Santos

Petrel Sub-Basin South-West 3D Marine Seismic Survey Oil Pollution Emergency Plan (OPEP)

PROJECT/FACILITY	Petrel Sub-Basin SW 3D Marine Seismic Survey
REVIEW INTERVAL	No Review Required
SAFETY CRITICAL DOCUMENT	NO

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0	Senior Oil Spill Response Coordinator	Team Leader – Security & Emergency Response Emergency Response Coordinator	Manager – HSE Offshore Division
1	Senior Oil Spill Response Coordinator	Environmental Approvals Team Lead	Manager – HSE Offshore Division

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List of Acronyms

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
APASA	Asia-Pacific Applied Sciences Associates
APPEA	Australian Petroleum Production & Exploration Association
API	American Petroleum Institute
AUV	Autonomous Underwater Vehicle
BIA	Biologically Important Area
BAOAC	Bonn Agreement Oil Appearance Code
CEO	Chief Executive Officer
CHARM	Chemical Hazard and Risk Management
CM	Control Measure
CMT	Crisis Management Team
CMMS	Computerised Maintenance Management System
CPI	Corrugated Plate Interceptor
CTD	Conductivity-temperature-depth
DAH	Dissolved Aromatic Hydrocarbons
DAWR	Department of Agriculture and Water Resources
DBCA	Department of Biodiversity, Conservation and Attractions
DISER	Department of Industry, Science, Energy and Resources
DoE	(Australian) Department of the Environment (now DoEE)
DoEE	(Australian) Department of the Environment and Energy (now DAWE)
DAWE	(Australian) Department of Agriculture, Water and Environment
DEPWS	Department of Environment, Parks and Water Security
DoF	Department of Fisheries
DMIRS	WA Department of Mines, Industry Regulation and Safety
DoT	Department of Transport
DPaW	Department of Parks and Wildlife (now DBCA)
DPIRD	Department of Primary Industries and Regional Development

Abbreviation	Description
DWER	Department of Water and Environment Regulation
EAP	Employee Assistance Programme
EMBA	Environment that May Be Affected
EP	Environment Plan
EPA	West Australian (WA) Environmental Protection Authority
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
EPO	Environmental performance outcome/objective
EPS	Environmental performance standard
ESD	Ecologically sustainable development
ETL	Environment Team Leader
FOB	Forward Operations Base/s
GHG	Greenhouse gases
GIS	Geographic Information System
HFC	Hydrofluorocarbons
HFO	Heavy Fuel Oil
HR	Human Resources
IAP	Incident Action Planning
IC	Incident Commander
ICC	Incident Command Centre
ICMM	Incident Command and Management Manual
IFO	Intermediate Fuel Oil
IMMR	Inspection, Maintenance, Monitoring and Repair
IMS	Invasive Marine Species
IMSMP	Invasive Marine Species Management Plan
IMT	Incident Management Team
IRT	Incident Response Team
KEF	Key Ecological Feature
Km	Kilometre
LMS	Listed Migratory Species
LTS	Listed Threatened Species
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBES	Multi-beam echo sounding
MCT	Monitoring Coordination Team

Abbreviation	Description
MDO	Marine diesel oil
MEECC	Maritime Environmental Emergency Coordination Centre
MFO	Marine Fauna Observer
MNES	Matters of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MOP	Marine Pollution Incidents
MOU	Memorandum of Understanding
MP	Marine Park
MSA	Master Services Agreement
MSS	Marine seismic survey
NATA	The National Association of Testing Authorities, Australia
NatPlan	National Plan for Maritime Environmental Emergencies
NEBA	Net Environmental Benefit Analysis
NMSC	National Marine Safety Committee
NOK	Next of kin
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NWS	Western Australia's North West Shelf
NT	Northern Territory
NT IC	Northern Territory Incident Controller
NT OSCP	NT Oil Spill Contingency Plan
NTOWRP	Northern Territory Oiled Wildlife Response Plan
ODS	Ozone depleting substances
OPEP	Oil Pollution Emergency Plan
OPGGS(E)(R)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSC	On-scene Commander
OSCP	Oil Spill Contingency Plans
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
PAH	Polycyclic aromatic hydrocarbons
P(SL)(E)R	State Petroleum (Submerged Lands) (Environment) Regulations 2012
PFC	Perfluorocarbons
RCC	Rescue Coordination Centre

Abbreviation	Description
SBP	Sub-bottom profiling
SF_6	Sulphur hexafluoride
SIMA	Spill Impact Mitigation Analysis
SME	Subject matter expert
SLA	Service level agreement
SMP	Scientific Monitoring Plans
SMPC	State Marine Pollution Coordinator
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SOPEP	Shipboard Oil Pollution Emergency Plan
SSS	Side-scan sonar
TMPC	Territory Marine Pollution Coordinator
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicles
VI	Varanus Island
VOO	Vessels of Opportunity
VPO	Vice President Offshore Upstream WA
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAOWRP	WA Oiled Wildlife Response Plan
WSP	Waste Service Provider

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">Vessel-based three-dimensional marine seismic survey in Commonwealth waters</td><td>Section 2 of the EP</td></tr>
<tr><td rowspan="3">Modelled Spill Locations (Lat/Long)</td><td colspan="3"><u>Release Site 1</u>
Latitude: 13° 36’ 35.6” S
Longitude: 127° 29’ 26.5” E</td><td rowspan="3">Table 3-1 of the EP</td></tr>
<tr><td colspan="3"><u>Release Site 2</u>
Latitude: 13° 59’ 31.5” S
Longitude: 127° 56’ 11.0” E</td></tr>
<tr><td colspan="3"><u>Release Site 3</u>
Latitude: 13° 35’ 39.97” S
Longitude: 128° 53’ 1.53” E</td></tr>
<tr><td>Permit Areas</td><td colspan="3">WA-454-P, WA-545-P, WA-27-R, WA-40-R (Commonwealth waters)</td><td></td></tr>
<tr><td>Installation Type</td><td colspan="3">N/A</td><td></td></tr>
<tr><td rowspan="3">Water Depth</td><td colspan="3">Release Site 1 ~70 m</td><td rowspan="3">N/A</td></tr>
<tr><td colspan="3">Release Site 2 – ~56 m</td></tr>
<tr><td colspan="3">Release Site 3 – ~65 m</td></tr>
<tr><td rowspan="2">Worst-case Spill Scenarios</td><td>Scenario</td><td>Hydrocarbon</td><td>Worst case volume (m³)</td><td rowspan="2">Section 6.1</td></tr>
<tr><td>Surface diesel release (surface spill)</td><td>Marine Diesel Oil</td><td>1,062</td></tr>
<tr><td>Hydrocarbon Properties</td><td colspan="3"><u>Marine Diesel Oil (MDO)</u>
Density kg/m³ at 25°C = 829
Dynamic viscosity (cP) = 4.0 @ 25°C
API Gravity = 37.6</td><td>Appendix A</td></tr>
<tr><td>Weathering Potential</td><td colspan="3">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 evaporation. Up to 65% will generally evaporate over the first two days. Approximately 5% is considered “persistent hydrocarbons”, which are unlikely to evaporate and will decay over time.</td><td>Appendix A</td></tr>
<tr><td>Protection Priorities</td><td colspan="3">No protection priorities have been identified for the purposes of this OPEP</td><td>Section 6.6</td></tr>
</table>

2 First Strike Response Actions

For an oil spill to the marine environment, 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 Plan [SOPEP]).

Further response information contained within this OPEP is concerned primarily when the Santos Incident Management Team (IMT) is engaged for support.

For an oil spill to the marine environment the On-scene Commander (OSC) is to contact the Incident Commander in Perth via the on-call Duty Manager (as per **Table 2-1** below). The OSC is either the Santos Company Site Representative (if present) or the Vessel Master. This will be determined during the planning stages of the activity.

Response information contained within this OPEP is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based IMT are engaged for support. Level 1 spills do not typically require the stand-up of the IMT for support, however on-site response actions to monitor the spill and regulatory requirements for reporting these spills still apply. 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.

