety Case to deploy Capping Stack. + Transport WWCI Capping Stack via air. + Use lightweight Rapid Cap to be mobilised via air from Houston, USA. + Suitable Capping Stack deployment vessel is confirmed to be available prior to drilling + Preposition WWCI Capping Stack standby crew in Perth. + Have relief well MODU on standby at activity location. + Alternative relief well design (slim hole design) + Schedule drilling campaign to avoid cyclone season. + Contract source control personnel through a provider in addition to existing arrangements. + Have Wild Well Control on standby in Perth during drilling operations in order to respond immediately to a LOWC. + Pre-drill riserless intervals for a potential relief well before drilling the main well. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 9-9**.
Monitor and evaluate
Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture in the incident.

ALARP assessment summary
Eight additional potential Control Measures were identified and assessed. Three additional Control Measures were accepted as reasonably practicable. The accepted Control Measures were: + Have two tracking buoys available in Darwin. + Require that vessel specifications be included in Vessel Tracking System. + Maintain a list of providers that could assist with fauna aerial observations. Five Control Measures were rejected as grossly disproportionate. Rejected Control Measures were: + Purchase oil spill modelling system and internal personnel trained to use system. + Have trained water monitoring specialists available in Darwin. + Have trained aerial observers based in Darwin. + Ensure trained marine mammal/fauna observers based at strategic locations such as Darwin. + Possibly use for surveillance purposes two vessels servicing Bayu-Undan operations in response to a spill. Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in **Table 10-34**.
Subsea Dispersant Injection
For a Barossa subsea LOWC, SSDI application is considered a secondary response strategy and is included only for its potential to reduce VOC exposure to response personnel working close to the well site (e.g. to deploy a Capping Stack). To assess the effectiveness of dispersant application, Santos will use the Industry Recommended Subsea Dispersant Monitoring Plan (API, 2020). Control Measures are in place for a rapid mobilisation of the SFRT, personnel and dispersants to Darwin; it is estimated that it will be ready to commence operations by day 11 to 12. A Control Measure involving the positioning of an SFRT on standby at a regional port in order to reduce deployment time was assessed but was found to be disproportionate in terms of costs to the reduction in risk gained. Dispersant volumes available within Australia and the mobilisation of these stocks exceed worse case requirements, hence dispersant is not a limiting factor to the SSDI operation. Seven additional Control Measures were identified and assessed. No additional Control Measures were accepted as reasonably practicable. All seven additional Control Measures were rejected as grossly disproportionate. Rejected Control Measures were: + Purchase Santos SFRT to be located in Darwin. + Relocate AMOSC SFRT to Darwin. + Position subsea bladder dispersant system next to well site. + Transport WWCI SSDI system from Singapore as a back-up unit. + Enable improved vessel access by contracting a suitable, dedicated vessel on standby. + Gain access to additional dispersant stockpiles owned by Santos. + Rent dispersants and position in Darwin. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 9-9**.
Mechanical dispersion
Mechanical dispersion is a secondary strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment, and no areas of improvement were identified. The use of mechanical dispersion in a response would be assessed as part of an operational NEBA. No potential additional Control Measures were identified and assessed. Performance standards and measurement criteria that have been developed for the in-effect Control Measures are shown in **Table 11-4**.

ALARP assessment summary
Oiled wildlife
Santos has developed a Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) as a Control Measure to ensure that a procedure is in place for OWR, where they are the control agency or Support Organisation, in order to provide an effective and coordinated OWR. Santos has access to the indicative resource requirements for the worst-case scenario in **Table 6-1** as per the WA Oiled Wildlife Response Plan, including mobilisation of AMOSC oiled wildlife equipment and industry OWR team to a forward staging area within 48 hours. AMSA also maintains an oiled wildlife washing container in Darwin. Potential Control Measures around additional responders through pre-hiring or contracts with additional service providers were investigated but were found to be not beneficial and/or the cost was grossly disproportionate to risk reduction. Three potential additional Control Measures were identified and assessed. All were rejected as grossly disproportionate. Rejected Control Measures were: + Have additional Santos OWR trained personnel positioned in Darwin. + Pre-hire and/or preposition staging areas and responders. + Use direct contracts with service providers. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 12-5**.
Waste
The Santos contract with the waste service provider has provisions for waste management operations of the scale estimated to be required in worst case scenarios detailed in **Table 6-1**. Further detail is captured in the Waste Management Plan – Oil Spill Response Support (BAA-201_0027). The waste service provider can mobilise waste receptacles to Darwin Port within 12–24 hrs. Given the waste service provider arrangements and preplanning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. For these components, potential Control Measures were identified and evaluated but were found to either make no improvement in capability or cost was grossly disproportionate. An area of improvement is the availability of vessels required for waste transport at sea. One potential additional Control Measure to address this area of improvement was identified and accepted: + Maintain contracts with multiple service providers to cover new geographic location. Two potential additional Control Measures were rejected as grossly disproportionate. Rejected Control Measures were: + Procure temporary waste storage for Santos stockpile. + Contract additional vessels on standby for waste transport. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 13-5**.
Scientific monitoring
Oil spill scientific monitoring will be conducted on behalf of Santos by a contracted monitoring service provider as detailed in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and the relevant Scientific Monitoring Programs. An area of improvement is the availability of vessels in the initial stages of response. To address this area of improvement, a potential Control Measure around more detailed vessel tracking was assessed and accepted. Additionally, three potential additional/improved Control Measures were identified and assessed. One Control Measure, having trained scientific monitoring personnel and equipment on standby in Darwin was rejected as disproportionate. Two potential Control Measures relating to maintaining equipment and lists of monitoring providers and the provision of water quality sampling kits to be located at strategic regional locations were both found to be reasonable and practicable, both were adopted. Four additional/improved potential Control Measures were identified and assessed. Three improved Control Measures were accepted as reasonably practicable. The accepted Control Measures were: + Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans. + Position oil sampling kit for scientific monitoring personnel at Darwin.

ALARP assessment summary
+ Determine required vessel specifications required for scientific monitoring implementation and improve accuracy of Vessel Tracking System. One Control Measure was rejected as grossly disproportionate. The rejected Control Measure was: + Have scientific monitoring personnel and equipment on standby in Darwin. Performance Standards and Measurement criteria that have been developed for the in effect and accepted Control Measures are shown in **Table 14-4**.

ALARP Assessment Worksheet

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Subsea First Response Toolkit (SFRT) - refer to SSDI tab.							
Blowout Preventer - Emergency Activation	Access to ROV capability for BOP hot-stab intervention maintained with MODU ROV contractor throughout the drilling program	In effect	Equipment	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts. BOP closed within 4-5 days.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of contract	In effect
	Dedicated BOP Intervention vessel equipped with ROV tooling package in field	Alternative	Equipment	BOP closed within 1-2 days (depending upon daylight hours available) reducing release of hydrocarbons by 2-3 days.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Costs associated with having an additional dedicated BOP intervention vessel on contract $50-60K USD/day.	Reject Removes limitation of having to wait 2-3 days for a suitable vessel. However, the cost of having a vessel on standby is a fixed cost, regardless of if a spill were to occur or not. The time saving of 2-3 days is not proportionate to the expense incurred.
Capping Stack	Capping stack is applicable as a secondary strategy for subsea wells and BOPs to be used. Santos has access to two Wild Well Control capping stacks (Singapore and Aberdeen). Singapore Capping Stack- Assembly and ready to mobilise will take approximately 6 days + 9 days to mobilise to incident (total= 15 days)	In effect	Equipment	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	Provides functionality, availability, reliability, survivability, compatibility and independence. Would only be used where there is suitable vertical access over the wellhead	Cost of contract	In effect
	Santos to purchase and maintain its own capping stack in Darwin	Alternative	Equipment	This is unlikely to provide any reduction in timeframes due to vessel access being the key time driver. In order for this to be effective, a suitable vessel would need to be on standby (with personnel) to realise benefit of capping stack in Darwin.	A capping stack positioned in Darwin would need to be disassembled and stored at a suitable location as there is no suitable locations to store a fully assembled capping stack. Unpacking the containers, assembly and testing of the capping stack is estimated to take 4-5 days, but the limiting factor will be the availability of a suitable vessel.	USD20 million to procure and USD 2.8 million per year to maintain	Reject Given access to the capping stack is in Singapore, there is no significant benefit in having a dedicated capping stack available in Darwin. Critical path time will most likely be sourcing and the availability of a suitable vessel, which is most likely to be in SE Asia i.e. the vessel would have to be made available and mobilised to Australia for any response regardless of capping stack location. Therefore, the additional cost in owning and maintaining a dedicated stack is unlikely to provide any significant environmental benefit.

	Incentivise a vendor to set up a capping stack Darwin	Alternative	Equipment	This is unlikely to provide any reduction in timeframes due to vessel access being the key time driver. In order for this to be effective, a suitable vessel would need to be on standby (with personnel) to realise benefit of capping stack in Darwin	This would result in needing to moving an existing stack away from a shared logistics hub, such as Singapore. This could potentially affect other operators sharing this contracted resource. In addition, there is no local expertise available on standby in Darwin to conduct maintenance or commence assembly operations if the capping stack was required.	Pay full time rental as a sole beneficiary.	Reject Critical time path will be sourcing and availability of a suitable vessel, which is most likely to be in SE Asia. Therefore, the additional cost in requesting a vendor to set up an existing capping stack in Singapore is unlikely to provide any significant environmental benefit.
	Purchase and maintain own capping stack and have suitable deployment vessel/crew on standby with pre - approved Safety Case to deploy capping stack	Alternative	Equipment People	Some debris removal may be required prior to Capping Stack installation. The SFRT would not be onsite until day 11-12 and then debris removal may take 1-2 days (depending on extent of damage). This option would therefore reduce Capping Stack deployment time by 1-2 days and only marginally reduce volume of oil contacting sensitive receptors.	A capping stack positioned in Darwin would need to be disassembled and stored at a suitable location as there is no suitable locations to store a fully assembled capping stack. Unpacking the containers, assembly and testing of the capping stack is estimated to take 4-5 days, but the limiting factor will be the availability of a suitable vessel. Purchasing a capping stack would also require training of personnel to maintain and install the stack, if it was required to be used. However, these personnel may not have the depth of experience that existing specialist personnel have whom are available through WWC, reducing the reliability and compatibility of this alternative.	Costs in addition to Capping Stack purchase/ maintenance costs are $80k USD per day for vessel/crew plus training costs for personnel.	Reject Based on drilling ~90 day well the costs of vessel/crew hire would be in the order of $5M additional to Capping Stack purchase/maintenance costs and not including mobilisation costs. Capping Stack deployment is a secondary source control strategy, is contingent on safety and technical considerations, and may not be effective in controlling the source. Given the low likelihood of a blowout event, the significant upfront costs involved and the presence of a more effective primary control strategy (relief well drilling) the costs are considered disproportionate to the level of risk reduction.

	Transport WWCI capping stack via air	Alternative	Equipment	The mobilisation time of the capping stack intervention system via airfreight is unlikely to provide a significant reduction in arrival time of the stack. The capping stack would need to be mobilised and flown into Darwin (3-5 days) and then assembled and tested (3-4 days). It would then need to be transferred and fastened on to the deployment vessel (1-2 days) and mobilised to the well site (1 day). This results in a total of 12 days. Therefore, this option is not expected to result in a significant improvement in arrival time of the capping stack, thus not resulting in any significant environmental benefit.	Air transportation of the capping stack requires it to be disassembled, which may affect the functionality of the stack if any components are damaged. The process of disassembly, packing, transport, unpacking and reassembly introduces a risk of damage to equipment, especially the metal pressure sealing surfaces associated with the high pressure connections of capping stacks. While the metal sealing rings have the strength to withstand very high pressures, they require a very smooth sealing surface to form a pressure seal. Mechanical handling of sealing components during capping stack disassembly risks damage to the smooth sealing surfaces and could result in additional time necessary to prepare the capping stack for deployment. Individual pressure sealing equipment elements must be packed separately. Damage to sealing surfaces may render the capping stack unusable until repairs can be undertaken at a certified machine shop. Therefore, air transportation adds an element of risk to the reliability of this alternative.	Cost of contracting Boeing 747 or Antonov 124 to transport the containers to Darwin.	Reject The risk associated with damaging equipment from airfreighting the capping stack and the minimal improvement in mobilisation time (12 days v's 15 days) is considered disproportionate to the incremental environmental benefit.
	Use of lightweight Rapid Cap to be mobilised via air from Houston, USA.	Additional	Equipment	The mobilisation time of the rapid cap would take approximately 10+ days, not resulting in any significant environmental benefit.	Airfreighting this cap in from Houston would not lead to any significant reduction in the estimated response time (10 days v's 15 days for preferred alternative of shipping Singapore stack). This is due to debris clearance taking 10+ days. Use of the Rapid Cap would only mitigate very specific cases (e.g. no debris) and industry experience indicates debris removal is likely for catastrophic failures. Although this lightweight cap only requires a lighter construction vessel with lesser specification on the crane and heave compensation, it is most likely this vessel will still need to be sourced from SE Asia.	Cost of having an additional contract for another capping stack.	Reject The mobilisation time of the rapid cap would take approximately 10+ days as the critical time path is likely to be debris clearance. The cost of having another contract with another equipment provider is disproportionate to the minimal environmental benefit gained.
	The location of suitable vessels (required vessel specs and Safety Case approval) for capping stack deployment are monitored monthly.	In effect	Procedure	Timely access to a suitable vessel could reduce mobilisation times for the capping stack thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	Suitable Capping Stack deployment vessel is confirmed to be available prior to drilling	Additional	Procedure	Timely access to a suitable vessel could reduce mobilisation times for the Capping Stack thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect

	Wild Well Control staff available via contract to assist with the mobilisation, deployment, and operation of the Capping Stack and well intervention equipment	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract	In effect
	Preposition WWCI Capping Stack standby crew in Perth	Additional	People	No environmental benefit as WWC personnel are available to provide support within 72 hours.	No change to effectiveness or reliability as WWC personnel available within a rapid timeframe under existing arrangements.	Significant additional costs in having WWC personnel on standby in Perth. Locating personnel with specialised expertise in Perth may also create issues for other operators, as WWC offer this service to multiple operators. Locating them in remote locations may increase travel times to other global locations if they are required.	Reject No environmental benefit in having access to personnel surplus to requirements
Relief well drilling	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract/ MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	This control measure provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Cost of contracts/ MOUs	In effect
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process top follow in the planning and mobilisation for relief well drilling by Santos WA Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	In effect
	MODU Capability Register is monitored monthly	In effect	Procedure	By monitoring MODU, it will be possible to gain an understanding of which MODU may be rapidly available for relief well operations. This could reduce mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	Relief well MODU on standby at activity location	Improved	Equipment	Reduce mobilisation times of MODU to drill relief well thus reducing hydrocarbon released to the environment. Instead of base timeframe for the drilling of a relief well of 90 days, relief well potentially could be drilled in 54 days (90 days less the 36 days required for MODU to be ready to spud/commence relief well operations).	Improved availability	The cost of having a MODU on standby is approximately $600,000 per day. If adopted this cost is paid regardless if there is a loss of containment or not.	Reject Likelihood of LOWC is considered unlikely and the cost of having a second MODU on standby at location is considered grossly disproportionate to the environmental benefit.

	Alternative relief well design (slim hole design)	Alternative	Equipment Procedure	Reduced relief well drill duration, potentially reducing volume of hydrocarbon released into the environment.	The alternative Barossa relief well design considered the construction of a smaller diameter well, which takes less time to drill. However, this relief well design had an unacceptable potential risk of not enabling the required rates of kill mud to be delivered during the dynamic kill operation.	Reduced cost compared to large diameter casing design	Reject This alternative presented an unacceptable potential risk of not enabling the rates of kill mud to be delivered during the dynamic kill operations, therefore was excluded as being ALARP for technical reasons. The relief well is required to be constructed using the same large diameter casing as the Barossa development wells, which eliminates the mud rates risk in comparison to the slim hole design.
	Suitable relief well confirmed to available prior to drilling	In effect	Procedure	Identification of a suitable MODU prior to drilling would decrease the time spent searching for a suitable MODU in the event of a spill, reducing mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	Regular monitoring of Relief Well Availability Register to ensure preferred MODU remains available throughout the activity	In effect	Procedure	Monitoring the Register will ensure Santos are aware of any changes in availability of suitable MODUs, enabling Santos to update the Source Control Plan and identify an alternative suitable MODU if the event a MODU changes location.	Provides availability, reliability, compatibility and independence	Effort spent monitoring	In effect
	Schedule drilling campaign to avoid cyclone season	Alternative	Procedure	Drilling the well in cyclone season does not increase the likelihood of a loss of containment. This will be verified by NOPSEMA in the accepted WOMP, where the plan to suspend the well during a cyclone will be assessed.	Does not alter the effectiveness of the response strategy.	Having to mob and de-mob a MODU to guarantee the well could be drilled outside of cyclone season would be a >5MM USD cost increase.	Reject There are no additional risks associated with cyclone season on a loss of well control. The barriers installed for cyclone suspension are independent of metocean conditions. Adjusting the timing would preclude the ability to drill for 6 months of the year, materially reducing the MODUs available to do the work. Having to mobe and de-mobe a MODU to guarantee the well could be drilled outside of cyclone season would be a >5MM USD cost increase, which is disproportionate to the benefit gained.

	Pre purchase of relief well drilling supplies	Additional	Equipment	Relief well drilling supplies such as casings and well head equipment could potentially reduce relief well drilling times	Increase in availability	Cost of purchase, maintenance and storage of supplies	Accept Offshore D&C commit to having long lead equipment for a relief well at our disposal as part of WOMP commitments for each well drilled.
	Direct Surface Intervention Via Well Control Experts	In effect	Procedure	Reduce time taken to control source and reduce environmental impacts	1) Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. 2) Mobilisation procedure for personnel as per SCERP 3-4) Contracts and Mou's for well control personnel (WWC)	Ability to implement and effectiveness of this control can only be determined at the time of an incident.	In effect
	Relief well design assessment to identify and screen relief well spud locations prior to drill campaign	In effect	Procedure	Reduce time taken to plan and execute relief well, and reduce environmental impacts	Improved availability and reliability	Effort required to conduct relief well assessment	In effect
	Contract source control personnel through an alternative provider in addition to existing arrangements	Alternative	People	No environmental benefit if existing service provider is adequate to fulfil requirements.	Improved availability and reliability	Significant additional cost in maintaining two contracts for the same service	Reject No environmental benefit in having an additional service provider
	Wild Well Control personnel on standby in Perth during drilling operations in order to respond immediately to a LOWC	Additional	People	No environmental benefit as WWC personnel are available to provide support within 72 hours which will coincide with starting to commence sourcing of relief well MODU	No change to effectiveness or reliability as WWC personnel available within a rapid timeframe under existing arrangements.	Significant additional costs in having WWC personnel on standby in Perth. Locating personnel with specialised expertise in Perth may also create issues for other operators, as WWC offer this service to multiple operators. Locating them in remote locations may increase travel times to other global locations if they are required	Reject No environmental benefit in having access to personnel surplus to requirements
	Pre-drill riserless intervals for a potential relief well before drilling the main well	Additional	Equipment Procedure	Could reduce relief well drill duration by 10 days. However, this activity would result in drill cuttings/discharges being released to the marine environment and noise emissions regardless if a LOWC were to occur or not.	Detailed relief well designs will be re-evaluated and revised for an actual LOWC event. There will be several locations for the relief well identified before an incident, with the optimal location selected after a LOWC incident, based on real-time information (i.e. prevailing weather). A pre-drilled relief well top-section might result in having to use a sub-optimal design and location. It is not industry practice, and such a pre-drilled riseless interval may adversely affect functionality and reliability of this response strategy.	The pre-drilling activity itself would require approximately 10 days and a complete rig move to perform, costing approximately 6-7MM USD. Once the main well was completed, the partially completed relief well would need to be abandoned, at a further cost of 6-7MM USD.	Reject This option may result in a sub-optimal relief well location being used. There is minimal environmental benefit gained for the grossly disproportionate costs associated with this option.
Source Control - Vessel Collision	Vessel Spill Response Plan (SOPEP/SMPEP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Vessel Contractor thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Effort required in contractor procedure due diligence.	In effect
No alternate, additional or improved control measures identified							

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ROV survey	ROV Survey conducted at the release point to determine the nature of the release. This information will inform the applicability of subsea chemical dispersion and initial choice of dispersant injection methods (e.g., number of nozzles, nozzle sizes) and DOR.	In effect	Procedure, equipment	SSDI can break-up oil droplets forcing greater entrainment of the oil into the water column below the sea surface. Has ability to reduce volatile organic compounds in the vicinity of a spill, making the area safer for responders. It typically requires smaller volumes of dispersant to be used as it has a higher encounter rate with the hydrocarbons than surface application.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Costs associated with vessel contract	In effect
No alternate, additional or improved control measures identified							
Subsea First Response Toolkit (SFRT) The SFRT includes debris clearance equipment and subsea dispersant equipment, including a dedicated dispersant stockpile (500 m³ of Dasic Slickgone NS) and ancillary equipment (e.g., pumps, flying leads, coiled tubing head, dispersant wands).	AMOSC SFRT stored at Oceaneering yard in Jandakot and can be transported to Darwin. It is estimated this would take 10 hours to arrange and up to 7 days to load and transport to Darwin, depending on the time of the year. A suitable vessel would be acquired by Santos during this timeframe and arrive in Darwin within 9 days of call-out. Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day 11-12 from call out.	In effect	Equipment	May improve capability to perform subsequent source control measures (e.g. capping stack) by reducing VOCs in the vicinity of the spill site. Equipment needed to clean the area around the wellhead, enable intervention and prepare for relief well drilling and safe installation of a well capping or containment device.	Provides functionality, availability, reliability, survivability, compatibility and independence. Availability - whilst the SFRT takes several days to mobilise to site and conduct initial surveys, this timeframe is considered reasonable given the technical nature of this equipment.	Cost of AMOSC membership for SFRT	In effect
	Purchase of Santos SFRT to be located in Darwin	Improved	Equipment	Reduces mobilisation time between storage and port of deployment	Improved availability however limited by vessel availability to deploy	Cost of SFRT purchase, storage and maintenance	Reject SFRT is estimated to arrive in Darwin only one day before vessel. Taking into account the significant costs of purchasing and maintaining a Santos-owned SFRT, an improvement of 2-3 days mobilisation time is not considered to provide a proportionate benefit.

	Relocate AMOSC SFRT to Darwin	Improved	Equipment	Reduces mobilisation time between storage and port of deployment (Darwin) by approx. 5 days	Improved availability however limited by vessel and personnel availability to deploy	AMOSC unable to alter storage location of SFRT as this could negatively impact other members	Reject Positioning of SFRT in Darwin in order to reduce deployment time was assessed but was found to be disproportionate in terms of costs to the reduction in risk gained and may adversely affect other SFRT members and their committed deployment times.
	Subsea bladder dispersant system positioned next to well site	Alternative	Equipment	Subsea dispersant bladder system can be prepositioned and operate remotely if SSDI is determined a suitable strategy via an operational NEBA. Bladder systems are positioned in framed housings on the seafloor. Autonomous application could commence by Day 1-2, reducing application times by 7-8 days.	Possible improved availability and independence, however technical development and procurement would be required as existing components in the market would need to be combined to develop this system. Placing bladders on the seabed adjacent to the BOP exposes them to risk of damage from debris in the event of a loss of well control. Additionally, bladder systems require extensive equipment and fluid deployment/recovery operations at each wellsite, exposing personnel to significant additional HES risks. Therefore, the design and development of this technology includes a high degree of uncertainty. Subsea bladders also have limited volume capacity, meaning this alternative would offer a short term application option until SSDI arrives via the SFRT.	Purchase of bladder system on top of SFRT membership as both systems would still be required.	Reject Subsea bladder systems are a unproven technology and bring additional risks to the environment and personnel. In addition, the cost of having a subsea bladder system in place is a fixed cost, regardless of if a spill were to occur or not.
	Transport WWCI SSDI system from Singapore	Additional	Equipment	No change as AMOSC SFRT system will arrive before WWCI system.	Would provide a back-up system, however, the complexity of the SFRT is such that backup system is not required.	WWCI SSDI system could be transported in tandem with WWC capping stack.	Reject AMOSC SFRT system is considered adequate and a back up system is not required.
No alternate, additional or improved control measures identified							
Subsea dispersant injection - planning	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a detailed process to follow for the mobilisation of SFRT and suitable vessel by Santos Source Control Team thereby reducing the timeframe and increasing the effectiveness of SFRT.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	In effect

No alternate, additional or improved control measures identified							
Dispersant supply vessels	Level 2: Suitable vessel sourced through Santos contractors. Vessel requirements outlined in Santos Source Control Planning and Response Guideline (DR-00-ZF-1001).	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Suitable vessel sourced through any regional contractors and monitored through Santos Vessel Tracking System.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Suitable vessel sourced as Vessels of Opportunity.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of contracts at the time of requirement.	In effect
	Enable improved vessel access by contracting a suitable, dedicated vessel on standby	Improved	Equipment	This alternative would result in SSDI commencing on Day 5-6, instead of Day 11-12 as vessel would be in Darwin on standby. Although this would treat released hydrocarbons for an additional 6-7 days, this would not result in a net reduction in environmental impacts as no shoreline accumulation is predicted for the worst-case scenario.	Improved availability and reliability	Costs associated with having a suitable vessel on contract and standby in Darwin - $50-60K USD/day.	Reject Removes bottleneck of having to wait for a suitable vessel. However, the cost of having a vessel on standby is a fixed cost, regardless of if a spill were to occur or not. The time saving of 6-7 days is not proportionate to the expense incurred, especially as SSDI is not anticipated to reduce environmental impacts.
Subsea dispersant injection - personnel	Oceaneering personnel for the deployment of the SFRT and SSDI application	In effect	People	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants. May improve capability to perform subsequent source control measures (e.g. capping stack).	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of Oceaneering contract for personnel	In effect
No alternate, additional or improved control measures identified							

Subsea dispersant injection - dispersant stocks	Level 2: Dedicated SFRT dispersant stockpile stored with SFRT at Jandakot (AMOSC, 500m^3 Dasic Slickgone NS). Additional dispersant stocks stored at Darwin (AMSA, 10m^3 Slick Gone EW, 10m^3 Slick Gone NS); Exmouth (AMOSC, 75 m^3 Slickgone NS); Karratha (AMSA, 10m^3 Slick Gone EW, 10m^3 Slick Gone NS); Fremantle (AMOSC, 27m^3 Corexit, 8 m^3 Slickgone NS) (AMSA, 52 m^3 Slick Gone EW, 48 m^3 Slick Gone NS). Available within 24 hours.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contracts, MOU with AMOSC, AMSA	In effect
	Level 3: Dispersant stocks stored at national stockpiles (AMOSC, 761m^3 including 500 m^3 associated with the SFRT) (AMSA, 355 m^3) OSRL dispersant stocks available in Singapore (50% of SLA = 380m^3 and 5,000m^3 as a subscriber to the Global Dispersant Stockpile) Mobilisation times depend on location.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contracts, MOUs with AMOSC, AMSA, OSRL	In effect
	Access to additional dispersant stockpiles owned by Santos	Additional	Equipment	No additional environmental benefit if surplus to requirements	Improved availability and reliability	Additional cost for purchase and maintenance of stockpiles	Reject Analysis indicates that dispersant supplies sufficient. Santos is already subscribing to OSRL stockpiles in excess of 5,000 m^3.
	Rent dispersants and position in Darwin	Additional	Equipment	No additional environmental benefit as existing dispersant stockpiles can be relocated to Darwin and dispersant manufacture can commence in a timeframe where dispersant demand does not exceed supply.	Availability already meets requirements	Additional cost for renting dispersant stockpiles	Reject Analysis indicates that timeframes for mobilising and relocating dispersant supplies are sufficient.

Dispersant effectiveness monitoring	To assess the effectiveness of dispersant application, Santos will use the Industry Recommended Subsea Dispersant Monitoring Plan (API, 2020) to determine the efficacy of subsea dispersant application.	In effect	Procedure	The Industry Recommended Subsea Dispersant Monitoring Plan (API, 2020) to assist in characterising the nature and extent of subsea or near surface dispersed oil, aid in the validation and accuracy of plume trajectory models and allow for rapid quantification of data to enable the IMT to make decisions about continuation of dispersant application. The IMT assesses the effectiveness of continued dispersant use against an operational NEBA assessment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of contracts to provide monitoring capability	In effect
No alternate, additional or improved control measures identified							

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider. The service provider will be contacted immediately (within 2 hours) upon notification of a level 2 or 3 spill. Upon activation, the service provider will provide trajectory models within: - 2 hours for OILMAP model for offshore and open ocean; - 4 hours for OILMAP operations for near-shore; and - Detailed modelling service is available for the duration of the incident.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract	In effect
	Access to additional spill modelling capability through OSRL	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	An additional service provider ensures redundancy (independence) if for some reason the other service provider was unable to fulfil the function. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	Cost of membership	In effect
	Purchase of oil spill modelling system and internal personnel trained to use system	Alternative	System, people	This could result in the faster generation of the initial model which may result in an environmental benefit as a consequence of the IMT making operational decisions quicker	Potentially increases availability Decrease in functionality- in house service may not be across technical advances to same extent as contracted service providers	Purchase of system, training of personnel, and on-call roster	Reject The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2 hour turn-around currently guaranteed by the service provider
Tracking buoys	Level 1: Two tracking buoys available on MODU. Ready for deployment 24/7. Ability to deploy tracking buoys within 2 hrs.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	In effect
	Level 2: two tracking buoys available in Darwin during activity. Darwin to Barossa is 20 hrs. pending vessel (pending vessel availability)	Additional	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	Accept

	Level 2/3: Eight tracking buoys mobilised from Varanus Island or Dampier Supply Base or Exmouth Freight and Logistics. Mobilisation timeframe- 48-72 hrs.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	In effect
	Level 2/3: tracking buoys available from AMOSC and through AMOSC Mutual Aid Mobilisation timeframe- 42-72 hrs	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Level 3: tracking buoys available from OSRL. Transit times (air) UK to Darwin = 3-4 days	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
Aerial surveillance - aircraft and crew	Maintain contract with service provider for dedicated aerial platform operating out of Darwin (Helicopter services available through Santos primary contracted suppliers. Wheels up within 1 hr. for emergency response. Spill surveillance < 10 hrs. (daylight dependent). Surveillance and recording using helicopter pilots is considered adequate for situational awareness.)	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of contract	In effect
	Level 2/3: Drones available via AMOSC. Mobilisation timeframe: < 48 hrs.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact Drones may be necessary for some sensitive environments and where personnel safety is at risk	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Level 2/3: Drones available via OSRL.- Third Party provider Mobilisation timeframe: depending on the port of departure, one to two day if within Australia	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact Drones may be necessary for some sensitive environments and where personnel safety is at risk	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
No alternate, additional or improved control measures identified							

Aerial surveillance - observers	Level 2: Trained Santos observers will be mobilised to airbase within 24 hrs., following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of training and maintaining trained staff	In effect
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of AMOSC membership	In effect
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days of activation in Darwin, remaining personnel available from 4 to 5 days in Darwin, subject to approvals/ clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
	Level 1: Ensure trained aerial observers based at Darwin for duration of activity.	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise ensures trained aerial observers available from Day 2, and potentially from Day 1 (current arrangements are that the pilot would provide the initial observations and recording on Day 1).	Improved availability and reliability	Costs associated with staff employment and training	Reject Cost is considered disproportionate to the incremental benefit given surveillance on Day 1 by pilots is considered sufficient
Aerial surveillance - unmanned aerial vehicles	Level 2: Unmanned Aerial Vehicles for aerial surveillance available through AMOSC (UAVs and pilots can be accessed through AMOSC with a mobilisation time of < 48 hrs.)	In effect	Equipment	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	Equipment	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							