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 (vessel-specific procedures, as applicable)	OSC/Vessel Master
Immediate	Control the source using site resources, where possible	Implement site source control procedures (Vessel SOPEP, as applicable)	OSC/Vessel Master
Within 30 minutes of incident being identified	Notify Santos Duty Manager	Verbal communication to Offshore Duty Manager's 's duty phone	OSC
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	OSC
Within 60 minutes	Gain situational awareness and begin onsite spill surveillance	Level 1 spills may only require use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance and tracking buoys) Activate the Monitor and Evaluate Plan Go to **Section 10**	OSC Incident Commander
Refer timeframes Go to **Section 7**	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures Go to **Section 7**	Initial notifications by Environment/Safety Team Leads
Level 2/3 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Duty Manager Incident Commander

When (indicative)	Activations		Who
	Objective	Action	
IMT Actions (0-48 hours)			
Within 90 minutes from IMT callout	Set-up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	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 Team Leader
Refer timeframes **Section 7**	Make regulatory notifications as required Notify and mobilise/put on standby external Oil Spill Response Organisations (OSROs) and Support Organisations, as required	Go to **Section 7**	Initial notifications by Environment/Safety Team Leads OSROs (Australian Marine Oil Spill Centre [AMOSC] and 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 10.8)**	IMT Operations Team Leader IMT Logistics/Supply Team Leaders IMT Environment Team Leaders
Activate on Day 1 for applicable scenarios	Source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario dependent**	Go to **Section 9**	IMT Operations Team Leader IMT Logistics/Supply Team Leaders

When (indicative)	Activations		Who
	Objective	Action	
Activate on Day 1 for applicable scenarios Refer **Section 11**	Reduce exposure of shorelines and wildlife to floating oil through mechanical dispersion	Go to **Section 11**	IMT Operations Team Leader IMT Logistics/Supply Team Leaders
Day 1	Identify environmental sensitivities at risk and conduct NEBA	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (**Section 6.7**)	IMT Environmental Team Leader
Day 1	Ensure the health and safety of spill responders.	Identify relevant hazard controls and develop hazard register Begin preparation Site Health and Safety Management requirements Refer Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016)	IMT Safety Team Leader
If/when initiated Refer **Section 12**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan. Go to **Section 12**	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics/Supply Team Leaders
If/when initiated Refer **Section 14**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan. Go to **Section 14**	IMT Environment Team Leader IMT Logistics/Supply Team Leaders IMT Operations Team Leader
If/when initiated	Safely transfer, transport and dispose of waste collected from response activities	Activate the Waste Management Plan. Go to **Section 13**	IMT Operations Team Leader IMT Logistics/Supply Team Leaders

When (indicative)	Activations		Who
	Objective	Action	
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 relevant Control Agencies may be AMSA (in Commonwealth waters), the Department of Transport (DoT) in Western Australia (WA) State waters, and/or the Northern Territory (NT) Government's Incident Management Team (IMT) in NT waters (refer **Section 4.2**) + Where another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos's support for a State/NT waters response is detailed in **Section 5.2.3**		Control Agency IMT Santos to provide the following roles to DoT Maritime Environmental Emergency Coordination Centre (MEECC)/IMT for State waters response: + CMT Liaison Officer + Deputy Incident Controller + Deputy Intelligence Officer + Deputy Planning Officer + Environment Support Officer + Deputy Public Information Officer + Deputy Logistics Officer + Deputy Finance Officer + Deputy Operations Officer + Deputy Waste Management Coordinator + Deputy Division Commander The above roles may also be provided to the NT IMT for NT waters response

3 Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Petrel Sub-Basin South-West (SW) 3D Marine Seismic Survey (MSS) Environment Plan (EP) (SO-00-BI-20006) (referred to throughout this OPEP as the Petrel Sub-Basin SW 3D MSS EP) 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 Energy Ltd. (Santos) proposes to conduct a marine seismic survey (MSS) in the Bonaparte Basin, located in Commonwealth waters off the northern coast of Australia (**Figure 3-1**). During the survey, a seismic survey vessel will tow a seismic source array and a series of streamers within the Operational Area. The seismic source will emit pulses of low-frequency sound which will reflect from the underlying rock layers beneath the seabed, and the reflected sound (seismic data) will be recorded by the towed streamers. The seismic survey vessel will be supported by other marine vessel and helicopter operations.

Refer to Section 2 of the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006) for details on the activity.

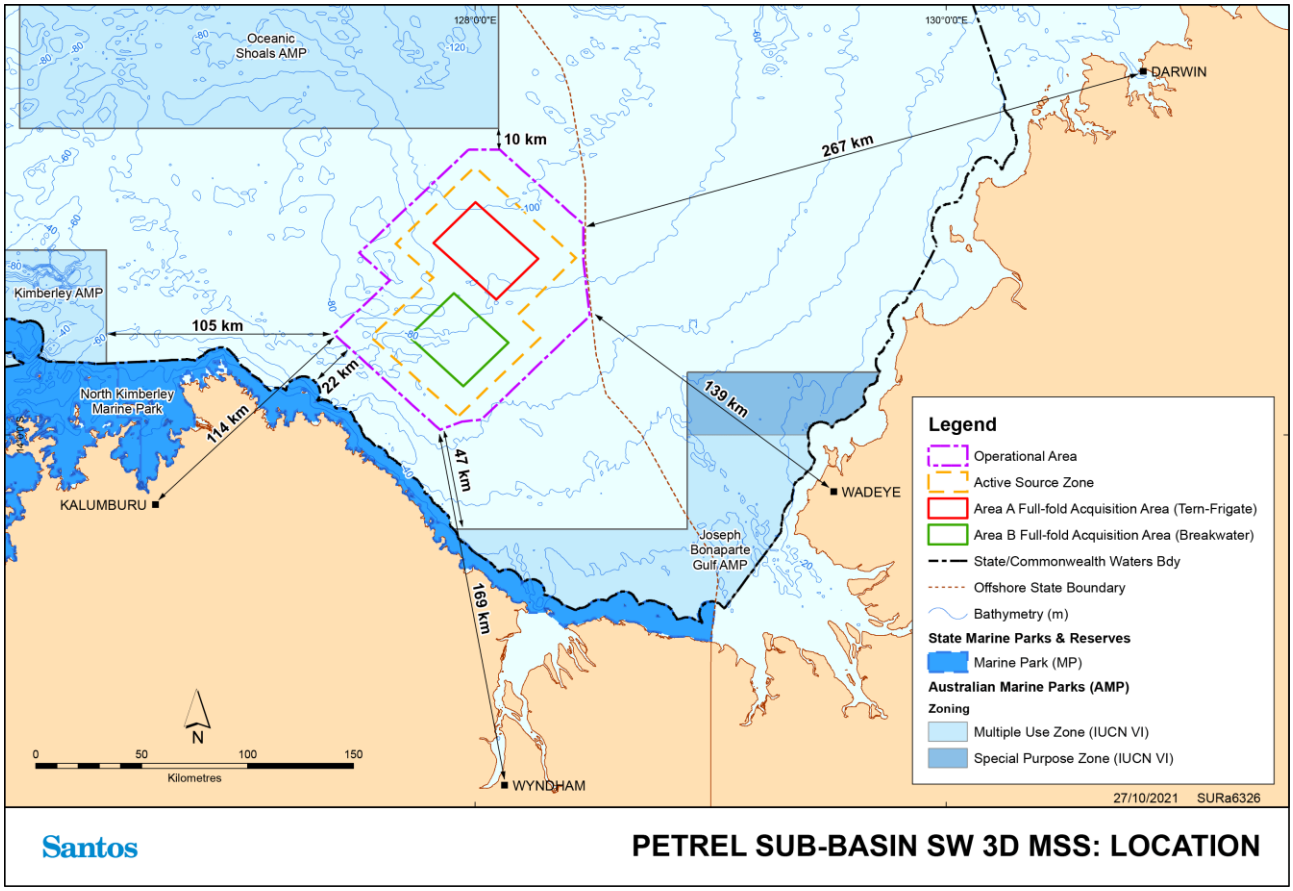

Figure 3-1: Schematic of the Petrel Sub-Basin SW 3D MSS operational area

3.2 Purpose

The purpose of this Oil Pollution Emergency Plan (OPEP) is to describe Santos' response to a hydrocarbon spill during marine seismic surveys within the operational area covered in the Petrel Sub-Basin SW 3D MSS EP.