Vessel surveillance	Level 1: vessels in use by Santos could be used for surveillance purposes in the event of a spill.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of existing contracts with vessel providers	In effect
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos Vessel Monitoring System.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of contracts at the time of requirement.	In effect
	Two vessels are in use by Santos servicing the Bayu-Undan operations could be used for surveillance purposes in response to a spill.	Additional	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability	Cost of existing contract with vessel contractors.	Rejected One vessel is required to be on station at the Bayu-Undan facilities at all the time. The second vessel preforms critical in-field activities such as methanol bunkering and assisting with off take tanker activities. Therefore, neither vessel could be considered to be reliably available to undertake vessel surveillance activities.
No alternate, additional or improved control measures identified							
Water Quality Monitoring (operational and scientific)	Maintain monitoring service provider contract for water quality monitoring services. Water quality monitoring personnel, equipment and vessel mobilised to Darwin within 72 hrs. of monitoring action plan approval.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of contracts	In effect
	Access to additional water quality monitoring services through OSRL	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of OSRL membership	In effect

	Required vessel specifications included in Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Improved availability and reliability	Cost to maintain and operate vessel tracking system	Accept
	Trained water quality monitoring specialists in Darwin	Additional	People	Ensure sampling is conducted correctly	Improves reliability	Costs associated with staff employment	Reject This is not necessary as a good procedure for sample collection is already in place
Satellite Imagery	Maintain membership with AMOSC provider to enable access and analysis of satellite imagery.	In effect	Systems	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	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Maintain membership with OSRL to enable access to and analysis of satellite imagery	In effect	System	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	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Wildlife Reconnaissance (aerial/ vessel surveillance. Shoreline and coastal habitat assessment)	Maintain contract with scientific monitoring service provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys.	In effect	People, procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of contract	In effect
	Maintain a list of providers that could assist with fauna aerial observations	Additional	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	Cost of maintaining list	Accept
	Ensure trained marine mammal/fauna observers based in Darwin	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1	Improved availability and reliability	Costs associated with staff employment and training	Reject Maintaining trained fauna observers at location is considered grossly disproportionate as they are required only for the initial stages of the response until observers from scientific monitoring provider can be mobilised.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Mechanical Dispersion	Use of vessel crews, contract vessels and vessels of opportunity to disperse small areas of amenable hydrocarbon types such as marine diesel.	In effect	People, equipment	Enhanced dispersion and biodegradation of released hydrocarbons	Provides availability, reliability, survivability, compatibility and independence. Limited functionality as mechanical dispersion is secondary response strategy limited by weather conditions, hydrocarbon type, hydrocarbon volume.	Cost of vessel time	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Oiled wildlife response - planning	Level 1/2: Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) which sets the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response	Additional	Procedure	The framework will facilitate a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Improved functionality and reliability.	Cost of document maintenance	Accept
	Implementation of the Northern Territory Oiled Wildlife Response Plan (NTOWRP) and Western Australian Oiled Wildlife Response Plan (WAOWRP)	In effect	Procedure	Working within the guidelines of the WAOWRP and NTOWRP will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort and time involved in maintaining OWR implementation plan within OPEP	In effect
No alternate, additional or improved control measures identified							
Oiled wildlife response - equipment	Level 2: OWR kits and containers available from AMSA in Darwin	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3: OWR kits and containers available for AMOSC, AMSA and DoT: Broome, Fremantle, Exmouth, Geelong, Dampier, Devonport and Townsville Mobilisation to Darwin within 2-7 days	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) Singapore to Darwin = 3–5 days of activation	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Oiled wildlife response - personnel	Level 1/2 Santos personnel trained in OWR. OWR trained personnel mobilised to Darwin within 48 hrs.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of training and maintaining training	In effect
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractors, and Industry Mutual Aid. Mobilisation of OWR personnel to Darwin will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Cost of membership with AMOSC	In effect
	Level 3 OWR personnel available through OSRL. OSRL staff initial 5 technical advisors available in Darwin from 2 to 3 days of activation, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel accessed through labour-hire arrangements would receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of labour hire at time of incident	In effect

	Additional Santos OWR trained personnel positioned in Darwin	Additional	People	Additional personnel trained in OWR will enhance the first strike capability of Santos and therefore enhance the likelihood of success of the OWR.	Improved functionality, availability, reliability and independence.	Cost of training staff	Reject Santos has recently trained additional staff for OWR. Existing OWR personnel capability meets the need.
	Prehire and/or prepositioning of staging areas and responders	Additional	System	This may enhance response times and first strike capability and hence improve the likelihood of success of the OWR. Conversely, prepositioned personnel and staging areas may result in negative impacts to the environment and wildlife.	Improved functionality, availability, reliability and independence.	Additional wildlife resources could total $1500 per operational site per day. This is a guaranteed cost regardless of whether a spill occurs or not.	Reject- the cost of setting up staging areas and having responders on standby is considered disproportionate to the environmental benefit gained. Further, prepositioned personnel and staging sites may have negative impacts on the environment and wildlife. The overall OWR capability Santos can access through Santos staff, AMOSC, AMOSC mutual aid, Santos labour force hire arrangements, DBCA and wildlife carer network are considered adequate, with further advice and international resources available through OSRL.
	Direct contracts with service providers	Alternative	System	This option duplicates the capability accessed through AMOSC and OSRL and would complete for the same resources	Does not improve effectiveness	Cost of contract	Reject- this option is not adopted as the existing capability meets the need.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcome	Effectiveness	Feasibility	Accept/ Reject
Waste Management	Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained and periodically reviewed. Waste service provider waste receptacles mobilised to Darwin within 12-24 hrs. of activation.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Cost of contract	In effect
	Maintain contracts with multiple service providers to cover new geographic location	Additional	System	Contract with existing waste service provider not sufficient to cover new geographic region (NT) as they are not located in Darwin and may not be able to service the location within the required timeframe	Improves functionality, availability, reliability, survivability, compatibility and independence.	Additional cost in maintaining two contracts for the same service	Accepted
	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Costs of contracts, MOU with waste service provider, AMOSC, AMSA and OSRL	In effect
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	Additional cost in purchase and maintenance of tanks	Reject Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA, OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commenced.
	Vessels for waste transport through Santos contracted providers.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	Contract with vessel contractors to be maintained and periodically reviewed	In effect
	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of wastey in the initial 2-5 days of response	Provides functionality, availability, reliability, survivability, compatibility and dependence	Cost in contracting vessels to remain on standby for incident waste requirements	Reject Expense of maintaining vessels on standby that are surplus to day to day requirements is disproportionate to environmental benefit. Santos is accustomed to coordinating logistics for tasks around finite resources. Santos monitors vessel availability through Santos Vessel Tracking System. Regularly contracted vessels could be supplemented with vessels of opportunity
	Vessel to vessel waste transfer plan gives details of waste storage requirements and procedures	In effect	Procedure	Allows effective use of available vessels and minimises vessel decontamination requirements	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of documentation development, implementation, maintenance and exercising	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Scientific Monitoring - monitoring service provider and equipment	Maintenance of Monitoring Service Provider contract for scientific monitoring services and annual review of standby manual. SMP provider and monitoring equipment mobilised to site within 72 hrs. of monitoring action plan approval.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of potential improvement; none identified	Cost of contract with Scientific Monitoring Service Provider	In effect
	Regular capability reports from Monitoring Service Provider shows personnel availability and annual reviews of standby manual	In effect	System	This ensures the Monitoring Service Provider has the capability to undertake Scientific Monitoring, including, post-spill preimpact surveys within the EMBA of receptors with deficient baseline data	Improves functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	In effect
	Conduct periodical review of existing baseline data sources across the Santos combined EMBA	In effect	System	This ensures that receptors within the EMBA with deficient baseline data are identified	Improves functionality and provides compatibility	Cost of contract with Scientific Monitoring Service Provider	In effect
	Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans	Improved	Procedure	Improve response time	Improved functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	Accept
	Purchase of oil sample kits for scientific monitoring personnel to be positioned at Darwin	Improved	Equipment	Improve response time	Improved availability and reliability	Cost associated with purchase of equipment and maintenance	Accept
Scientific Monitoring - vessels	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos Vessel Monitoring System. Santos to mobilise monitoring vessels to deployment location within 72 hrs of monitoring action plan approval.	In effect	Equipment	Improve response time	Provides availability and reliability	Effort associated with maintaining MSA	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of contracts at the time of requirement.	In effect

	Required vessel specifications included in Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Improved availability and reliability	Cost to maintain and operate vessel tracking system	Accept
Scientific monitoring - personnel	Scientific monitoring personnel and equipment on standby at Darwin	Additional	Personnel, equipment	Improve mobilisation time	Improved availability and reliability	The cost of training and employing dedicated pre-positioned monitoring personnel is disproportionate to the potential benefit	Reject - Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial phase of response.
No alternate, additional or improved control measures identified							

Appendix C Pollution Report

Department of **Transport**

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

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.

Once you have completed the form please check that all relevant fields have been filled with accurate data.
Please email completed form to marine.pollution@transport.wa.gov.au

Appendix D Situation Report

Department of Transport

When blank, this form is classed as **OFFICIAL**, when filled out, this form is classed as **OFFICIAL-SENSITIVE.**

Marine Pollution Situation Report (SITREP)

Send completed form to:
Maritime Environmental Emergency Response
Department of Transport
GPO Box C102 PERTH, WA 6839
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:	

To post the form please click on the "POST" button below

POST

RESET

MEP_Sitrep_1114

Santos

Appendix E Vessel Surveillance Observer Log

Santos

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

Santos

Timeline of observations:

Time	Description

Appendix F Aerial Surveillance Observer Log

Santos

Aerial Surveillance Observer Log – Oil Spill

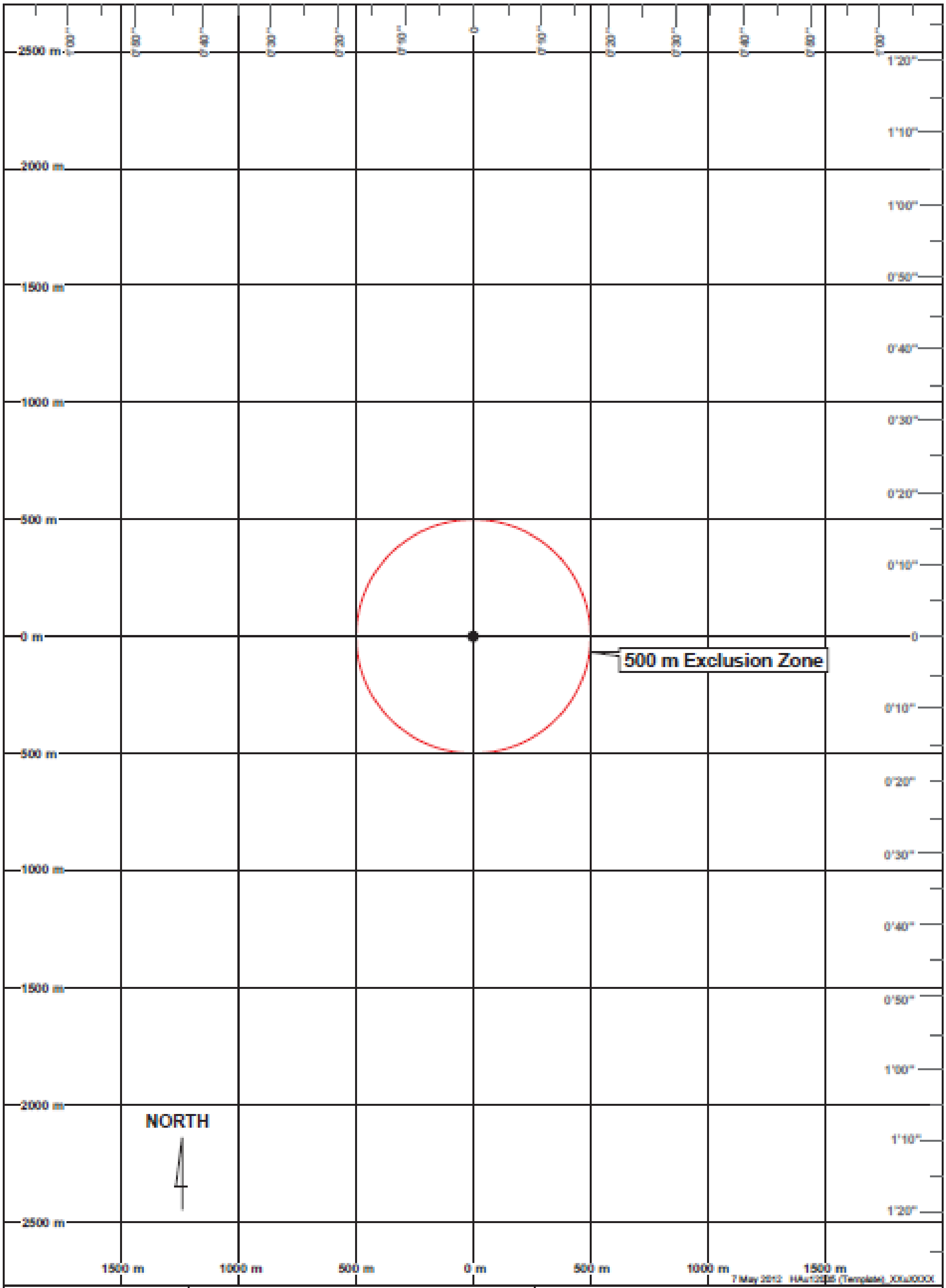
Survey Details			
Date:	Start time:	End Time:	Observer/s:
Incident:		Area of Survey:	
Aircraft type:	Call sign:	Average Altitude:	Remote sensing used:
Weather Conditions			
Wind speed (knots)		Wind direction	
Cloud base (feet)		Visibility	
Time high water		Current direction	
Time low water		Current speed (nM)	

Slick Details						
Slick grid parameters (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	% 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 G Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



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

Appendix H Aerial Surveillance Marine Fauna Sighting Record

Santos

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

Date:		**Time:**	
Latitude:		**Longitude:**	

MARINE FAUNA ID GUIDE

○ Humpback whale

○ Blue whale

○ Minke whale

○ Sperm whale

○ Killer whale

○ Bryde's whale

○ Whale species unknown

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Leatherback turtle

○ Turtle species unknown

Santos

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**<u>Behaviour / Comments.</u>** **Proximity to oil? Oiled?** **Milling? Feeding? Transiting?**
Cetaceans (Whales/ Dolphins)					
Turtles					
Birds					
Dugongs					
Sharks					
Other					

Santos

Other details for each observation location

WEATHER DETAILS

Sea State ◯ Mirror calm ◯ Small waves ◯ Slight ripples
◯ Large waves some whitecaps ◯ Large waves, many whitecaps

Visibility ◯ Excellent ◯ Good ◯ Moderate ◯ Poor ◯ Very Poor

OBSERVER DETAILS

Observer Name	Observer signature	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I Oiled Wildlife Response Personnel and Equipment

In the event of a spill impacting wildlife, Santos will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014) and WAOWRP.

This appendix outlines the current OWR equipment, personnel and services available to Santos through current arrangements.

Overall OWR capability per OWR strategy

The overall OWR capability of Santos is outlined in **Table I-1**. Santos has access to aircraft that could be used for wildlife reconnaissance within hours of a spill. This would be followed by further access to vessels and Santos personnel trained in OWR that could be mobilised within 24 hours for vessel and wildlife shoreline reconnaissance, demonstrating Santos' ability to mount a swift response that could also be sustained as long as required.

Santos has the capability to set up oiled wildlife field stations within 3-4 days of a spill through access to AMOSC equipment and equipment purchased at the time of a spill. Santos could also arrange the transport of wildlife from the field to a primary care facility.

The indicative personnel required for a high impact-rated response is 93 personnel (as per the WAOWRP) (DBCA, 2022a), however depending on the number and species impacted, may require many more. Santos' current arrangements could support a large scale OWR (requiring >93 personnel) mainly through support staff, such as, non-technical wildlife support roles (management, logistics, planning, human resourcing, transporter, cleaners, trades persons, security etc). These roles could be filled by Santos personnel and labour hire agencies that can provide workers that undergo an induction and basic training. In addition, many of the roles required for an OWR require technical expertise and Santos will need to activate OWR arrangements with AMOSC and OSRL to fulfil roles, as well as make contractor arrangements for accessing skilled wildlife personnel at the time of a spill.

Table I-1: Santos OWR capability per OWR strategy

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
Reconnaissance	Identify opportunities to create synergies with surveys required for Monitor and Evaluate and Scientific Monitoring activities	Rotary Wing Aircraft & flight Crew	Karratha Learmonth Onslow	Wheels up within 1 hour for Emergency Response.
		Drones and pilots	Local WA hire companies	1-2 days
		Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
		Aerial surveillance crew Santos staff AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel available	Perth and Varanus Island (VI) (Santos aerial observers) Australia wide	Santos trained personnel - next day mobilisation to airbase <24 hours
Preventative actions	Mainly effective for bird species Requires relevant WA/NT licence approval	2 x AMOSC Wildlife fauna hazing and exclusion kits 3 x AMOSC Wildlife fauna hazing and capture kits 1x AMOSC Breco buoy	1 x Fremantle, 1 x Geelong 3 x Fremantle 1 x Fremantle	48 hours
Rescue and field processing	Wildlife handling and first aid should only be done by persons with appropriate skills and experience or under the direction of DBCA	4 x AMOSC Oiled Fauna Kits (basic medical supplies, cleaning/rehab, PPE)	1 x Fremantle, 1 x Exmouth, 1 x Broome, 1 x Geelong	
		50 % of OSRL OWR response packages (Wildlife Search and Rescue kits / Cleaning and	5 x Singapore, 2 x Bahrain, 7 x UK, 5 x Fort Lauderdale	Location dependent

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
		Rehab. kits (including field first aid)		
Transport	Transport of oiled animals by aeroplane or helicopter may be restricted due to Civil Aviation Safety Authority (CASA) regulations; such transport will depend on the level of oiling remaining on animals. Therefore, consultation with the air transport provider must take place before transport to ensure the safest and most efficient means	Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
Primary care facility	OWR container could be placed on the deck of a suitably sized vessel for field processing in remote locations (benefits associated with temperature regulation and access to water and electricity) An OWR container on a vessel could also be used to aide transport form offshore islands	OWR container/mobile washing facility 2 x AMOSC 4 x AMSA	AMOSC – 1 x Fremantle, 1 x Geelong AMSA - 1 x Dampier, 1 x Darwin, 1 x Devonport, 1 x Townsville	Location dependent
		AMOSC call off contract with DWYERTech NZ – a facilities management group	New Zealand	Availability within 24 hrs of call-off
Personnel	Untrained personnel would receive an induction, on-the-job training and work under the supervision of an experienced supervisor	Santos provides OWR training to staff, and to-date, approximately 20 personnel have received OWR training.	Perth and Varanus Island	< 48 hours
		Santos maintains labour hire arrangements for access to untrained personnel		
		1 x AMOSC Oiled Wildlife Advisor	Victoria, Australia	< 48 hours

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
		60 x AMOSC OWR Strike Team Members		< 48 hours
		AMOSC MOU with Phillip Island National Park (PINP) (best-endeavours availability)	Victoria, Australia	Best-endeavour availability
	Sea Alarm staff act in a technical advisory role and do not engage in hands-on OWR activities but work impartially with all parties (titleholder, local authorities, mobilised experts and local experts, and response groups), aiming to maximise the effectiveness of the wildlife response.	Via OSRL Access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation Access to OWR assessment service from the Global Oiled Wildlife Response Service (GOWRS) consisting of a ready-to-deploy team of 4 specialists in Operations/Planning, Field & Capture, Rehab & Facilities, Vet/Incident-specifics.	Belgium Various locations in northern and southern hemisphere	Sea Alarm: Upon notification able to provide remote advice and option to mobilise a Sea Alarm Technical Advisor on-site during an incident GOWRS: Mobilised on a best-endeavours basis

Australian Maritime Safety Authority (AMSA)

AMSA maintains four oiled wildlife response containers/ mobile washing facilities in Dampier, Darwin, Devonport and Townsville. All resources under the National Plan (including the four OWR containers) are available to Santos through formal request to AMSA under the arrangements of the National Plan. The containers also include some limited PPE and fresh and wastewater pools.

Western Australia Department of Transport (DoT)

The WA DoT maintains one OWR container/ mobile washing facility which is available through the State Hazard Plan for Maritime Environmental Emergencies and the National Plan on request.

Australian Marine Oil Spill Centre (AMOSC)

Santos is a participating company of AMOSC and as such has access to AMOSC's Level 2/3 oiled wildlife equipment and personnel as outlined in the AMOSPlan.

Equipment

Table I-2 provides a summary of the oiled wildlife response equipment maintained by AMOSC.

Table I-2: AMOSC Wildlife Equipment

Location	Oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	Fauna hazing and exclusion equipment	Oiled wildlife washdown container (mobile washing facility)
Fremantle	-	1 x fauna hazing & exclusion kit 3 x fauna hazing & capture kit 1 x Breco bird hazing buoy	1 x Oiled Wildlife Response Container
Exmouth	1 x Oiled fauna kit	-	-
Broome	1 x Oiled fauna kit	-	-
Geelong	2 x Oiled fauna kit	1 x fauna hazing & exclusion kit	1 x Oiled Wildlife Response Container
Total	**4 x Oiled fauna kit**	**2 x fauna hazing & exclusion kits** **3 x fauna hazing & capture kits** **1 x Breco bird hazing buoy**	**2 x Oiled Wildlife response Containers**

Personnel

AMOSC currently has the following arrangements in place for OWR personnel:

- 1 x AMOSC OWR Officer available to act as an Industry Oiled Wildlife Advisor (OWA)
- AMOSC call off contract with DWYERtech Response NZ
  - A facilities management group with availability within 24 hours of call off
- 60 x AMOSC OWR Strike Team members
  - Volunteer OWR trained industry personnel
- MOU with Phillip Island National Park (PINP), Victoria (best-endeavours availability)

- Approx. 39 PINP staff – collection/facility ops/rehabilitation
    - Approx. 45 volunteers – collection/facility ops/rehabilitation
    - Approx. 20 staff – animal feeding
    - 6 x PINP staff - wildlife emergency response including cetacean stranding/entanglement
    - 13 x PINP staff - wildlife team leaders

Oil Spill Response Limited (OSRL)

Through the associate membership, Santos has access to the following OWR equipment and personnel services from OSRL.

Equipment

OSRL maintains a Level 3 wildlife equipment stockpile. This equipment is stored across the OSRL base locations and is designed to support the first 48 hours of the response and to ensure availability of critical equipment items that may be difficult to source locally (N.B. this equipment does not provide everything that will be required to successfully operate a primary care facility and is focussed primarily on bird casualties (n=100)). Equipment is sorted according to search and rescue (including field first aid), medical, and cleaning and rehabilitation (**Table I-3**).

Table I-3: OSRL Wildlife Equipment (as per OSRL Equipment Stockpile Status Report, April 2023)

OWR Response Package	UK	Singapore	Bahrain	Fort Lauderdale
Wildlife Search and Rescue	1	1	1	1
Wildlife Search and Rescue Medical	1	1	-	-
Cleaning and Rehabilitation	-	-	1	-
Wildlife Cleaning and Rehabilitation Part 1	2	1	-	-
Wildlife Cleaning and Rehabilitation Part 2	2	1	-	2
Wildlife Cleaning and Rehab. Medical	1	1	-	1

Personnel

Through the OSRL Oiled Wildlife SLA, Santos has access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation, a small non-governmental organisation based in Brussels, Belgium that works to improve global preparedness and response for oiled wildlife incidents. Santos has the option to mobilise a Sea Alarm Technical Advisor during an incident. Sea Alarm staff will act in a technical advisory role at the incident management level and will work impartially with all parties (titleholder, local authorities, mobilised experts and local experts, and response groups), with the aim of maximising the effectiveness of the wildlife response.

In 2023, the Global Oiled Wildlife Response Service (GOWRS) will become part of OSRL's SLA. GOWRS is a ready-to-deploy Assessment Team of 4 x wildlife response experts, drawn from ten leading international wildlife response organisations. The Assessment Team will be available 24-7-365 to deploy for a four-day in-country incident assessment. Before formal integration into the SLA, this service is available from OSRL on a best endeavours basis.

In addition, through the SLA, Santos has the option to access OSRL's internal staff with OWR expertise (1 x UK) as part of the 18 personnel commitment for any single incident.

Appendix J Scientific Monitoring Plans

2 Scientific Monitoring Plans by Receptor

The following components of the SMP are outlined in this section:

+ 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 Mammals
+ SMP9: Marine Reptiles
+ SMP10: Seafood Quality
+ SMP11: Fish, Fisheries and Aquaculture
+ SMP12: Whale Sharks.

Given the low likelihood and unpredictable nature of a Level 3 incident, it is very unlikely that one pre-established monitoring design will be appropriate for all scenarios. Instead, monitoring will require an adaptive approach which may employ previous baseline monitoring, new post-spill data, spatial control sites, or post-spill pre-impact data that follows a consistent decision framework (Department of Environment and Conservation 2009). The scientific monitoring implemented will be in accordance with the scale, location, and duration of the oil spill. Only the relevant plans as determined by the initiation criteria will be implemented.

Table 1 provides a glossary of an SMP as prepared in this report.

Table 1: Glossary of Scientific Monitoring Plans.

SMP Receptor	
Rationale	Importance of receptor, possible impact and importance of monitoring program.
Aim	Description of program aim(s)
Baseline	Refer to Baseline Data Review (SO-91-RF-20022).
Contact	Contact is defined as occurring where any aerial, visual or florescence observation reports submitted to the Incident Command Team (ICT) show presence or likely presence of oil; or spill fate modelling predicts oil at sensitive receptors of > 1g/m^2 for surface oil, and >10 ppb for entrained and dissolved oil. This then activates the relevant SMP, which determines if any impact has occurred based upon applicable thresholds.
Initiation criteria	Initiation criteria, based on data from OMPs.

Termination criteria	Termination criteria based on analysis of Scientific Monitoring data translated to the Incident Management Team (IMT) through the planning function.
Receptor impact	Measured states and pressures according to the State-Pressure-Response model.
Methodological approach	Descriptions of sampling methods in order to carry out scientific monitoring, including reference to methods described in an appendix.
Scope of works	Timeline for scope of works (SoW) development.
Statistically significant	The basis of the significance is determined by the methodological approach as outlined in the relevant SMP.
Resources	List of required resources which may not necessarily be listed within a description of a particular method.
Implementation	Mobilisation requirements for service provider(s).
Analysis and reporting	Summary of analysis, data management and reporting.

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 OMP1 (Surveillance and Monitoring), to inform the sampling design of other SMPs where objectives are to evaluate impact to 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 to the Baseline Data Review (SO-91-RF-20022). In addition, relevant available metadata 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.

SMP1 – Marine Water Quality	
	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.
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): 1. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 2. 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; 3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See **Appendix A** and **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> SMP1 – Marine Water Quality A water quality probe will be used to measure conductivity (to derive salinity in PSU), temperature and depth (CTD), dissolved oxygen (% and mg/L), turbidity (FNU or NTU), 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.

SMP1 – Marine Water Quality	
	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 Appendices: + 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 work	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Resources	+ Marine scientist with experience in water quality sampling + Geographic Information Systems (GIS) personnel + National Association of Testing Authorities (NATA) accredited laboratories for water sample analysis + Vessel and tender in operation + Refuelling facilities + Sample containers and preservative + Sampling equipment + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.

SMP1 – Marine Water Quality	
	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.

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 to the Baseline Data Review (SO-91-RF-20022). In addition, relevant available databases 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 as defined in **Table 1**.
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

SMP2 – Sediment Quality	
	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 is 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
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): 1. If sites are contacted in which long-term baseline data is available, a control chart (time-series) design will be applied; 2. 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; 3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See **Appendix A** and **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.

SMP2 – Sediment Quality	
	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 extent 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. Infauna samples A subset of the sediment sample shall be sieved in the field (if time permits) with collected infauna preserved (10% buffered formalin or 70% ethanol as prescribed by the receiving laboratory) 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.
Scope of work	Prepared by monitoring provider for issue within 24 hours of SMP having been activated.
Resources	+ Marine scientist with field experience in deep sea sediment sampling + Scientist with skills in infauna identification + GIS personnel + NATA accredited laboratory for sample contaminant analysis + Laboratory for infauna sorting and taxonomic identification + Vessel with appropriate davit/winch to deploy grab/corer equipment and tender in operation + Refuelling facilities

Santos

SMP2 – Sediment Quality	
	+ Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.

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 to the Baseline Data Review (SO-91-RF-20022). In addition, relevant available databases shall be reviewed for applicable rocky shoreline and sandy beach biota baseline data.
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 as defined in **Table 1**.
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

SMP3 – Sandy Beaches and Rocky Shores	
	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.
Methodological approach	Monitoring will be designed as follows: 4. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 5. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 6. 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 (10% buffered formalin or 70% ethanol as prescribed by the receiving laboratory) and sent to laboratory for identification of fauna to lowest taxonomic resolution possible. Process to follow that for baseline data where this pre-exists.

SMP3 – Sandy Beaches and Rocky Shores	
	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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in shoreline macroinvertebrates sampling + Supporting Scientist + GIS personnel + Helicopter or available vessel and tender in operation + Refuelling facilities + Sample containers and preservative + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby + Laboratory facilities for sorting and taxonomic identification of specimens
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.
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.

SMP4 Mangrove Communities

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
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	Refer to the Baseline Data Review (SO-91-RF-20022). 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 as defined in **Table 1**.
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.
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).

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
	Where long term on-ground baseline monitoring has occurred, further post impact on-ground monitoring should be carried out to complement any analysis of remote sensing. Analysis of long-term on-ground monitoring data will be as follows: 1. Where long-term baseline data sites (only) are contacted a control chart (time-series) design will be applied. 1. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 2. Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See **Appendix A** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (SO-91-RF-20022 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 operations (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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in mangrove condition assessment + Supporting Scientist + GIS and remote-sensing personnel + Available vessel in operation + Satellite and/or aerial imagery
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.

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) occurs 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. 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 to the Baseline Data Review (SO-91-RF-20022). In addition, relevant available baseline databases 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 as defined in **Table 1**.
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.
Methodological approach	Monitoring will be designed as follows: 7. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 8. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied.

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	9. Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See **Appendix A** for detailed description of these approaches and **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 or 70% ethanol as prescribed by the receiving laboratory) 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Scientist with experience in epifauna and infauna assessment and sampling + Supporting Scientist + GIS personnel + Helicopter or available vessel and tender in operation + Refuelling facilities + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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 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.

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 that 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 life cycles. 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 region.
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 to the Baseline Data Review (SO-91-RF-20022). In addition, relevant available baseline metadata databases will be reviewed for applicable benthic habitat and coral health and reproduction baseline data. Remote sensing data, satellite and aerial imagery previously acquired 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 as defined in **Table 1**.
Termination criteria	<u>Benthic habitat cover and composition</u>

SMP6 – Benthic Habitats	
	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.
Methodological approach	Monitoring design will be as follows: 10. Where long-term baseline data sites are contacted, a control chart (time-series) design will be applied. 11. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 12. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied (See **Appendix A** for detailed description of these approaches and **Figure 1**). <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 random 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 may also be recorded where practicable (for example following methodologies employed by Babcock et al. (2008) to contribute to SMP11.

SMP6 – Benthic Habitats	
	Coral Health and Reproduction 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, ecotoxicology 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Senior Marine Scientist with experience in benthic habitat assessment + Supporting Scientist + Divers or ROV operators + GIS personnel + Available vessel in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby + Diving equipment or ROVs + Video recording facilities + Satellite imagery
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.
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).

SMP6 – Benthic Habitats	
	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 ecotoxicological laboratory in addition to standard suite of ecotoxicological tests using released hydrocarbon. Data will be entered to spatially explicit database and analysed 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.

SMP7 Seabirds and Shorebirds

SMP7 – Seabirds and Shorebirds	
Rationale	Marine waters and coastal habitats in the EMBA contain key habitats that are important to birds, including offshore islands, sandy beaches, tidal flats, mangroves and coastal and pelagic waters. These habitats support a variety of birds which utilise the area in different ways and at different times of the year. Birds can be broadly grouped according to their preferred foraging habitat as coastal/ terrestrial birds, seabirds and shorebirds, both migratory and resident. 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 to the Baseline Data Review (SO-91-RF-20022). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (Department of Agriculture, Water and the Environment (DAWE) (http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and any local oiled wildlife response plans should also be consulted.