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

This OPEP is to be read in conjunction with the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006) and will remain valid for the duration of life of the EP. If improved preparedness measures are identified within this time frame, the OPEP will be revised accordingly.

The response strategies outlined in this OPEP have been developed by Santos utilising 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 Net Environmental Benefit Assessment' (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; and
- 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 Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006) covers the Operational Area, located in Commonwealth waters of the Bonaparte Basin, offshore from north-west Australia (**Figure 3-2**).

The Operational Area

The Operational Area intersects a number of petroleum licences areas (WA-454-P, WA-27-R, WA-40-R), all of which are in Commonwealth waters. The Operational Area at its closest is approximately 28 km north-east of the Kimberley coastline and 120 km west of the Northern Territory (NT) coastline. Water depths in the Operational Area range from 49 m to 110 m.

Section 3 of the Petrel Sub-Basin SW 3D MSS (SO-00-BI-20006) includes a comprehensive description of the existing environment. A summary of nearest regional features and distances from the Operational Area are provided in **Table 3-1**.

Table 3-1: Distances from the Operational Area to key regional features

Regional Feature	Distance from Operational Area
Oceanic Shoals Marine Park	10 km N
Joseph Bonaparte Gulf Marine Park	52 km SE
North Kimberley Marine Park (WA State)	30 km S
Kimberley Marine Park	105 km W
Cartier Island Marine Park	429 km WNW
Ashmore Reef AMP	473 km WNW

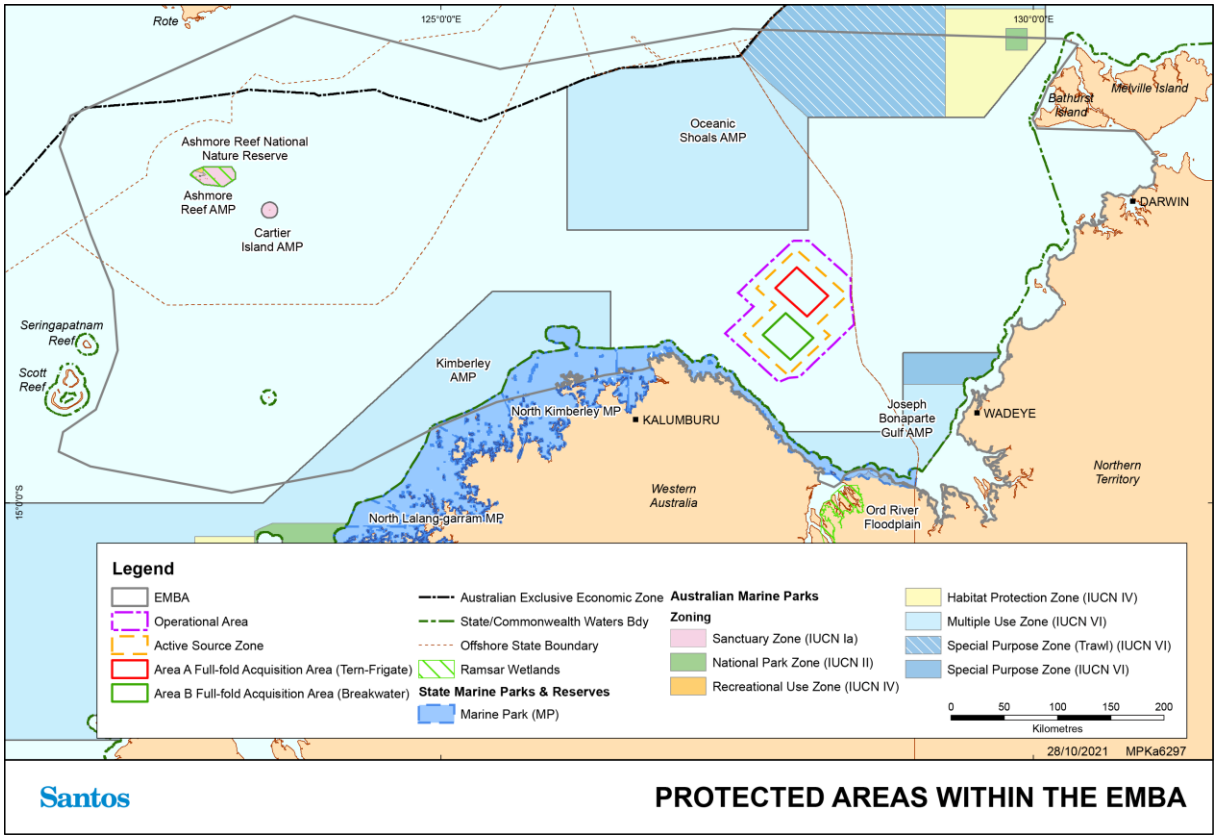

Figure 3-2: Petrel Sub-Basin SW 3D MSS EP location map and regional features

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:

+ Incident Command & Management Manual (SO-00-ZF-00025);
+ Berthing and Terminal Handbook (TV-22-IG-00067);
+ Offtake Operational & Pilotage Procedure (NV-91-IG-10010.03);
+ Incident Response Telephone Directory (SO-00-ZF-00025.020);
+ Refuelling and Chemical Management Standard (QE-91-IQ-00098);
+ Santos Source Control Planning and Response Guideline (DR-00-OZ-20001);
+ Oil Pollution Waste Management Plan (QE-91-IF-10053);
+ Oil Spill Response HSE Management Manual (SO-91-RF-10016);
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
+ Oil Spill Scientific Monitoring Baseline Data Review (QE-00-BI-20001);
+ Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001); and

+ Oil Spill Response Readiness Guideline (SO-91-OI-20001).

Relevant Tactical Response Plans are made available within the ‘First Strike Resources’ folder within the Offshore Emergency Response on Santos intranet site.

4 Oil Spill Response Framework

4.1 Spill Response Levels

Santos uses a tiered system of incident response levels consistent with State and National incident response plans including the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) and the National Plan for Maritime Environmental Emergencies (NatPlan). Spill Response Levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos Incident Command and Management Manual (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 onsite 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 Incident Response Team (IRT) and its resources	Source of spill has been contained Oil is evaporating quickly and no danger of explosive vapours Spill likely to naturally dissipate No media interest/does not have an adverse effect on the public
Level 2	
An incident that cannot be controlled by the use of onsite resources alone and requires external support and resources to combat the situation; or **An incident that can be controlled 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

During a spill response there will be both a Jurisdictional Authority and a Control Agency assigned to the oil spill incident for all spill response levels.

Definitions of Jurisdictional Authority and Control Agency are as follows:

+ Control Agencies: 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; and
+ 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.

With respect to a hydrocarbon spill within the Operational Area, the relevant Jurisdictional Authority and Control Agency varies dependent upon the location of the oil pollution (Commonwealth or State/NT waters), the nature of the incident (vessel based) and the spill response level (refer **Table 4-2**).

To aid in the determination of whether a spill is classed as a vessel spill, the following guidance is adopted:

+ A vessel is a ship at sea to which to which the *Navigation Act 2012* applies.

Table 4-2: Jurisdictional authorities and control agencies for MSS oil spill response

Role	Spill Level	State/NT waters/shoreline oil pollution	Commonwealth waters oil pollution
		Vessel[1]	Vessel[1]
Control Agency	1	DoT (WA) / Vessel owner (NT)	AMSA
	2/3	DoT (WA) / NT IMT (NT)	AMSA
Jurisdictional Authority	1/2/3	DoT (WA) / Department of Environment, Parks and Water Security (DEPWS) (NT)	AMSA

[1] Vessels are defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2017) as a seismic vessel, supply or support vessel, or offtake tanker.