SMP7 – Seabirds and Shorebirds	
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 as defined in **Table 1**.
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 (relevant regional authority and/or DAWE).
Receptor impact	Impact to seabirds and shorebirds 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: 1. Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. 2. 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. 3. Where no baseline data sites are involved a gradient approach to quantifying impacts will be applied (See **Appendix A** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (SO-91-RF-20022).

SMP7 – Seabirds and Shorebirds	
	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, such as Birdlife Australia's Australian Shorebird Monitoring Program and survey guidelines standardised by the DAWE (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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	+ Experienced seabird biologist + Experienced shorebird biologist + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel and tender in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.
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.

SMP8 Marine Mammals

SMP8 – Marine Mammals	
Rationale	At least 11 species of listed marine mammals are known to, or are thought to occur, in Australian waters within the environment that may be affected. These include cetaceans (whales and dolphins) and sirenians (dugong). 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 that may have resulted from the hydrocarbon spill and associated response.
Baseline	Refer to the Baseline Data Review (SO-91-RF-20022). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and local oiled wildlife response plans should also be consulted.
Initiation criteria	Operational monitoring indicates that marine mammals are contacted or predicted to be contacted by a hydrocarbon spill as defined in **Table 1**.
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 of the region; AND No further instances of dead marine mammals with detectable levels of hydrocarbons attributable to the hydrocarbon spill; AND Monitoring is terminated in consultation with the relevant environmental authority (relevant regional authority and/or DAWE).
Receptor impact	Impact to marine mammals 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)

SMP8 – Marine Mammals	
	+ 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	**Aerial survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s) + Refuelling facilities **Vessel-based survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel in operation + Sample container and preservative + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.
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. 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.

Santos

SMP9 Marine Reptiles

SMP9 – Marine Reptiles	
Rationale	At least 10 species of listed marine reptiles are known to, or are thought to occur, in Australian waters within the environment that may be affected. This includes six species of marine turtle that occur in, use the waters, and nest on sandy beaches, two species of sea snake and one species of estuarine crocodile found in most major rivers systems of the Kimberley region and in the Northern Territory. 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.
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 marine reptile populations in relation to an oil spill and associated activities.
Baseline	Refer to the Baseline Data Review (SO-91-RF-20022). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and local oiled wildlife response plans should also be consulted.
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 as defined in **Table 1**.
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 (relevant regional authority and/or DAWE).
Receptor impact	Impact to marine reptiles from pressures including hydrocarbons is measured through change in: + Abundance + Health/condition + Nesting success (turtles and crocodiles). Impact to other marine reptiles from pressures including hydrocarbons is measured through change in observed injury and condition. Other pressures to these states are:

SMP9 – Marine Reptiles	
	+ 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.
Methodological approach	**Abundance** In-water impacts – aerial surveys. Shoreline impacts – ground surveys (either rapid 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 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 work	Prepared by monitoring provider for issue within 24 hours of SMP being activated.
Resources	**Aerial survey** + Senior marine scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s)

SMP9 – Marine Reptiles	
	+ Refuelling facilities **Vessel-based Survey** + Senior Marine Scientist + Trained marine wildlife observers x 2 + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis and necropsy + Available vessel in operation + Decontamination/washing facilities + Safety aircraft/rescue vessels on standby
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.
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 for the region. 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.

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 to the Baseline Data Review (SO-91-RF-20022). Human health benchmarks relating to the exposure of PAHs shall be used to determine health effects as per Yender et al. (2002).

SMP10 – Seafood Quality	
	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 predict or observes contact of oil to target species for consumption as defined in **Table 1**.
Termination criteria	The following termination criteria will be adopted in consultation with responsible fisheries and human health agencies. Hydrocarbon concentrations in seafood tissues are not above levels considered a human health risk; 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 work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Marine vessel + Sample containers and preservative + NATA accredited laboratory for sample analysis + Decontamination/washing facilities
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).

SMP10 – Seafood Quality	
	Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed 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.

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 to the Baseline Data Review (SO-91-RF-20022). In addition, available relevant survey databases shall 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 as defined in Table 1.
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 responsible fisheries agencies.
Receptor impact	Impact to fish, fisheries and aquaculture from pressures including hydrocarbon concentrations is measured through change in: + Species diversity + Abundance of indicator taxa

SMP11 – Fish, Fisheries and Aquaculture	
	+ Assemblage structure + Health. Other pressures to these states are: + Accidental chemical spillage + Overfishing + 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: 13. Where long-term baseline data sites are contacted a control chart (time-series) design will be applied. 14. Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied. 15. If baseline data is not available, a gradient approach to quantifying impacts will be applied (See **Appendix A** for detailed description of these approaches and **Figure 1**). Where relevant, data available from responsible fisheries agencies 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 work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Marine scientist trained in fish identification and necropsy + Marine scientist with BRUV experience + NATA accredited laboratory for sample analysis + Available vessel and tender in operation + Decontamination/washing facilities

SMP11 – Fish, Fisheries and Aquaculture	
	+ Safety aircraft/rescue vessels on standby + Resources to analyse BRUV data.
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.
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.

SMP12 Whale Sharks

SMP12 – Whale Sharks	
Rationale	The whale shark (*Rhincodon typus*) is known to occur within the region. One of the best known aggregation sites occurs along the central and north-west coast of Western Australia from March to July. Whale sharks are also known to be highly migratory and a biologically important area for foraging extending into the Kimberley region of Western Australia also overlaps with the environment that may be affected. Effects to the whale shark 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 quantify impacts of an oil spill on whale sharks within Biologically Important Areas (BIAs) along the north-west and north Western Australian coastline.
Baseline	Refer to the Baseline Data Review (SO-91-RF-20022). The Oil Spill Response Atlas (Australian Maritime Safety Authority (AMSA)), National Conservation Values Atlas (DAWE - http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) and Pilbara Region Oiled Wildlife Response Plan (Department of Parks and Wildlife and Australian Marine Oil Spill Centre 2014) should also be consulted.

SMP12 – Whale Sharks	
Initiation criteria	Operational monitoring indicates that whale shark aggregations are contacted or likely to be contacted by a hydrocarbon spill as defined in **Table 1**.
Termination criteria	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.
Receptor impact	Impact to whale sharks from pressures including hydrocarbons is measured through observed injury and mortality. Other pressures to these states are: + Intentional and unintentional mortality from fishing outside Australian waters + Boat strike + Habitat disruption from mineral exploration, production and transportation + Marine debris + Climate change.
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 work	Prepared by monitoring provider for issue within 24 hours of this SMP being activated.
Resources	+ Senior marine scientist + Trained marine wildlife observers x 2 + Fixed wing aircraft (incl. pilot/s) + Refuelling facilities + Personnel with pathology or veterinary skills + NATA accredited laboratory for sample analysis + Available vessel and tender in operation + Decontamination/washing facilities

SMP12 – Whale Sharks	
	+ Safety aircraft/rescue vessels on standby
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.
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.

3 Receptor Description, Impact and Baseline Data

A values and sensitivities assessment is undertaken that describes the environmental receptors that occur within the particular EMBA. This includes their general distribution within the EMBA, as well as Biologically Important Areas, Key Ecological Features and habitat critical, and their potential response to hydrocarbon spills.

Potential baseline data which may be used to support monitoring for the sensitive receptors identified during the values and sensitivities assessment are reviewed and assessed for its suitability to provide a meaningful baseline from which to assess the impact of a hydrocarbon spill. The most up-to-date and spatially relevant baseline studies are detailed in the Baseline Data Review (SO-91-RF-20022). These baseline data are not intended as a static list, but are continually updated, and augmented by co-operation amongst resource companies and other agencies. During the standby phase, data quality are progressively and critically assessed following a data governance framework. These data will be accessed in the event of a spill in order to develop the most reliable monitoring program. The Baseline Data Review forms a basis for determining the level of priority for obtaining baseline data prior to oil contact, in the event of a hydrocarbon spill.

4 Scientific Monitoring Principles

4.1 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 2**). A structured decision-making framework for allocating monitoring effort in both time and space is described in **Figure 1**.

Table 2: 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:	English et al. (1997), Snedecor and Cochran (1989)

Principle	Explanation	Key guiding references
	Environmental covariates are considered in sampling design recorded and incorporated statistically. A hierarchical or stratified sampling design is used to address variation at multiple scales Design is standardized, by sampling equivalent strata (e.g., level of exposure, depth etc.).	
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)
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)

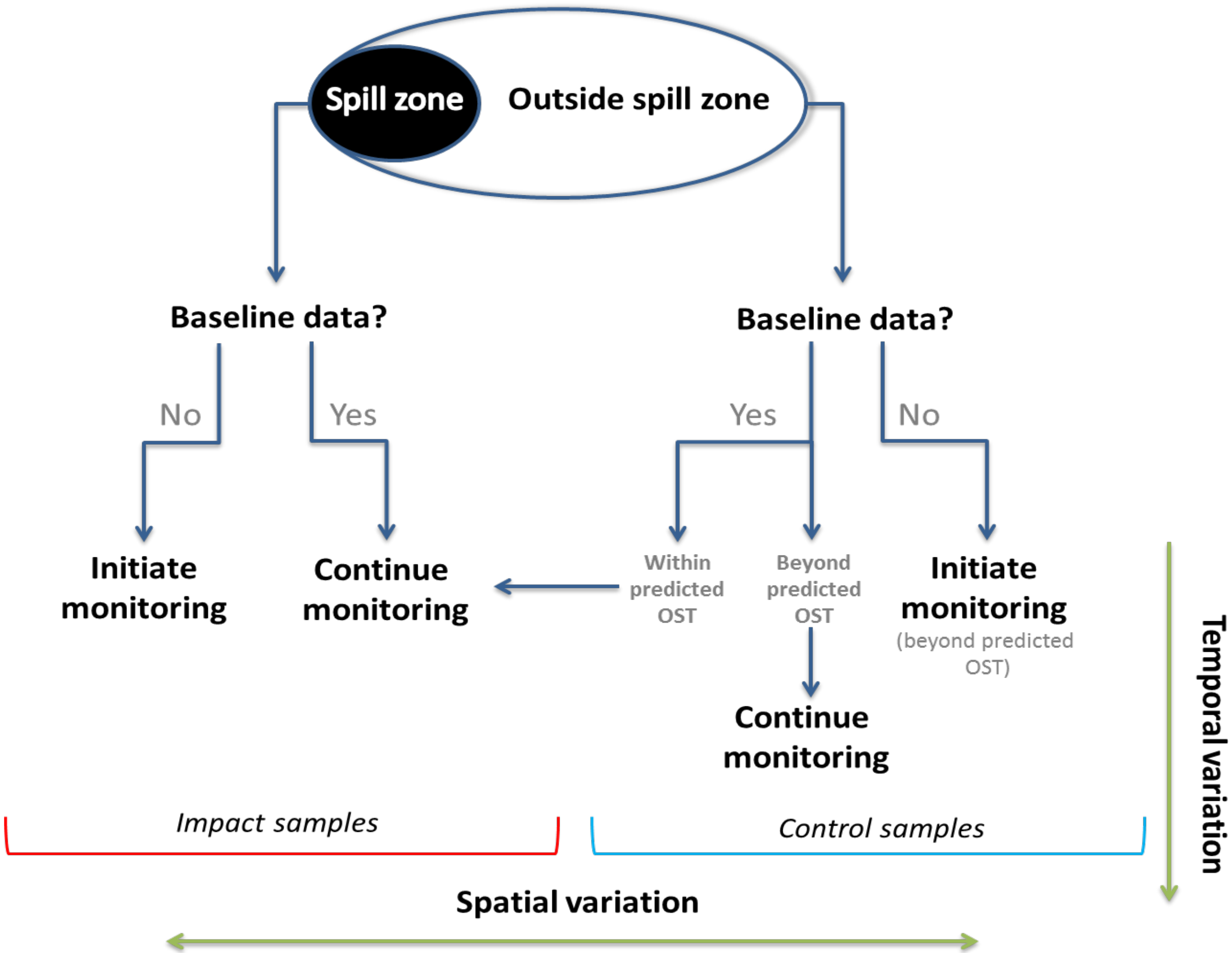


Figure 1: Structured Decision Making Process Based on Gregory et al. (2012) in Reference to Monitoring Programs, the Availability of Baseline Data, and Oil Spill Trajectory. An ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

4.2 Data Analysis

Appendix A details the most important approaches to statistical analysis and related sampling design. These approaches are summarised in Table 3 (below). An important consideration is how this information is best summarised and communicated to guide further decision making and management. **Appendix A** also describes the reporting of environmental outcomes through the use of report card systems and includes a summary of their structure and design.

Table 3: Summary of Data Analysis Techniques.

Analysis type		Description	Strength	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.

Analysis type	Description	Strength	Limitations	Addressing limitations
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.

4.3 Data Governance

Under NOPSEMA guidelines, data governance refers to the management of data and its quality, generation and enforcement of data policies and standards surrounding the handling of environmental and biodiversity data in the unlikely event of an incident (National Offshore Petroleum Safety and Environmental Management Authority 2016). **Appendix B** provides a description of the key requirements for data governance of oil spill-related data and suggests a suitable framework.

5 Mobilising Scientific Response Teams

Detailed information for activating and implementing a scientific monitoring response is provided in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162).

6 References

Alongi, D. M. 2002. Present state and future of the world's mangrove forests. Environmental Conservation 29:331–349.

Astron Environmental Services. 2013. Apache OSMP - Desktop Mangrove Assessment. Unpublished report to Apache Energy Limited.

Astron Environmental Services. 2019. Scientific Monitoring Plan Baseline Data Review, July 2019. Unpublished report for Santos WA Energy Limited.

Australian and New Zealand Governments. 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra.

Babcock, R., M. Haywood, M. Vanderklift, G. Clapin, M. Kleczkowski, D. Dennis, T. Skewes, D. Milton, N. Murphy, R. Pillans, and A. Limbourn. 2008. Ecosystem impacts of human usage and the effectiveness of zoning for biodiversity conservation: broad-scale fish census. CSIRO Marine and Atmospheric Research, Australia.

Bamford, M., and D. Moro. 2011. Barrow Island as an Important Bird Area for migratory waders in the East Asian-Australasian flyway. Stilt 60:46–55.

Barter, M. 2002. Shorebirds of the Yellow Sea: importance, threats and conservation status. Australian Government Publishing Service, Canberra, Australia.

Bennelongia Pty Ltd, A. 2010. Analysis of possible change in ecological character of the Roebuck Bay and Eighty Mile Beach Ramsar sites.

Carey, J., and M. Keough. 2002. Compositing and subsampling to reduce costs and improve power in benthic infaunal monitoring programs. Estuaries 25:1053–1061.

Cresswell, I., and V. Semeniuk. 2011. Mangroves of the Kimberley coast: ecological patterns in a tropical ria coast setting. Journal of the Royal Society of Western Australia 94:213–237.

Department of Environment and Conservation. 2009. Nature Conservation Service: Biodiversity Conservation Appraisal System: A Framework to Measure and Report on

Biodiversity Outcome Based Conservation Achievements and Management Effectiveness. Perth.

Department of Parks and Wildlife, and Australian Marine Oil Spill Centre. 2014. Pilbara Region Oiled Wildlife Response Plan. Department of Parks and Wildlife and Australian Marine Oil Spill Centre, Western Australia.

Department of the Environment and Energy. 2017. EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species.

Department of the Environment and Heritage. 2006. Standardised protocols for the collection of biological samples from stranded cetacean. http://www.environment.gov.au/resource/standardised-protocols-collection-biological-samples-stranded-cetacean.

Duke, N. C., M. C. Ball, and J. C. Ellison. 1998. Factors influencing biodiversity and distributional gradients in mangroves. Global Ecology and Biogeography Letters 7:27–47.

Duke, N., A. Wood, K. Hunnam, J. Mackenzie, A. Haller, N. Christiansen, K. Zahmel, and T. Green. 2010. Shoreline ecological assessment aerial and ground surveys 7-19 November 2009. UniQuest PTY Ltd.

English, S., C. Wilkinson, and V. Baker. 1997. Survey Manual for Tropical Marine Resources. 2nd edition. Australian Institute of Marine Science, Townsville.

Eros, C., H. Marsh, R. Bonde, T. O'Shea, C. Beck, C. Recchia, K. Dobbs, M. Turner, S. Lemm, R. Pears, and R. Bowter. 2000. Procedures for the salvage and necropsy of the dugong (*Dugong dugon*) - Second Edition, Research Publication No. 85. Great Barrier Marine Park Authority, Townsville.

Gagnon, M. M. 2009. Report on biopsy collection from specimens collected from surrounds of West Atlas oil leak–sea snake specimens. Curtin University, Perth.

Gagnon, M. M., and C. Rawson. 2012. Montara Well Release, Monitoring Study S4A Phase IV – Assessments of Effects on Timor Sea Fish. Curtin University, Perth.

Gagnon, M. M., and C. A. Rawson. 2010. Montara Well Release: Report on necropsies from birds collected in the Timor Sea. Curtin University, Perth, Western Australia.

Gerrodette, T. 1987. A power analysis for detecting trends. Ecology 68:1364–1372.

Gibson, L. E., and A. P. Wellbelove. 2010. Protecting critical marine habitats: The key to conserving our threatened marine species: a Humane Society International and WWF-Australia Report.

Gregory, R., L. Failing, M. Harstone, G. Long, T. McDaniels, and D. Ohlson. 2012. Structured decision making: a practical guide to environmental management choices. Wiley-Blackwell.

Grochowsi, A., and A. Stat. 2017. Water and Sediment Sampling for Environmental DNA Extraction, Joint Technical Memorandum. BMT Oceanica & Trace and Environmental DNA (TrEnD) Laboratory at Curtin University.

Gueho, R. 2007. Rhythms of the Kimberley: a seasonal journey through Australia’s north. Fremantle Press, Australia.

Hedley, S., J. Bannister, and R. Dunlop. 2011. Abundance estimates of Southern Hemisphere Breeding Stock ‘D’ Humpback Whales from aerial and land-based surveys off Shark Bay, Western Australia, 2008. Journal of Cetacean Research and Management:209–221.

Hilty, J., and A. Merenlender. 2000. Faunal indicator taxa selection for monitoring ecosystem health 92:185–197.

Hockings, M., S. Stolton, F. Leverington, N. Dudley, and J. Courrau. 2006. Evaluating Effectiveness: A Framework for Assessing Management Effectiveness of Protected Areas. 2nd edition. International Union for Conservation of Nature and Natural Resources.

Hook, S., G. Batley, M. Holloway, P. Irving, and A. Ross, editors. 2016. Oil Spill Monitoring Handbook. CSIRO Publishing.

Hurlbert, S. 1984. Pseudoreplication and the design of ecological field experiments. Ecological Monographs 54:187–211.

Jarman, S., and S. Wilson. 2004. DNA-based species identification of krill consumed by whale sharks. Journal of Fish Biology 65:586–591.

Kathiresan, K., and B. L. Bingham. 2001. Biology of mangroves and mangrove ecosystems. Advances in marine biology 40:81–251.

Kenkel N.C, Juhasz-Nagy P, and Podani J. 1989. On sampling procedures in population and community ecology. Vegetation 83:195–207.

Kobryn, H. T., K. Wouters, L. Beckley, and T. Heege. 2013. Ningaloo Reef: Shallow Marine Habitats Mapped Using a Hyperspectral Sensor. PLoS ONE 8:e70105.

Kohler, K. E., and S. M. Gill. 2006. Coral point count with Excel extensions (CPCe): A visual basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences 32:1259–1269.

Legg, C. J., and L. Nagy. 2006. Why most conservation monitoring is, but need not be, a waste of time. Journal of Environmental Management 78:194–199.

Masini, R. J., C. B. Sim, and C. J. Simpson. 2009. Protecting the Kimberley: A synthesis of scientific knowledge to support conservation management in the Kimberley region of Western Australia. Department of Environment and Conservation.

Nagelkerken, I., G. van der Velde, M. W. Gorissen, G. J. Meijer, T. Van't Hof, and C. den Hartog. 2000. Importance of Mangroves, Seagrass Beds and the Shallow Coral Reef as a Nursery for Important Coral Reef Fishes, Using a Visual Census Technique. Estuarine, Coastal and Shelf Science 51:31–44.

National Offshore Petroleum Safety and Environmental Management Authority. 2016. Operational and Scientific Monitoring Programs Information Paper. Perth.

Pendretti, Y. M., and E. I. Paling. 2001. WA Mangrove Assesment Project 1999-2000. Perth Murdoch Univeristy.

Quadrant Energy Australia Limited. 2018. Quadrant Environmental Monitoring Program Mangrove Monitoring Method Statement, EA-00-RI-10058.06. Quadrant Energy Australia Limited, Perth.

Rawson, C., M. M. Gagnon, and H. Williams. 2011. Montara Well Release: Olfactory Analysis of Timor Sea Fish Fillets. Curtin University, Perth.

Reynolds, S. D., B. M. Norman, M. Berger, C. E. Franklin, and R. G. Dwyer. 2017. Movement, distribution and marine reserve use by an endangered migratory giant. Diversity and Distributions 2017:1–12.

Robson, B. J., M. A. Burford, P. C. Gehrke, A. T. Revill, I. T. Webster, and D. W. Palmer. 2008. Response of the lower Ord River and estuary to changes in flow and sediment and nutrient loads. Water for a Healthy Country Flagship Report, CSIRO.

Santos WA Energy Limited. 2018. Values and Sensitivities of the Western Australian Marine Environment, EA-00-RI-10062. Santos WA Energy Limited.

Shortis, M., E. Harvey, and D. Abdo. 2009. A review of underwater stereo-image measurement for marine biology and ecology applications. Pages 257–292 *in* R. Gibson, R. Atkinson, and J. Gordon, editors. Oceanography and Marine Biology: An Annual Review. CRC Press, Boca Raton, Florida USA.

Skalski, J. 1995. Statistical considerations in the design and analysis of environmental damage assessment studies. Journal of Environmental Management 43:67–85.

Sleeman, J. C., M. G. Meekan, G. Mark, B. J. Fitzpatrick, C. R. Steinberg, R. Ancel, and C. J. A. Bradshaw. 2010. Oceanographic and atmospheric phenomena influence the abundance of whale sharks at Ningaloo Reef, Western Australia. Journal of Experimental Marine Biology and Ecology 382:77–81.

Snedecor, G., and W. Cochran. 1989. Statistical methods. Iowa State University Press, Iowa.

Standards Australia. 2005. Australian Standard 2542: Sensory analysis - Method 2.4. Standards Australia, Sydney.

Stem, C., R. Margolius, N. Salafsky, and M. Brown. 2005. Monitoring and evaluation in conservation: A review of trends and approaches. Conservation Biology 19:295–309.

Thompson, A., and B. D. Mapstone. 1997. Observer effects and training in underwater visual surveys of reef fishes. Marine Ecology Progress Series 154:53–63.

Toft, C., and P. Shea. 1982. Detecting community-wide patterns: Estimating power strengthens statistical inference. The American Naturalist 122:618–625.

Underwood, A. J. 1991. Beyond BACI: experimental designs for detecting human environmental impacts on temporal variations in natural populations. Australian Journal of Marine and Freshwater Research 42:569–587.

Underwood, A. J. 1992. Beyond BACI: the detection of environmental impacts on populations in the real, but variable, world. Journal of Experimental Biology and Ecology 161:145–178.

Underwood, A. J. 1994. On Beyond BACI: sampling designs that might reliably detect environmental disturbances. Ecological Applications 4:3–15.

Varcoe, T. 2012. A park manager's perspective on ecological monitoring. Page *in* D. Lindenmayer and P. Gibbons, editors. Biodiversity Monitoring in Australia. CSIRO Publishing, Canberra.

Wade, S., and R. Hickey. 2008. Mapping Migratory Wading Bird Feeding Habitats using Satellite Imagery and Field Data, Eighty-Mile Beach, Western Australia. Journal of Coastal Research 243:759–770.

Waples, K. 2007. Kimberley Biodiversity Review. Department of Environment and Conservation.

Watson, J., L. Joseph, and A. Watson. 2009. A rapid assessment of the impacts of the Montara oil leak on birds, cetaceans and marine reptiles. Department of the Environment, Water, Heritage and the Arts, Canberra.

Wilson, B. 1994. A representative Marine Reserve System for Western Australia. Department of Conservation and Land Management.

Wilson, B. 2013. The Biogeography of the Australian North West Shelf: Environmental Change and Life’s Response. Elsevier.

Wilson, S., M. Meekan, J. Carleton, T. Stewart, and B. Knott. 2003. Distribution, abundance and reproductive biology of <i>Pseudeuphausia latifrons<i> and other euphausiids on the southern North West Shelf, Western Australia. Marine Biology 142:369–379.

Wilson, S., T. Pauly, and M. Meekan. 2001. Daytime surface swarming by *Pseudeuphausia latifrons* (Crustacea, Euphausiacea) off Ningaloo Reef, Western Australia. Bulletin of Marine Science 68:157–162.

Yender, R., J. Michael, and C. Lord. 2002. Managing Seafood Safety After an Oil Spill. Hazardous Materials Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration, Seattle.

Zell, L. 2007. Kimberley Coast. Wild Discovery.

Appendix K SMP and Operational Monitoring Activation Process

K-1 SMP Activation Form

Instructions

In the event of a spill requiring a response from RPS follow these steps:

1. Activate a response – call **1300 424 115** and leave a voicemail if there is no answer.
2. Immediately complete this Activation Form and email to osmp.response@rpsgroup.com.au.

You will either talk directly with or receive a call back from the Monitoring Coordinator. In the event that a call back is not received after 30 minutes, please call **1300 424 115** again.

Note: If new information should become available after submitting this form, or the situation changes, please advise the RPS Monitoring Coordinator as soon as possible.

Section 1: Contact Details of notifying person

Name of notifying person		
Position in Incident Command Team		
Direct phone		
Mobile		
Email address		
Command centre location		
Command centre direct phone		
Date and time of notification	Click here to enter a date.	Enter time, i.e. 1400 WST

Section 2: Spill Details

<table>
<tr><td colspan="2">Date and time of spill</td><td colspan="3">Click here to enter a date.</td><td colspan="3">Enter time, i.e. 1400 WST</td></tr>
<tr><td colspan="2" rowspan="2">Spill source location (GDA94, MGA Zone 50)</td><td colspan="6">Insert coordinates in GDA94 format (easting and northing).</td></tr>
<tr><td colspan="6">Insert location description</td></tr>
<tr><td colspan="2">Source of spill / hydrocarbon type</td><td colspan="6"></td></tr>
<tr><td colspan="2">Cause of spill (if known)</td><td colspan="6"></td></tr>
<tr><td colspan="2">Status of spill</td><td colspan="2">☐ Secured</td><td colspan="2">☐ Uncontrolled</td><td>☐ Unknown</td><td></td></tr>
<tr><td rowspan="3">Release rate</td><td>Instantaneous release</td><td colspan="5"></td><td rowspan="3">State units</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Continuous release</td><td></td><td>per hour for</td><td></td><td>☐ Hours</td><td>☐ Days</td></tr>
<tr><td rowspan="4">Spill Description</td><td>Estimated quantity</td><td colspan="5"></td><td rowspan="4">State units</td></tr>
<tr><td>Incident tier</td><td colspan="5">☐ 1 ☐ 2 ☐ 3</td></tr>
<tr><td>Direction of travel</td><td colspan="5"></td></tr>
<tr><td>Trajectory</td><td colspan="5"></td></tr>
<tr><td colspan="2">Modelling provider log in details</td><td colspan="6"></td></tr>
</table>

Section 3: OMP/SMP activation

SMPs to be activated. **Where there is doubt whether an SMP should be activated the SMP should be selected. Refer to the Oil Spill Scientific Monitoring Plan (EA- 00-RI-10099) for initiation criteria for SMPS.**	☒ SMP1 – Water quality ☒ Operational water quality monitoring
	☐ 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 ☐ Yet to be determined ☐ Other:_____

Section 4: Safety

Detail any known safety or security risks	
Weather conditions on site and short-term forecast	

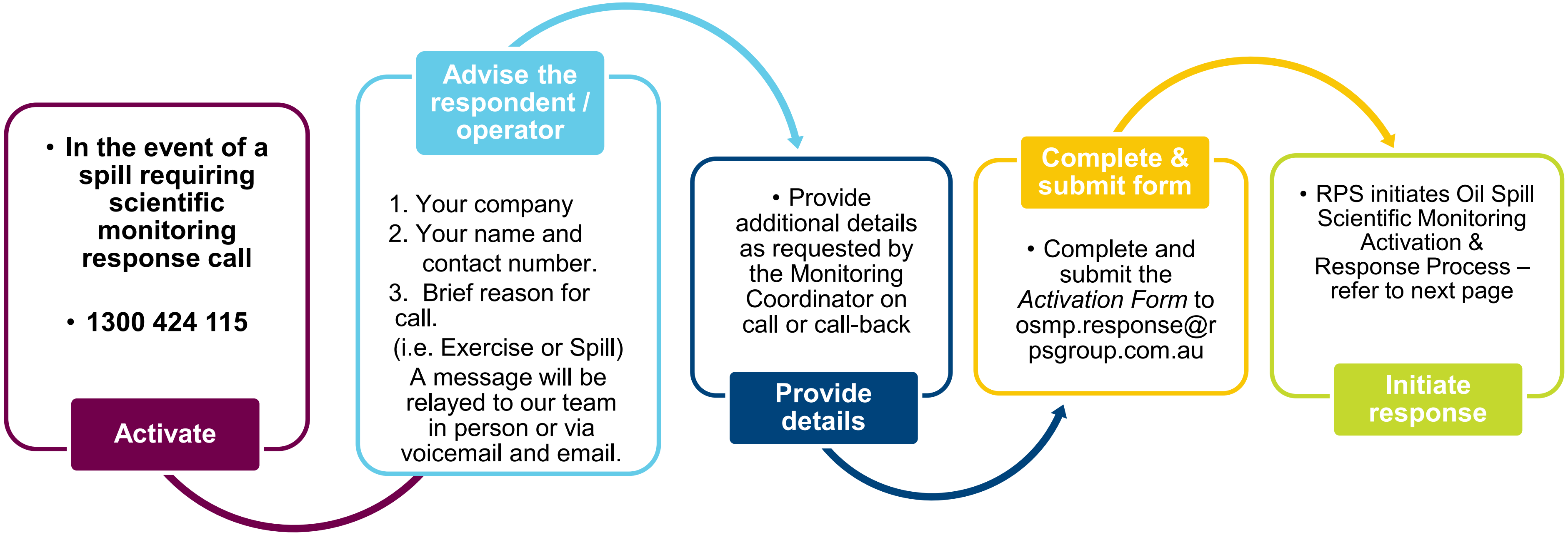
Section 5: Approval

I authorise the activation of a response by RPS Australia Group Pty Ltd in connection with the above incident under the terms of Contract #7686 and authorise expenditure against the pre-approved emergency mobilisation budget.

Signature:	
Position:	
Date and Time:	

K-2 SMP Activation Process

ACTIVATE OUR TEAM



OIL SPILL SCIENTIFIC MONITORING ACTIVATION AND RESPONSE PROCESS

Phase 1: Activation

- Monitoring provider activated

0-2 hours

Phase 2: Response Planning and Preparation

- Briefings
- Review of spill modelling and receptors
- Determine scale and objectives of response
- Determine personnel/equipment/ induction and medical requirements
- Monitoring Action Plan & logistics request
- License applications

2-53 hours

Phase 3: Mobilisation

- Inductions/medicals
- Review/update HSE documentation and risk assessment
- Equipment preparation and freighting
- Pre-mob briefings
- Mobilisation
- **Target 48 hrs in field for SMP1**

29 hours – 5 days

Phase 4: Response Operations

- Daily field monitoring activity reports to Santos
- Field debriefs and reporting

5 days +

Table i: Activation and response process and timeframes. Tasks for Santos are colour coded in grey, tasks for RPS are coloured in purple.