4.3 Vessel Spills in Commonwealth Waters

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

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

4.4 Cross-jurisdictional Vessel Spills

For a large vessel spill (Level 2/3) that crosses Jurisdictions between Commonwealth and State or NT waters, two Jurisdictional Authorities exist (AMSA for Commonwealth waters and DoT for State waters or NT IMT for NT waters). Coordination of Control Agency responsibilities will be determined by DoT/NT Government and AMSA, based on incident specifics with Santos providing first strike response and all necessary resources (including personnel and equipment) as a Supporting Agency.

5 Santos Incident Management

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

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

The establishment and involvement of the CMT will be dependent on the severity of the spill.

The Santos incident response organisational structure is defined in the Incident Command and Management Manual (SO-00-ZF-00025) and shown in **Figure 5-1** for reference.

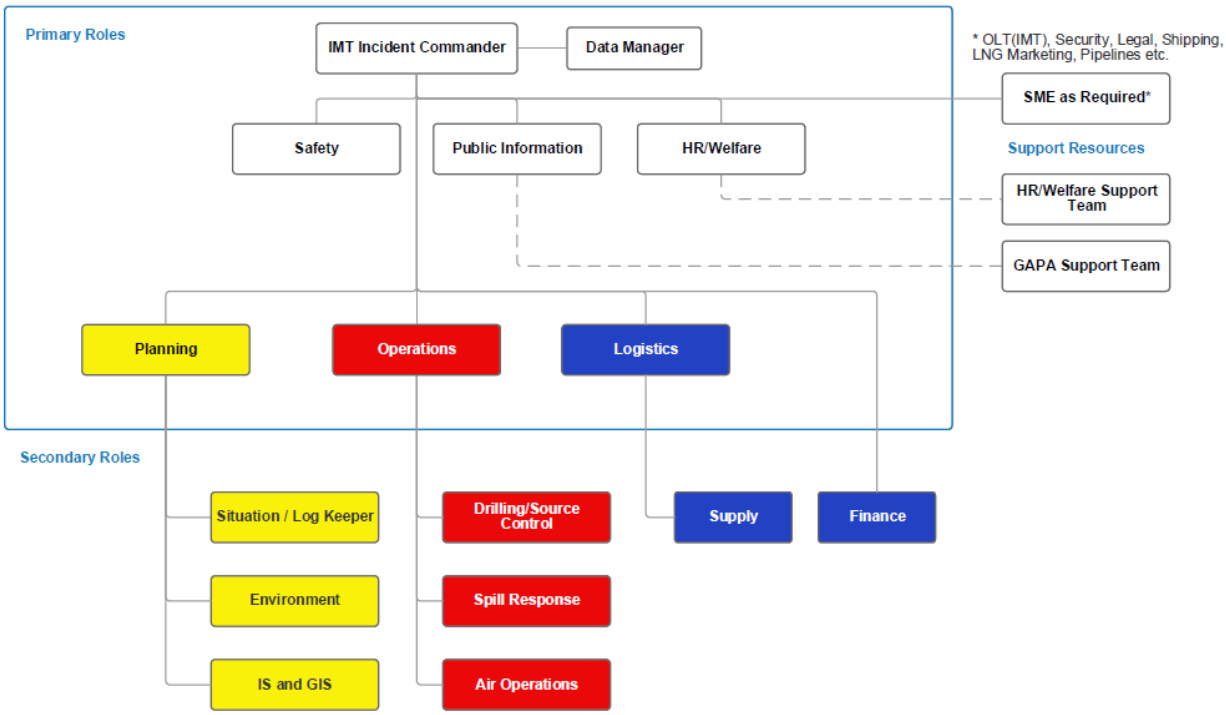

Figure 5-1: Santos Incident Management Team organisational structure

Note: For a Level 2/3 Petroleum Activity spills whereby DoT or NT IMT is involved as a Control Agency, either within a single jurisdiction (State/NT water only spills) or cross-jurisdictional (spills from Commonwealth to State/NT waters), Santos will work in coordination with the DoT/ NT IMT in providing spill response capability. Santos' expanded organisational structure for these situations is detailed in ***Section 5.2.3****.*

5.1 Roles and Responsibilities

The tables below provide an overview of the responsibilities of the Santos CMT (**Table 5-1**), IMT (**Table 5-2**), and field-based response team members in responding to an incident (**Table 5-3**).

Also provided are the roles and responsibilities of Santos personnel required to work within DoT's organisational structure (**Table 5-5**), where DoT has responsibilities for spill response as a Control Agency, as per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements. Similar roles may also be provided to support the NT Government as required in the event of a response in NT waters. NT spill response is goverened by the NT Oil Spill Contingency Plan (OSCP).

DoT will provide a Liaison officer/Duty Incident Commander to the Santos IMT in a coordinated response, as outlined for reference in **Table 5-4**. It is noted that these roles may also come from NT Government in the event of a response in NT waters.

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

Santos CMT Role	Main Responsibilities
CMT Leader	+ Maintain contact with IMT or Issue Notification stakeholder until the CMT is fully functional + Articulate the overall response priorities and required actions using the PEARL approach + Consider response options to achieve priorities, including mitigating the potential worst-case scenario + Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder + Ensure CEO or delegate is engaged for all internal (staff) and external communications + Confirm frequency of CMT reports and meetings and coordination with CEO, IMT and other stakeholders + Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities + Consider CMT requirements for the next phase of activity, allocating actions as appropriate
Administrator – EHS & Governance	+ Provide location, time and meeting medium details (i.e. telecon etc.) to CMT members + Work with the CMT Log Keeper to maintain an accurate CM Log with key situation details, meeting decisions/actions and next meeting time/location details + Disseminate approved briefing material to personnel following CMT Leader's direction + Liaise with Public Affairs/Safety & Security/Facilities on any reception, premises security or media/advisor briefing requirements + Ensure role discipline of CMT representatives, monitoring action progress and any coordination + At each CMT meeting summarise and record: – any change/handover in CMT representatives – the situation reviews and actions since last CMT meeting – any issues raised between meetings requiring escalation to or coordination with the CMT

Santos CMT Role	Main Responsibilities
Duty Manager	+ With CEO agreement and appointment of a CMT Leader, assist with/oversee activation of the CMT + Ensure the core CMT and specialist members are given details for the initial CMT meeting including location, time and meeting medium (i.e. telecon etc.) + Where applicable contact IMT Leader or Issue Notification stakeholder and gain latest update for team + Articulate the overall response priorities and required actions using the PEARL approach. Ensure ongoing monitoring for hidden or emerging risks + Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder + Ensure appropriate Legal Protocols are established on advice from CMT Legal + Ensure CEO or delegate is engaged for all internal (staff) and external communications + Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities
Government & Public Affairs	+ Without delaying CMT attendance, gain advice from Government and Public Affairs teams on main and social media situation, government stakeholder requests and requirements, and immediate strategy + Gain requirements from the CEO or delegate on strategy, timings, and media representation + Follow the Crisis Management Process using the nominated support tools + At initial CMT meeting, take the lead role setting out and updating the stakeholder communications plan + Identify current and immediate messaging needs (i.e. Holding Statements, internal communications, industry advices, government notifications, media releases) and ongoing issues management + Advise on Government and Public Affairs recommendations and other considerations to support company sustainability and resilience + Advise on and coordinate the stakeholder management approach across all levels of Santos, including media monitoring and media inquiry + Engage and oversee any specific asset or sub teams required for stakeholder management

Santos CMT Role	Main Responsibilities
Risk & Audit	+ Advise on current and potential company risk issues + Determine if additional specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on Santos risk options and recommendations, other mitigation controls to company sustainability, and resilience requirements + Monitor and assess cumulative risk consequences and potential exposures to Santos + Engage and oversee any specific sub teams or specialists required for Risk and Audit support + Between meetings, liaise with sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed
Safety and Security	+ Identify current and potential safety and security response, support or regulatory issues + Determine if additional safety or security specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on safety and security recommendations and other considerations to support company sustainability and resilience + Advise on notifications to any safety or security related stakeholders, including mandatory regulatory advice or reports + Monitor and assess safety and security consequences, advise on strategies and potential penalties and financial exposures to Santos + Engage and oversee any specific sub teams or specialists required for Safety and Security support + Between meetings, liaise with sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed

Santos CMT Role	Main Responsibilities
Human Resource Team Leader	+ Identify current and potential Human Resources (HR), People Support (PS) and Industrial Relations (IR) response, support (including incident site deployment) or regulatory issues + Determine if additional HR, PS or IR specialists are needed. If so, coordinate and monitor their implementation (via the IMT where active with the respective IMT Leader) and keep the CMT updated + Advise on and coordinate the personnel and next of kin communication approach across all levels of Santos with support from the Government and Public Affairs representative + Advise on HR, PS and IR recommendations and other considerations to support company sustainability and resilience + Monitor and report on any casualty condition, movement and health tracking to support injured parties (staff, contractors, and community as applicable) + Advise and coordinate management of HR, PS and IR stakeholders (via the IMT Leader where an IMT is active), including emergency services, union representation + Monitor any HR or IR consequences, advise on strategies and potential penalties and financial exposures to Santos + Engage and oversee any specific asset or sub teams used for HR, PS and IR stakeholder management + Between meetings, liaise with asset and sub teams and specialist advisors to ensure an effective response. Ensure confidentiality and authorised comment is continually observed
Legal & Company Secretariat	+ Identify current and potential legal and company secretary issues + Determine if additional legal specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated + Advise on Legal Professional Privilege matters for the CMT and coordinate with other groups (including IMT representation) to ensure company information and personnel are appropriately advised + Advise the CMT, asset and sub teams about contractual obligations, including Joint Venture and supply agreements, as required + Advise on legal and company secretariat recommendations and other considerations to support company sustainability and resilience + Advise on notifications to regulatory or legal related stakeholders, including mandatory advice or reports + Monitor and assess legal consequences, advise on strategies and potential penalties and financial exposures to Santos
Additional CMT support available as required: + Environment and Land Access + Assets and Operations + Engineering and Technical + Exploration	

Santos CMT Role	Main Responsibilities
	+ Finance + Information Systems + Insurance + Marketing and Trading + Treasury + Commercial and Procurement

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

Santos Management/ IMT Role	Main Responsibilities
Vice President Offshore Upstream WA (VPO)	+ 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 VPO is advised by the Incident Commander
Incident Commander	+ Coordinate all support in accordance with the Incident Response Plan (IRP) and/or activity specific Oil Spill Contingency Plan or OPEP + Set the response objectives and strategic direction + Oversee the development and implementation of Incident Action Plans + Oversee implementation of MoUs and contracted support for 'mutual aid' + Ensure co-ordination with external organisations/police, etc. + Prepare and review strategic and tactical objectives with the VPO + Liaise with the VPO and provide factual information + Set response termination criteria in consultation with regulatory authorities + Coordinate authorities for search and rescue
Planning Team Leader	+ Collect and document situational awareness information of the incident + Develop, document, communicate and implement Incident Action Plans to achieve incident objectives + Determine the status of action/s or planned activities under the Incident Action Plans and assess and document performance against the objectives + Assess long term consequences of incident and plan for long term recovery + Manage the Geographic Information System (GIS) Team in a response

Santos Management/ IMT Role	Main Responsibilities
Operations Team Leader	+ Coordinate operational aspects of Incident Response + Provide the key contact for OSCs + Liaise with contractors or third parties + Mobilise additional Santos staff and external experts to form Technical Support Team + Assist Planning Team Leader with overall general plan preparation and preparation of Incident Action Plans + Implement Incident Action Plans + Manage field response teams and activities
Public Information/ Government & Public Affairs	+ Manage all communication with media + Liaise with government. + Prepare media releases for CMT approval. + Brief all Santos personnel appearing before the media. + Manage the Telephone Support Team. + Ensure timely release of communications briefs to the Telephone Support Team.
Logistics Team Leader	+ Mobilise response equipment, helicopters, vessels, supplies and personnel + Provide transport and accommodation for evacuated personnel + Oversee the implementation of the Waste Management Plan throughout a Tier 2 or Tier 3 oil spill response + Assist in the development of Incident Action Plans + Liaise with the Supply Team to activate supply contracts and arrange procurements
Supply Team Leader	+ Arrange fast track procurement + Activate supply contracts as required + Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident
Environmental Team Leader	+ Manage notification to designated Environmental Authorities and liaise as required + Assist in the development of Incident Action Plans + Advise of the Net Environmental Benefit Analysis of oil spill response strategies and tactics + Oversee the implementation of scientific monitoring programs in an oil spill response + Provide liaison for implementation of the WA Oiled Wildlife Response Plan (WAOWRP) or Northern Territory Oiled Wildlife Response Plan (NTOWRP) in an oil spill response

Santos Management/ IMT Role	Main Responsibilities
HR/Welfare Team Leader	+ Obtain personnel status involved in the incident + Review Persons on Board (POB) lists and clarify accuracy through Safety Team Leader + Obtain list of Contactor Companies involved in the incident and obtain Third-Party Contractor contact to advise of situation and safety of personnel when appropriate + Obtain employee's emergency contact list (NOK) to advise of situation and safety of personnel when appropriate + Liaise with CMT HR Team Leader + Work with Logistics Team Leader to arrange transport for affected families to hospitals, etc. + Assist with arrangements through the Employee Assistance Programme (EAP) to support families/employees + Validate media and holding statements information with regards to personnel matters + Work with Public Information on content of internal statements to staff and approved by CMT + Put EAP on alert if appropriate + Work with Police welfare person or doctors as required + Be prepared to accompany police to provide initial company support + Arrange NOK notifications for affected personnel (excluding Police managed fatalities) + Determine NOK assistance required i.e. family travel to hospital, child support, etc. + Arrange for dedicated management support for families and next-of-kin, if appropriate + Arrange EAP counselling at airports and homes where required – HR personnel to attend where possible
Safety Team Leader	+ Manage notification to Designated Safety Authorities and liaise as required + Assist in the development of Incident Action Plans + Oversee the development and implementation of incident Safety Management Plans as required + Work with the HR/ Welfare Team Leader to support personnel safety
IMT Data Manager	+ Ensure IMT resources are in place and functional in the ICC. + Oversee the setting up of communications systems by the Computing and Communications Leader. + Establish the incident specific electronic folder system for records/information management. + Distribute manuals, contact lists and supporting information to IMT personnel. + Record and collect all information associated with the response to the incident. + Maintain filing system for Incident Response.

Santos Management/ IMT Role	Main Responsibilities
GIS	+ Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database' + Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database' + Manage and keep up-to-date marine maps in the 'GIS in IMT Database' + Provide IMT with quick access to up-to-date drawings and data sets in the ICC + Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps
Finance	+ Handle accounting services and financial record-keeping, track and report on incident costs + Facilitate all procurement requirements and ensure that expenditures are properly audited + May be tasked with handling the receipt and processing of IMT third party claims
Spill Response	+ Provide specific advice and support to the IMT on spill response matters, excluding source control + Activates and supervises spill response elements in accordance with the Incident Action Plan (IAP) and directs its execution + Directs dedicated spill response equipment, requests or releases resources, approves group operational plans, and approves spill response changes to the IAP as necessary
Air Operations	+ Provide specific advice and support to the IMT on air operation matters + Activates and supervises air operation elements in accordance with the Incident Action Plan (IAP) and directs its execution + Directs dedicated air operations equipment, requests or releases resources, approves group operational plans, and approves air operations changes to the IAP as necessary
Situation/Log Keeper	+ Maintain the IMT main event log + Collate inputs from other IMT members into the main event log + Assist with updating status boards, and other visual displays + Collate IMT information on stand down
Information Systems (IS)	+ Provide specific advice and support to the IMT on IS matters + Activate and lead IS support resources as required
Subject Matter Expert	+ Provide specific advice to the IMT on the area of expertise as relevant to the incident + Develop assessments and strategies to address the incident + Activate and lead an SME support team as required