Step	Responsibility	Action	Timeframe	Resources	Date/Time complete

Phase 1 – Activation

0-2 hours

Step	Responsibility	Action	Timeframe	Resources	Date/Time complete
1	Santos IMT (Environmental Unit Leader (EUL))	RPS Monitoring Coordinator notified of incident.	On approval from Santos Incident Commander	RPS oil spill response phone number and answering service (1300 424 115)	
2	Santos IMT (EUL)	Complete *Activation Form* and submit to RPS via email to osmp.response@rpsgroup.com.au	Within one hour following initial notification (Step 2)	Activation Form	
2	RPS Monitoring Coordinator (MC)	Call back client for further details, and request *Activation Form* if not received.	Within 30 minutes of receiving initial notification	Activation Form	
3	RPS MC	Call Planning & Logistics Officer to advise of incident.	Immediately following Step 2	Mobile phone	
5	RPS Planning & Logistics Officer (PLO)	Notify MCT, Technical Advisors and key subcontractors via SMS, email or phone.	Within 30 minutes of Step 3	RPS OSM Resource Register	
6	RPS PLO	Notify relevant staff of incident via email or phone.	Within one hour of receiving Activation Form	RPS OSM Resource Register	
7	RPS MC	Provide twice daily email updates to Santos IMT including: • latest progress • plan for next 24-48 hours • key logistical requirements/constraints • info required from Santos • any other business.	(1200 and 1700) or as agreed with Santos IMT	n/a	
8	RPS MC, Operations Officer and PLO	Maintain Incident Log throughout response.	Daily	Functional Log	

Phase 2 – Response Planning

Step	Responsibility	Action	Timeframe	Resources	Date/Time complete	Timeline
9	RPS MC and RPS PLO	Determine location of monitoring coordination operations (in office or remote) and ensure team is equipped to operate remotely if necessary.	Within 2 hours of activation form (Step 4)			2-7 hours
10	Santos IMT (EUL)	Provide spill trajectory modelling (access link to portal) and sensitive receptor information to RPS.	Within 4 hours of activation form (Step 4)	RPS OST modelling Department of Transport database: WAMOPRA (navigatusconsulting.com) Santos GIS Mapping		
11	RPS MC, PLO and Operations Officer	Attend Santos incident briefing if required and relay information to MCT.	As advised by the Santos IMT (EUL)	n/a		
12	MCT and Technical advisors	MCT and Technical Advisors to convene to review personnel and equipment resource status.	Within 6 hours of activation form (Step 4)	Capability report Training matrix Resource chart		
13	RPS PLO RPS Operations officer	Confirm availability of additional personnel and equipment resources.	Within 8 hours of activation form (Step 4)	External Supplier Details RPS OSM Resource Register		
14	RPS MC in consultation with Santos EUL	Define the scale of response - identify which SMPs are activated and if a First Strike Response[2] approach is necessary. Identify if operational water quality monitoring is required.	Within 2 hours of receiving spill and receptor information (Step 10).	Scientific Monitoring Plan[4] Relevant OPEP Spill trajectory modelling Operational monitoring results.		

15	RPS Technical Advisors in consultation with Santos EUL	**Determine monitoring locations for activated SMPs:** Identify monitoring locations in order of priority for activated SMPs based on: • nature of hydrocarbon spill • spill trajectory modelling and time to shoreline impacts • sensitive receptors impacted or potentially at risk of being impacted • state of current baseline data • current environmental conditions • current results of operational monitoring. Determine if post-spill pre-impact data is required to be collected from any locations. Refer to SMP Work Method Statements for decision making process when considering availability of baseline data.	Within 12 hours of receiving spill modelling (Step 10).	Relevant SMPs Information from RPS: • baseline information for relevant receptors. Information from Santos IMT: • sensitive receptor information (including relevant conservation/ management plans) from relevant EP, Santos GIS mapping and online resources (DoT oil spill response atlas, DoE conservation values atlas, DoE species profile and threats database) • oil spill trajectory modelling • response strategies and priority protection areas • results from OMPs currently activated baseline information for relevant receptors as referenced in the relevant SMP.	17 hours
16	RPS Operations Officer, PLO & Technical Advisors in consultation with Santos EUL	**Determine personnel requirements:** • Identify number and competencies of personnel required for monitoring teams for each SMP based on: – activated SMPs – number of locations to be monitored – number of locations where pre-spill baseline data needs to be collected – timing of hydrocarbon spill and overlap with sensitive receptors in activated SMPs – logistical and equipment resource constraints.	Within 12 hours of receiving spill modelling (Step 10).	Information from RPS: • Capability report • Training matrix • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • sensitive receptor information • oil spill trajectory modelling	

		Arrange additional personnel if required. Determine status of required Santos induction/medicals for personnel and request online training profiles and medical bookings if required.		• response strategies and priority protection areas • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation, etc).	**17 hours**
17	RPS Operations Officer, PLO & Technical Advisors in consultation with Santos EUL	**Determine equipment requirements:** • Identify number and competencies of equipment required for each SMP based on: – activated SMPs – number of locations to be monitored – number of field teams and timing of mobilisation to the field – logistical and equipment resource constraints. • Arrange additional equipment resources if required.	Within 12 hours of receiving spill modelling (Step 10).	Information from RPS: • Resource chart • relevant SMPs and WMS. Information from Santos IMT: • equipment (i.e. vessels, aircraft) availability • logistics (availability of flights, accommodation etc).	
18	RPS MC, Operations Officer, PLO & Technical Advisors	**Submit Monitoring Action Plan (MAP)** (mission, objectives, strategies, tactics, tasks), including scope of works and spatial information for survey locations to inform Santos SIMOPS and other permission requirements. **Prepare and submit cost estimate.** **Prepare and submit logistics request:** • Allocate personnel and equipment resources to field teams for relevant SMPs. Submit scope of work (SoW) and logistics request for each activated SMP to Santos IMT for approval.	Within 24 hours of receiving spill modelling (Step 10) for relevant SMPs.	Information from RPS: • 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.	**17 – 53 hours**
19	RPS Technical Advisors in consultation with Santos EUL	Submit fauna licence applications	Within 24 hours of receiving spill modelling (Step 10).	• Proposed monitoring locations • SMP methods	

20	Santos IMT (EUL)	Santos to approve MAP, provide purchase order and initiate logistical arrangements.	Within 24 hours of MAP submission (Step 18) [5]	RPS Mobilisation and Logistics Request	**17 – 53 hours**
21	RPS MC	Advise field personnel by email meeting invite, or phone if not in office. Delegate and initiate tasks for field preparation.	Preliminary notification prior to submission of MAP, then confirm once approved by Santos	Field team allocation	

Phase 3 - Mobilisation

Step	Responsibility	Action	Timeframe	Resources	Date/Time complete	Timeline
24	RPS PLO	GIS and device preparation requests (field maps, data capture) submitted, and discussed with Geospatial team.	To be initiated during MAP preparation	https://voyager/		29 -hours – 5 days
26	Field Team Leaders	Compile SMP field documentation, forms, GIS information, field equipment, and prepare and submit HSE documentation to Santos IMT.	Commence once MAP submitted (Step 18). Submit HSE documentation 24 hours prior to mobilisation.	Information from RPS: • SoW • Grab packs, SMP WMS and HSE documentation • GIS information/field maps • field equipment. Information from Santos IMT: • booking and logistics confirmations.		
27	RPS Technical Advisors	Conduct scope specific pre-mobilisation briefings.	24 hours prior to mobilisation.	Pre-mob Briefing Template		
28	Santos EUL	Santos to approve HSE plan.	8 hours prior to mobilisation.	• Mobilisation and Logistics Form • HSE plan		
29	RPS PLO	Personnel mobilised to site for First Strike Response.	Within 72 hrs of MAP approval (Step 20)	Approved SoW		

Phase 4 – Response Operations

Step	Responsibility	Action	Timeframe	Resources	Date/Time complete	Timeline
30	RPS MC	Conduct Monitoring Action Plan review with MCT and Technical Advisors and communicate to Santos IMT (EUL).	Daily	Monitoring Action Plan template		5 days +
31	RPS PLO	Hold post-demobilisation debrief with field teams.	Within 3 days of demobilisation.	Demob. Meeting Template		
32	Santos EUL	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	RPS Field Team Leaders	Provide activity reports to Santos EUL.	Daily	Daily Activity Report Template		

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

[2] First Strike Response is a rapid initial mobilisation of personnel and equipment following an oil spill incident to undertake priority scientific monitoring. Objectives of this first strike response may include:

- collection of pre-impact baseline data,
- collection of impact data for areas or receptors of high environmental significance,
- rapid assessment to determine impacts on receptors to inform operational monitoring or the future scientific monitoring requirements, if required.

The initial first strike response may not include monitoring of all activated SMPs and may include a smaller contingent of personnel and equipment, depending on the objective. The objectives and approach of the first strike response will be determined in consultation with Santos.

[3] 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.

[4] Approval of the MAP in a timeframe longer than 24 hours after submission may result in delays to mobilisation.

K-3 Dispersant Operational Monitoring Activation Form

Operational Monitoring – Dispersants Activation Form

Activation Summary
In the event of a spill requiring a response from Advisian: 1. **Phone (03) 9389 3637 to alert the Advisian Operational Standby Response.** 2. **Complete the Activation Form below and email to spillresponse@advisian.com** **If you do not receive a response from the Advisian Operational Standby Response Team within 60 minutes, please call again.**

A. Activation Contact			
Date/Time of Activation (AWST)			
Notification Contact Name			
Position in ICT			
Phone		Mobile	
Email		ICT Link	
CC		ICT Phone	

B. Spill Details			
Date/Time of spill (AWST)			
Spill source location coordinates		Geographic Coordinate System	
Spill Status & Details if Known: • Quantity • Release rate • Source & cause • Trajectory • Controlled/uncontrolled			

<table>
<tr><th colspan="4">C. Activation Details</th></tr>
<tr><td>Operational Monitoring Scope</td><td colspan="3">Operational water quality monitoring – Dispersant monitoring</td></tr>
<tr><td>Dispersant Application (Surface/Subtidal)</td><td colspan="3"></td></tr>
<tr><td>Survey Vessel (if known)</td><td colspan="3"></td></tr>
<tr><td>Mobilisation Port (if known)/Via vessel/Helo</td><td></td><td>12/24 hour ops?</td><td></td></tr>
<tr><td>Other Notes on Mobilisation/Logistics:</td><td colspan="3"></td></tr>
</table>

K-4 Dispersant Operational Monitoring Activation Process

Operational Monitoring – Dispersants Activation Summary

1.1 Introduction

The Santos operational and scientific monitoring plan (OSMP) would be activated after a level two or three unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. One of the response options available as part of a response is to apply chemical dispersants either surface or subsurface. Monitoring the effectiveness, distribution and fate of any application of chemical dispersants is essential to verify impact and contact predictions for response planning and other monitoring plans.

1.2 Scope

Advisian will provide a response that is scalable to the size, type and duration of the spill, and chosen dispersant application response. Advisian will mobilise resources and expertise to undertake the operational monitoring required to implement both the SMART protocol for surface-applied dispersants and (with minor modification) the subsea dispersant monitoring plan, as described in the API Technical Report 1152.

Advisian will:

- provide a 24/7 spill response standby service
- participate in an annual exercise as requested
- provide monthly resourcing and capability reports
- maintain pool of equipment dedicated to oil spill response and ready for rapid mobilisation
- mobilise resources in alignment with the implemented strategy (SMART or API 1152).

1.3 Activation

Advisian maintains a maintain a call service number and dedicated email address, twenty-four hours a day, seven days a week (24/7), to contact in the event that a spill has occurred, and the response option of dispersant application has been decided on. Advisian spill response resource activation is summarised below:

Activation Summary
In the event of a spill requiring a response from Advisian: **1. Phone (03) 9389 3637 to alert the Advisian Operational Standby Response.** **2. Complete the Activation Form (Attachment 1) and email to spillresponse@advisian.com** **If you do not receive a response from the Advisian Operational Standby Response Team within 60 minutes, please call again.**

1.4 Mobilisation

Mobilisation times will algin with existing monitoring plans. Advisian will make all reasonable endeavors to mobilise Personnel for at least 1 team will be ready to deploy (ex-Perth) within 72 hours of receipt of approved Monitoring Action Plan (MAP), subject to contractual agreements (PO), logistics (Non-Advisian equipment preparation, consumables and freight) and deployment documentation being in place (Field plans, HSE documentation and risk assessments).

1.5 Contractual Arrangements

Advisian has agreement with Santos for the provision of operational monitoring – dispersants (Purchase Order: 4800010987) and would deliver works under the existing Outline Agreement between Santos Ltd and Advisian Pty Ltd (Contract No.4821176).

Activation of monitoring services will be via verbal authorisation by the Santos IMT to the Advisian Operational Standby Response, submission of an Activation Form, and by a purchase order as soon as possible after activation.

1.6 Proposed approach to delivering the operational monitoring program – dispersants

Operational monitoring will be undertaken aligned with sampling strategies outlined in the SMART protocol for surface dispersant application or API for subsurface dispersant application, specifically:

- The Special Monitoring of Applied Response Technologies (SMART) program for monitoring of dispersant application
- The Industry Recommended Subsea Dispersant Monitoring Plan form the American Petroleum Institute (API 1152 2020),

Together these plans represent industry best-practice for monitoring dispersant application during a significant hydrocarbon spill response.

Where practicable, the standard operating procedures for monitoring activities will be aligned with existing standards and processes, including:

- CSIRO Oil Spill Monitoring Handbook
- Australian Marine Safety Authority (AMSA) sampling guides
- Australian and New Zealand Environment and Conservation Council (ANZECC) Guidelines
- revised ANZECC/Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) Sediment Quality Guidelines.

The main scope of operational and scientific spill response will be managed by a separate contractual arrangement (currently with Astron/BMT). The data obtained from these scopes may be used to inform this scope, potentially providing required baseline, reactive baseline, reference and additional operational data for the dispersant application monitoring.

Appendix L Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

Assurance arrangements

Santos has a primary Monitoring Service Provider (MSP) for the implementation of Scientific Monitoring Plans (SMPs) 1-11. A contractual arrangement exists between Santos and the MSP to maintain standby arrangements as per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162); The MSP has the resourcing capability to implement a first-strike response at all times. The MSP maintains a relationship with primary sub-contractors for the provision of scientific monitoring for those SMPs where the MSP does not have the required capability. Between the MSP and primary sub-contractors, capability exists to deliver first strike resourcing against SMPs 1-11. SMP 12 will be conducted by capability obtained through the Australian Institute of Marine Science (AIMS).

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the MSP and subcontractor Planning and Logistics Officers and delivered to the Santos Spill Response Adviser along with a summary of any changes in resourcing, and if required, how gaps in resourcing have been managed. Since the establishment of the scientific monitoring contract in 2015 the MSP has always demonstrated through this process that it has the required capability to meet first strike resourcing as per the standby services contract.

Santos ensures that MSP standby arrangements are adequate through its exercise and auditing program. Santos regularly conducts exercises and tests with the MSP and its sub-contractors to ensure that Santos IMT roles and MSP/sub-contractor monitoring roles are familiar with the SMP activation arrangements while providing spot checks on resource availability. Santos has previously also undertaken an audit of the MSP against its Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162). Assurance activities to date have demonstrated a high degree of compliance with standby service requirements.

Continuous improvement

Santos is committed to further improving its oil spill scientific monitoring capability. To that end, Santos is participating in a Joint Industry Operational and Scientific Monitoring Plans project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2023, is working towards a joint-industry capability for implementing a common suite of oil spill operational and scientific monitoring plans. The project aims to deliver efficiencies in implementing and testing oil spill scientific monitoring arrangements while increasing the level of resourcing and capability available to participating companies.

Baseline data assessment process

The Santos approach to undertaking a baseline assessment is to first consider the nature and scale of the worst-case spill scenarios within the overall Santos EMBA. For activities where the worst-case scenarios are deemed to result in the greatest potential impact a baseline assessment is undertaken, focussing on those sensitive receptors for which modelling predicts contact[24] within seven days at a probability >5% (**Table L-1**). It is considered that contact within seven days would require an enhanced understanding of available baseline data to ensure a timely response.

Santos is currently committed to undertaking a review of the status, availability, currency and suitability of existing baseline data for oil spill scientific monitoring sources every 2 years. A

[24] Contact is defined as oil concentrations at sensitive receptors of ≥1 g/m² for surface oil, ≥10 g/m² shoreline oil and ≥ 10 ppb for entrained and dissolved oil.

comprehensive review of the baseline data was completed in February 2023 and included all SMPAs within the overall Santos EMBA, including the Barossa EMBA.