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

Field-Based Position	Main Responsibilities
On-scene Commander (OSC)*	+ Assess facility-based situations / incidents and respond accordingly + Single point of communications between facility/site and IMT + Communicates the incident response actions and delegates actions to the Incident Coordinator + Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan + Coordinates medical evacuations as required + Refer to the facility Incident Response Plan for detailed descriptions of roles and responsibilities
Company Site Representative (CSR)	+ Notifies the Perth based Incident Commander of oil spills + Coordinates onsite monitoring of oil spill and ongoing communication with Incident Commander
Facility Incident Response Team (IRT)	+ Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan + Coordinate forward operations response teams and activities for on-asset incidents + Refer to the facility Incident Response Plan for detailed descriptions of roles and responsibilities within the IRT
Medical Evacuation Team	+ Manage all medical and transportation requirements related to injured personnel to an appropriate medical facility + Refer to the Medical Evacuation Procedure (QE-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team
Off-Asset 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
Oiled Wildlife Response Team	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife + Refer to the Western Australia Oiled Wildlife Response Plan/ Northern Territory Oiled Wildlife Response Plan (NTOWRP) for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team
Scientific Monitoring Teams	+ Manage scientific monitoring response to potential environmental impacts + Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities

** The OSC is either the Santos Company Representative (if any on board) or the Vessel Master. Detail agreed during the activity planning stage.*

Table 5-4: WA DoT roles embedded within the Santos CMT/IMT (note these roles may also come from NT Government in the event of a response in NT waters)

DoT / NT roles embedded within Santos CMT/IMT	Main Responsibilities
DoT Liaison Officer (prior to DoT assuming role of Control Agency) Deputy Incident Controller – State waters (after DoT assumes Control Agency)	+ Provide a direct liaison between the Santos IMT and the MEECC. + Facilitate effective communications between DoT's State Marine Pollution Coordinator (SMPC) / the Incident Controller and Santos' appointed CMT Leader/ Incident Commander + Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters + Assist in the provision of support from DoT to Santos + Facilitate the provision of technical advice from DoT to Santos Incident Controller as required
Media Liaison Officer	+ Provide a direct liaison between the Santos Media team and DoT IMT Media team + Facilitate effective communications and coordination between the Santos and DoT media teams + Assist in the release of joint media statements and conduct of joint media briefings + Assist in the release of joint information and warnings through the DoT Information & Warnings team + Offer advice to the Santos Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures

Table 5-5: Santos personnel roles embedded within the State Maritime Environmental Emergency Coordination Centre/WA DoT IMT (note similar roles may also be provided to support the NT IMT in the event of a response in NT waters)

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
CMT Liaison Officer[2]	+ Provide a direct liaison between the Santos CMT and the State MEECC + Facilitate effective communications and coordination between the Santos CMT Leader and the State Marine Pollution Coordinator (SMPC) + Offer advice to SMPC on matters pertaining to Santos crisis management policies and procedures
Deputy Incident Controller	+ Provide a direct liaison between the DoT IMT and the Santos IMT + Facilitate effective communications and coordination between the Santos Incident Commander and the DoT Incident Controller + Offer advice to the 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 DoT IMT
Deputy Intelligence Officer	+ As part of the DoT Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness + Facilitate the provision of relevant modelling and predications from the Santos IMT + Assist in the interpretation of modelling and predictions originating from the Santos IMT + Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the Santos IMT + Facilitate the provision of relevant mapping from the Santos IMT + Facilitate the provision of relevant mapping originating from the Santos IMT + Assist in the interpretation of mapping originating from the Santos IMT

[2] The role described as the *Santos Liaison Officer (CMT*) in Figure 5-2

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
Deputy Planning Officer	+ As part of the DoT Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans + Facilitate the provision of relevant IAP and sub plans from the Santos IMT + Assist in the interpretation of the Santos OPEP from Santos IMT + 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 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 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 Planning Team, assist the Environment Officer in the performance of their duties in relation to the provision of environmental support into the planning process + Assist in the interpretation of the Santos OPEP and relevant 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 DoT IMT to the Santos IMT

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
Deputy Public Information Officer[3]	+ As part of the Public Information Team, provide a direct liaison between the Santos Media team and DoT IMT Media team + Facilitate effective communications and coordination between Santos and DoT media teams + Assist in the release of joint media statements and conduct of joint media briefings + Assist in the release of joint information and warnings through the DoT Information & Warnings team + Offer advice to the DoT Media Coordinator on matters pertaining to Santos media policies and procedures + Facilitate effective communications and coordination between Santos and DoT Community Liaison teams + Assist in the conduct of joint community briefings and events + Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos community liaison policies and procedures + Facilitate the effective transfer of relevant information obtained from through 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 + Facilitate the acquisition of appropriate supplies through Santos's existing OSRL, AMOSC and private contract arrangements + Collects Request Forms from 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 Logistics Team, assist the Logistics Officer Supply 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 + Collects Waste Collection Request Forms from DoT to action via the Santos IMT

[3] In the event of an incident, access to media and communications response strategy and a comprehensive stakeholder list inclusive of all potentially relevant stakeholders, including indigenous organisations are contained via Santos' internal intranet site for use by CMT/IMT members

Santos roles embedded in the State MEECC/DoT IMT	Main Responsibilities
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's existing OSRL, AMOSC and private contract arrangements + Facilitate the communication of financial monitoring information to the Santos to allow them to track 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 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 DoT Operations Section + Offer advice to the 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 DoT response efforts
Deputy Division Commander	+ As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction + Provide a direct liaison between Santos's Forward Operations Base/s (FOB/s) and the DoT FOB + Facilitate effective communications and coordination between Santos Division Commander and the DoT Division Commander + Offer advice to the DoT Division 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 Safety Coordinator deployed in the FOB on matters pertaining to Santos safety policies and procedures

5.2 Regulatory Arrangements and External Support

5.2.1 Australian Marine Oil Spill Centre

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

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. 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, BHP, Chevron and Woodside have signed a Memorandum of Understanding (MoU) that defines the group's mutual aid arrangements. Under this MoU, Santos, BHP, Chevron and Woodside have agreed to use their reasonable endeavours to assist in the provision of emergency response services, personnel, consumables and equipment.

5.2.2 Australian Maritime Safety Authority

The Australian Maritime Safety Authority (AMSA) is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction.

Upon notification of an incident involving a ship, AMSA will assume control of the incident and response in accordance with AMSA's Marine Pollution Response Plan. AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-source incidents. AMSA is to be notified immediately of all ship-source incidents through RCC Australia (Santos Incident Response Telephone Directory [SO-00-ZF-00025.020]).

An MoU has been established between Santos and AMSA, outlining respective roles and responsibilities when responding to vessel-sourced marine pollution incidents and petroleum activity related marine pollution incidents.

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

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.

5.2.3 Western Australian Department of Transport

In the event that a Level 2/3 Marine Oil Pollution Incident enters, or has potential to enter, State waters, the HMA (DoT Director General) will take on the role as the State Marine Pollution Coordinator (SMPC) and DoT will take on the role as a Control Agency.

Santos will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within two hours of spill occurring) of such an incident. On notification, the HMA will activate their MEECC and the DoT IMT.

For facility oil spills entering State waters (i.e. across jurisdictions) both Santos and DoT will be Control Agencies. Santos will work in partnership with DoT during such instances, as outlined within the DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements Available online: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements.

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 is completed. Appendix 1 within DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements provides a checklist for formal handover.

For a cross-jurisdictional response, there will be a Lead IMT (DoT or Santos) for each spill response activity, with DoT's control resting primarily for State waters activities.

Appendix 2 within DoT's *Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements* provides guidance on the allocation of a Lead IMT to response activities for a cross jurisdictional spill.

To facilitate coordination between DoT and Santos during a cross jurisdictional response, a Joint Strategic Coordination Committee (JSCC) will be established. The JSCC 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 DoT as Control Agency, initially 11 personnel to fill roles in the DoT IMT or FOB (refer **Section 5.1**) and operational personnel to assist with those response strategies where DoT is the Lead IMT. Concurrently 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 attends the DoT Fremantle ICC 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 DoT Fremantle ICC no later than 8am on the day following the request being formally made to Santos by the SMPC.

Figure 5-2 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DoT's MEECC/IMT.

Figure 5-3 shows the overall cross jurisdictional organisational structure referenced from the SHP-MEE.

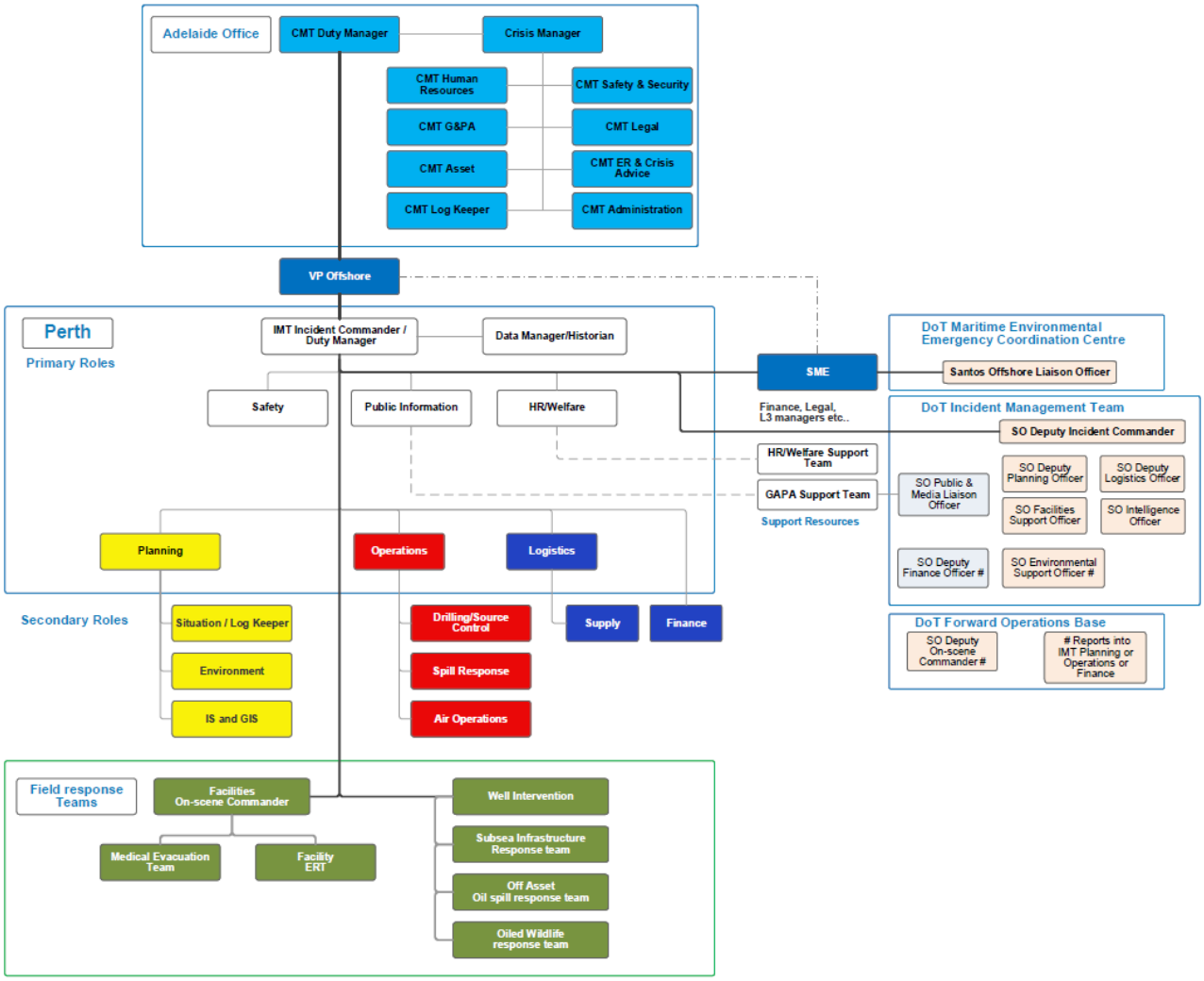

Figure 5-2: Santos cross jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering WA State waters

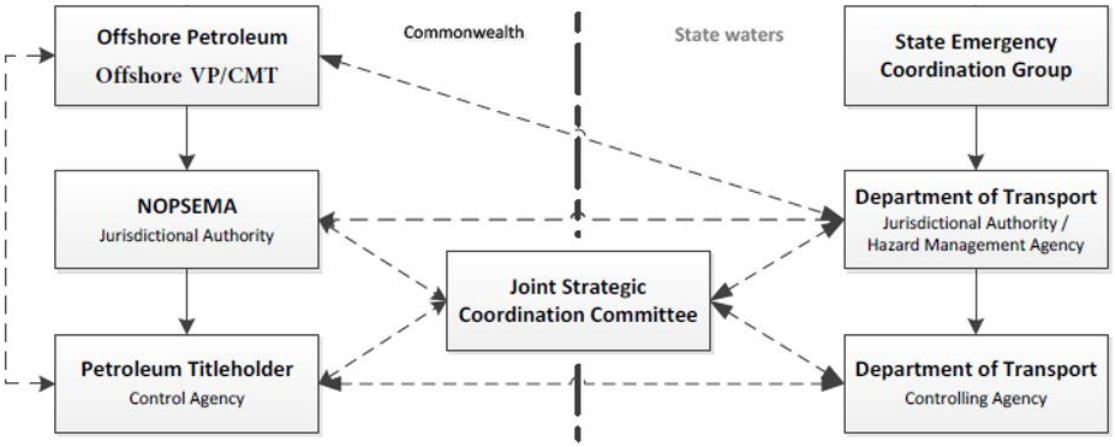

Figure 5-3: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

5.2.4 Western Australian 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 (DoT). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) and regional sub-plans.

For a Level 2/3 petroleum spill that originates within or moves into State waters, 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 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 State Marine Pollution Coordinator and/or DoT Incident Controller.

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

5.2.5 Northern Territory (NT) Government

If a Level 2/3 spill arises which has potential to enter NT waters, the titleholder must notify the Regional Harbourmaster and the NT Pollution Response Hotline (DEPWS) which will provide the communication link to the Territory Marine Pollution Coordinator (TMPC), who will establish an NT Incident Controller (NT IC) as the ongoing point of contact.

Notification to the TMPC and Regional Harbourmaster is to be completed as soon as practicable (within the first 24 hours of spill occurring or sooner) which will allow sufficient time to accurately determine the predicted time of any potential shoreline impact. The TMPC will appoint an NT IC.

Santos will commence coordination with the NT IC, mobilising resources and personnel into Darwin.

For Level 2/3 spills that cross from Commonwealth waters into Territory waters, AMSA will remain as Control Agency for Commonwealth waters and the NT Government (via NT Incident Management Team [IMT]) will be Control Agency for NT waters.

The NT IMT with advice from NT Environment, Scientific and Technical advisors will work with AMSA (and support from Santos, if requested) to confirm protection priorities and undertake an initial and ongoing Spill Impact Mitigation Analysis (SIMA) to determine the most appropriate response in Territory waters.

The NT IMT will be established in Darwin and consist of staff from across NT Government. The NT IMT will be supported by existing NT emergency response arrangements[4] and the titleholder, as Supporting Agency. Additional support, if required, will be provided under the provisions of the *NT Emergency Management Act 2013*, through the Territory Emergency Management Council and the NT Government Functional Groups.

At the request of the TMPC, the Titleholder will be required to provide all necessary resources, including personnel and equipment, to assist the NT IMT in performing duties as the Control Agency. This may include the provision of personnel to work within the NT IMT located in Darwin, to assist response activities such as shoreline protection, with the required numbers to be determined based on the nature and scale of the spill and response requirements at the time.