The assessment of baseline data included:

1. A review of the following parameters for each program identified:
    - Integrated Marine and Coastal Regionalisation of Australia
    - Custodian- contact point for data
    - Spatial extent
    - Variables available for monitoring
    - Methods applied to monitoring
    - Year of most recent data capture
    - Total duration of monitoring program
    - Data completeness (number of years monitored as proportion of program duration)
    - How often data is captured
    - Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
    - Is there any clear indication that the monitoring will continue?
2. The quality of the following parameters was then ranked as high, medium, low or unknown:
    - Year of most recent capture:
        - 2017-2021 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
        - 2011-2016 = medium
        - <2011 = low
    - Duration
        - >4 years = high
        - 2-4 years = medium
        - 1 year = low
    - Data completeness:
        - 100% = high
        - 75-99% = medium
        - <75% = low
    - Frequency of capture
        - Annually = high
        - Bi-annually = medium
        - <Bi-annually = low
    - Appropriateness of parameters
        - High/medium/low

    Appropriateness of parameters was based on reference to the Scientific Monitoring Plan's targeted states for each receptor and considering whether the monitoring parameters were sufficient to compare against these states. Parameters were considered highly appropriate if all targeted states for a receptor could be quantified, of medium appropriateness if only some states could be quantified and low if the monitored parameters had little relevance to the targeted states of an individual receptor.

3. An overall assessment of each study program was then made as follows:
    - All parameters rated high = overall 'good'
    - At least one parameter rated medium = overall 'fair'
    - At least one parameter rated low = overall 'poor'
    - Unknown = overall not enough data to rate

The above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact – Classified as "good" in the above assessment (i.e., data was current, of reasonable duration and frequency, and employed appropriate methodologies) or 2) the existing baseline data is unlikely to be suitable to detect change in state – classified as "fair" or "poor" by the above assessment (i.e., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies). Following this assessment, a scientific monitoring priority area (SMPA) by SMP matrix summarising recommendations on baseline data status and recommendations for further action was developed (**Table L-2**) based on three categories:

+ **Not applicable** – SMP is not applicable to the scientific monitoring priority protection area as sensitive receptor does not occur.
+ **Survey** – current monitoring/knowledge is considered sufficient (i.e., could be used to detect change in state in the event of a significant impact) and is considered a lower priority for post-spill pre-impact data collection.
+ **Priority survey** – current monitoring/knowledge is insufficient, not in place or not practicable; or a baseline assessment has not been undertaken. Post-spill pre-impact baseline data collection should be prioritised.

Barossa drilling capability assessment

The scientific monitoring protection areas for this activity are presented in **Table L-1**. Noting that the SMPAs identified are based on stochastic modelling outputs (i.e. the outcomes of hundreds of spill modelling simulations rather than a single spill event) and therefore it is unlikely that all of the SMPAs would be contacted or contacted within 7 days, for a single spill event.

Based on the assessment of priority survey areas/receptors outlined in **Table L-2**, a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days); this capability is outlined in **Table L-3**. As demonstrated, Santos has excess capability than the expected requirement.

The two key ecological features (KEFs) listed (Shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise) occur within the Northern Marine Region and a component of both also occur within the Oceanic Shoals AMP (**Figure L-1**). Some of the banks and shoals listed also occur within the two KEFs and the Oceanic Shoals AMP (**Figure L-1**). Thus allowing for sampling overlap for some SMPAs.

The mobilisation of SMP teams and monitoring equipment to deployment locations will be within 120 hours (72 hours from monitoring plan approval). Most of the SMP activities will be vessel-based (apart from aerial surveillance of wildlife), and the approximate steam time to the Barossa operational area is 20 hours. In consideration of these timeframes, mobilisation of scientific monitoring teams to some priority receptor sites may not be possible within contact timeframes and in such instances experimental designs not relying on pre-impact baseline would have to be employed (these experimental design approaches are described within the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099)).

The results of the baseline and capability assessment of protection priority areas summarised herein has been provided within the Environment Functional Team Folder on the Emergency Response Intranet page so that this information is accessible to guide Santos IMT Environmental roles and monitoring provider roles in the event of activating oil spill scientific monitoring.

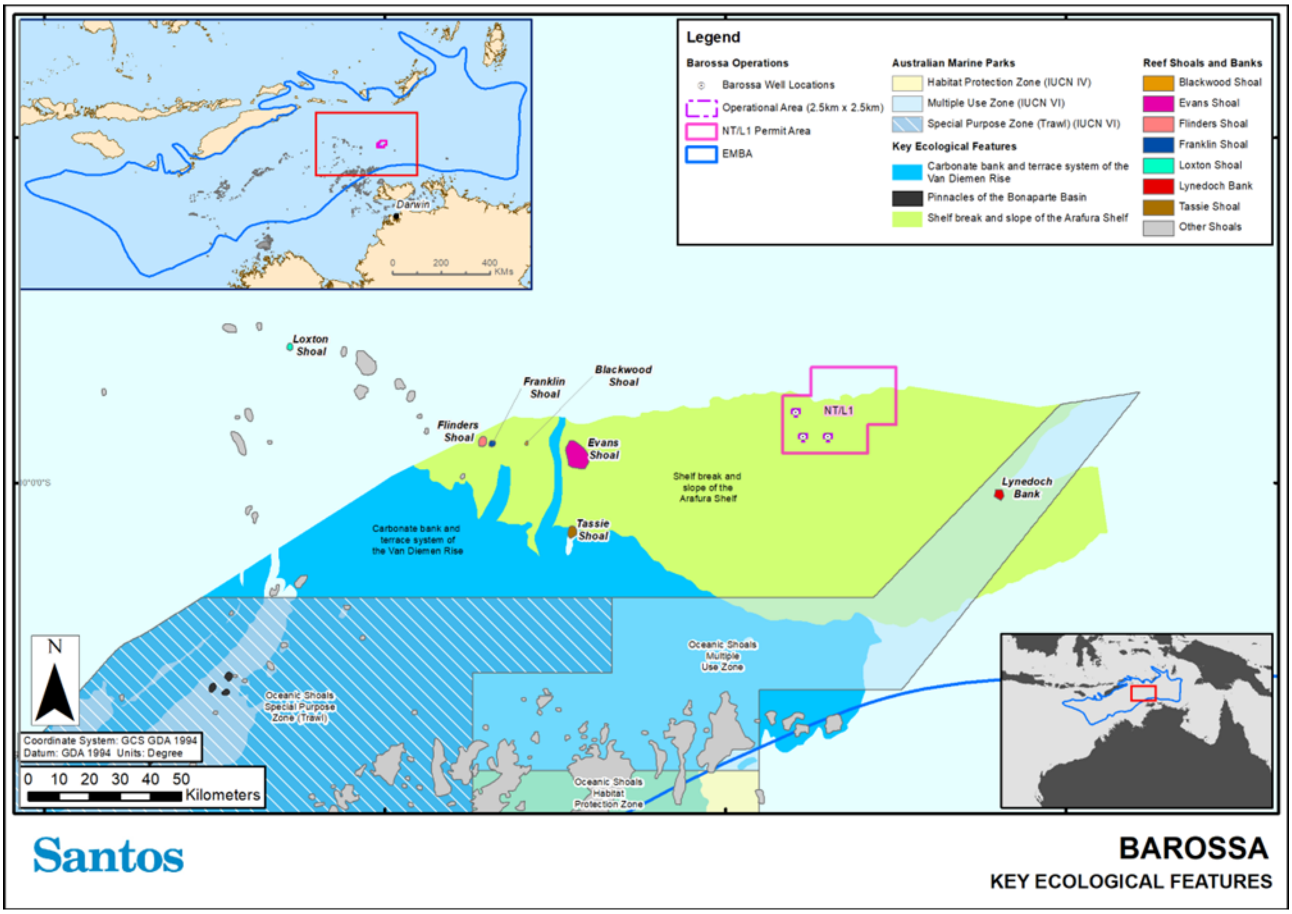


Figure L-1: Barossa KEFs

Table L-1: Minimum time to contact for loss of well control (subsea) of 129,000 m^3 Barossa condensate scenario over 90 days (RPS, 2019a)

Scientific monitoring priority area	Water depth (average) (m)	Approximate distance from Barossa Operational Area	Probability (%) floating oil (≥1 g/m²) on sea surface	Minimum arrival time floating oil (≥1 g/m²) (days)	Probability (%) entrained (≥10ppb) in the 0-10 m depth layer	Probability (%) entrained (≥10ppb) in the 10-20 m depth layer	Minimum time entrained oil (≥10 ppb) at any depth (days)
Oceanic Shoals AMP	87	33 km	52 (transitional)	10 days 2 hours	94 (summer)	14 (transitional)	3 days 14 hours (summer) 6 days (transitional)
Shelf break and slope of the Arafura Shelf KEFs	100	Within the operation areas	100 (all)	1 hour	100 (all)	97 (summer)	-
Carbonate bank and terrace system of the Van Diemen Rise KEFs	140	65 km	74 (transitional)	2 days 17 hours	100 (transitional & winter)	27 (winter)	3 days 2 hours (transitional) 2 days 14 hours(winter)
Unnamed Shoal	60	79 km	66 (transitional)	4 days 17 hours	-	-	-
Evans Shoal	18	81 km	67 (transitional)	2 days 7 hours	100 (transitional & winter)	15 (summer)	6 days 22 hours (summer) 2 days 22 hours (transitional) 3 days 14 hours (winter)
Franklin Shoal	10.5	111 km	44 (transitional)	3 days 14 hours	100 (winter)	-	4 days(transitional) 4 days 5 hours (winter)-

Scientific monitoring priority area	Water depth (average) (m)	Approximate distance from Barossa Operational Area	Probability (%) floating oil (≥1 g/m²) on sea surface	Minimum arrival time floating oil (≥1 g/m²) (days)	Probability (%) entrained (≥10ppb) in the 0-10 m depth layer	Probability (%) entrained (≥10ppb) in the 10-20 m depth layer	Minimum time entrained oil (≥10 ppb) at any depth (days)
Flinders Shoal	6.8	109 km	36 (transitional)	3 days 19 hours	100 (transitional & winter)	-	4 days (transitional) 4 days 7 hours (winter)
Blackwood Shoal	15	97 km	53 (transitional)	3 days	100 (transitional & winter)	-	5 days 19 hours (transitional) 4 days 5 hours (winter)-
Tassie Shoal	15	89 km	40 (transitional)	4 days 19 hours	99 (transitional & winter)	12 (summer)	8 days 7 hours (summer) 4 days 10 hours (transitional) 4 days 2 hours (winter)
Loxton Shoal	10.1	174 km	24 (transitional)	6 days 19 hours	95 (winter)	-	6 days 22 hours (transitional) 8 days (winter)
Lynedoch Bank	Unknown	56 km (south-east)	-	-	75 (summer)	-	6 days 14 hours (summer)

Santos

Table L-2: Summary of recommendations for further action based on review of available baseline data

SMP	Scientific monitoring priority areas										
	Oceanic Shoals AMP	Shelf break and slope of the Arafura Shelf KEF	Carbonate bank & terrace system of the Van Diemen Rise KEF	Unnamed Shoal	Evans Shoal	Franklin Shoal	Flinders Shoal	Blackwood Shoal	Tassie Shoal	Loxton Shoal	Lynedoch Bank
Water Quality (SMP1)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sediment Quality (SMP2)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sandy Beaches/Rocky Shorelines (SMP3)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mangroves (SMP4)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Intertidal Mudflats (SMP5)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benthic Habitats (SMP6)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Seabirds/ shorebirds (SMP7)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Marine megafauna (SMP8)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Marine reptiles (SMP9)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey

SMP	Scientific monitoring priority areas										
	Oceanic Shoals AMP	Shelf break and slope of the Arafura Shelf KEF	Carbonate bank & terrace system of the Van Diemen Rise KEF	Unnamed Shoal	Evans Shoal	Franklin Shoal	Flinders Shoal	Blackwood Shoal	Tassie Shoal	Loxton Shoal	Lynedoch Bank
Fish, Fisheries & Aquaculture (SMP11)	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Survey	Survey
Whale sharks (SMP12)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table L-3: Capability assessment for rapid sampling of scientific monitoring protection priority areas within seven days

<table>
<tr><th>SMP</th><th>Survey Prioritisation</th><th>Required capability</th><th>Actual Team capability</th></tr>
<tr><td>Water Quality (SMP1)</td><td>Priority survey</td><td rowspan="2">1 team of 2 personnel</td><td>2 teams of 2 personnel
Field Team consists of:
+ Field Team Leader (> 2 years exp.)
+ Field Team Member (1-2 years exp.)</td></tr>
<tr><td>Sediment Quality (SMP2)</td><td>Priority survey</td><td>2 teams of 2 personnel
Field Team consists of:
+ Field Team Leader (> 2 years exp.)
+ Field Team Member (1-2 years exp.)</td></tr>
<tr><td>Sandy Beaches/Rocky Shorelines (SMP3)</td><td>Not applicable</td><td rowspan="3">No shoreline accumulation predicted at any exposure value</td><td>1 teams of 2 personnel
Field Team consists of:
+ Field Team Leader (> 2 years exp.)
+ Field Team Member (1-2 years exp.)</td></tr>
<tr><td>Intertidal Mudflats (SMP5)</td><td>Not applicable</td><td>1 teams of 2 personnel
Field Team consists of:
+ Field Team Leader (> 2 years exp.)
+ Field Team Member (1-2 years exp.)</td></tr>
<tr><td>Mangroves (SMP4)</td><td>Not applicable</td><td>Not applicable[1]</td></tr>
</table>

SMP	Survey Prioritisation	Required capability	Actual Team capability
Benthic Habitats (SMP6)	Priority survey	1 team of 2 personnel	1 teams of 2 personnel Field Team consists of: + Field Team Leader (> 2 years exp.) + Field Team Member (1-2 years exp.)
Seabirds/ shorebirds (SMP7)	Priority survey	Vessel-based Field Team: 1 team of 2 personnel Aerial Filed Team: 1 team of 2 personnel	1 teams of 2 personnel Field Team consists of: + Field Team Leader (> 2 years exp.) + Field Team Member (1-2 years exp.)
Marine megafauna (SMP8) (including whale sharks)	Priority survey		Vessel-based Field Team[2]: 1 team of 2 personnel (both experienced wildlife observers) Aerial Filed Team[3]: 1 team of 2 personnel (both experienced wildlife observers)
Marine reptiles (SMP9)	Priority survey		
Seafood Quality (SMP10)	Priority survey	1 team of 3 personnel	1 team of 3 personnel Field Team consists of: + Field Team Leader (> 2 years exp.) + 2 x Field Team Member (1-2 years exp.)
Fish, Fisheries & Aquaculture (SMP11)	Survey		

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

[2]Vessel-based surveys for marine mammals, birds and reptiles could be conducted by the same team for multiple SMPAs, provided they have the appropriate skills and targeting the applicable areas for the target species.

[3] Aerial surveys for marine mammals, birds and reptiles could be conducted by the same team for multiple SMPAs in proximity, provided they have the appropriate skills and targeting the applicable areas for the target species.

Appendix M Forward Operations Guidance

The IMT operate from Perth within the Santos IMT room. These rooms are equipped and subject to reviews and updates as detailed in the Santos Incident Management Plan – Upstream Offshore (SO-00-ZF-00025).

To facilitate a streamlined response, forward operational bases are required close to the response operational areas equipped with near duplicated IMT equipment and personnel. Further information on FOBs is provided in the Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

Forward Operating Base (FOB)

For a significant Level 2/3 response requiring coordination of resources to be deployed to the field, Santos will establish a FOB. For a Level 2/3 spill crossing from Commonwealth to Territory/WA State waters (cross-jurisdictional spills) NT Control Agency / WA DoT will establish a FOB.

For a Barossa development activity spill response, Santos will establish a FOB at the Santos Logistics and Supply Base, located at East Arm Wharf, Darwin Harbour. The Santos Logistics and Supply Base at East Arm Wharf is connected to the Santos internet and telephone system.

Additional FOBs may be set up as operational requirements dictate.