The Territory Emergency Management Council will delegate responsibilities associated with wildlife and activities in National parks, reserves and Territory marine parks. Direct coordination will be managed through the designated NT Government Functional Group.

Relevant guidance to support an oiled wildlife response in the event of an oil spill is outlined in the Northern Territory Oiled Wildlife Response Plan (NTOWRP), the plan is designed to ensure timely mobilisation of appropriate resources (equipment and personnel) in the event of an incident (**Section 12**).

5.2.6 Oil Spill Response Limited

Through an associate membership, Santos has access to spill response services from Oil Spill Response Limited (OSRL) with offices in Perth, Singapore, UK and at other various locations around the world. In the event of a Level 2/3 response, Santos could access OSRL's international personnel, equipment and dispersants, primarily through OSRL's Singapore stockpile, 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).

5.2.7 Department of Industry, Science, Energy and Resources

Department of Industry, Science, Energy and Resources (DISER) 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). DISER 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 OPICC, Liaison Officer/s will be deployed from DISER to the Petroleum Titleholders IMT.

[4] NT Emergency Response arrangements in accordance with the NT Government – Territory Emergency Plan (February 2021)

For incidents that are classified at a greater level that 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 OPICC will not be convened, although DISER will remain as the lead agency.

5.3 External Plans

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

+ AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
+ Details the cooperative arrangements for response to oil spills by Australian oil and associated industries
+ 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
+ NatPlan - National Plan for Maritime Environmental Emergencies and National Marine Oil Spill Contingency Plan
  - Sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
+ HazPlan – SHP-MEE – Western Australia State Hazard Plan for Maritime Environmental Emergencies
  - Details the management arrangements for preparation and response to a marine pollution incident occurring in State waters.
+ DoT Oil Spill Contingency Plan
  - Defines the steps required for the management of marine oil pollution responses that are the responsibility of the DoT.
  - DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements).
+ Northern Territory Oil Spill Contingency Plan
  - Outlines the steps required for the management of marine oil pollution responses that are the responsibility of the NT Government (the NTOSCP is currently being revised in 2021).
+ Northern Territory Emergency Plan
  - Describes the NT's approach to emergency and recovery operations, the governance and coordination arrangements, and roles and responsibilities of agencies.
+ Shipboard Oil Pollution Emergency Plan (SOPEP)

  - Under MARPOL Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.

+ Western Australia Oiled Wildlife Response Plan (WAOWRP)
  - Defines the steps, personnel, equipment and infrastructure required for the management of wildlife in an oil pollution response. Each region has a regional sectored operational plan that gives further details on sensitivities and available resources. The East Kimberley regional operational plan is the relevant regional plan for OWR associated with the Petrel Sub-Basin SW 3D MSS.
+ Northern Territory Oiled Wildlife Response Plan (NTOWRP)
  - Defines strategies and nominates indicative personnel numbers and role requirements for OWR.
+ Oil Spill Response Limited (OSRL) Associate Agreement
  - Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
+ Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

5.4 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. DoT) and third-party spill response service providers.

5.5 Training and Exercises

The IMT undertake a number of workshops, desktops and an activation exercise, as per the Santos Offshore Division Incident Crisis Management Training and Exercise Plan (SO-92-HG-10001), to familiarise the IMT members with roles and responsibilities, OPEP arrangements and the functions and process contained within an OPEP.

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

5.5.1 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 IMT positions

IMT Role	Exercise	Training
Incident Commander Operations Team Leader	One Level 2 exercise annually or two Level 2 desktop exercises annually	+ PMAOMIR320 + PMAOMIR418 + AMOSC – IMO3 Oil Spill Command & Control
Planning Team Leader Logistics Team Leader Environmental Team Leader		+ PMAOMIR320 + AMOSC – IMO2 Oil Spill Management Course
Safety Team Leader Supply Team Leader GIS Team Leader IMT Data Manager HR/Welfare Team Leader		+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training

5.5.2 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 Oil Spill Operators Course	12
Santos Facility Incident Response Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents	Internal Santos training and exercises as defined in each facility's Incident Response Plan OSC to have AMOSC – Oil Spill Response Familiarisation Training	One IR team per operational facility per shift
Santos Aerial Observers	Aerial surveillance of spill Deployed by IMT in the aerial surveillance aircrafts	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually)	7

Responder	Role	Training	Available Number
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 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course	As defined in Core Group Member Reports[5] Target to maintain at least 84 members (Ref.: AMOSC Core Group Program and Policies)
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
AMOSC Oil Spill Response Specialists	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract	As per AMOSC training and competency matrix	8
Oiled Wildlife Response Roles (Level 4)	Refer OPEP **Section 12** and **Appendix I**: Oiled Wildlife Response Personnel and Equipment		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	Monitoring Coordination Team (MCT) SMP Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports MCT – five personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision	No previous training required; on the job training provided	Nominally over 1,000

[5] An average of 41 personnel plus 16 AMOSC staff members available as of 5th May 2021.

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 (NRT) – Trained oil spill response specialists, including aerial observers, containment and recovery crews, and shoreline clean-up personnel, deployed under the direction of AMSA and the IMT in a response. The NRT is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2013b);
+ WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE): State Response Team (SRT) – Oil pollution response team available to assist under the jurisdiction of the WA DoT. SRT members remain trained and accredited in line with the State Hazard Plan (SHP-MEE) requirements; and
+ NT Oil Spill Contingency Plan (NT OSCP): NT Response Team are available to assist under the jurisdiction of the NT IMT.

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.

5.6 Response Testing Arrangements & Audits

Santos has oil spill response testing arrangements and auditing programmes in place which are detailed within the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001). 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.

5.6.1 Testing Arrangements

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

1. Review
2. Audit
3. Equipment Checks/ Deployments
4. Desktop Exercise
5. 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. 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 5-4 Excerpt of Testing Arrangement 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 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.

5.6.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos Assurance Schedule (E-910HA-20002). Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and corrective actions required (non-conformances) will be formally

noted and discussed, with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong and Fremantle are audited every two years under the direction of AMOSC's participating members. The intent of this audit 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 Emergency & Oil Spill 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 vessel based activities. Of the credible spill scenarios identified in the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006), a worst-case scenario has been selected from a response perspective taking into account the following characteristics:

+ The scenario represents the maximum credible release volume;
+ The scenario represents the greatest spatial extent from a response perspective based on surface oil and shoreline accumulation as these are the key factors contributing to response; and
+ Proximity to sensitive receptors, shorelines, State/NT/Commonwealth boundaries, etc.

The worst case credible spill risk selected to inform this OPEP is presented in **Table 6-1**. Detail on the derivation of this maximum credible spill is provided within the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006).

Three release locations in the Operational Area were originally selected for stochastic modelling. Revision 1 of this OPEP includes a reduction of the Operational Area due to removal of Full-fold Acquisition Area C from the scope of the survey. As such, one release site (Release Site 3) is now located 23 km south-east of the revised Operational Area and, therefore, provides conservative model predictions of the hydrocarbon exposures that may occur in this area and towards NT waters.

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 the Petrel Sub-Basin SW 3D MSS

Worst-case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)	Release duration	Maximum extent of surface hydrocarbons >1g/m^2
Surface diesel release (surface spill)	Marine Diesel Oil	1,062	6 hours	~40 km

6.2 Response Planning Thresholds

Environmental impact assessment thresholds are addressed in Section 7.1 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 are shown 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 K**)
>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

** Containment and recovery and surface dispersant application are not applicable spill response strategies under this OPEP*

Containment and recovery effectiveness drops significantly with reduced oil thickness (McKinney and Caplis, 2017; NOAA, 2013). McKinney and Caplis (2017) tested the effectiveness of various oil skimmers at different oil thicknesses. Their results showed that the oil recovery rate of skimmers dropped significantly when oil thickness was less than 50 g/m².

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50 to 100 g/m² 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 to 3 (EMSA, 2010).

6.3 Stochastic Spill Modelling Results

The selected worst-case spill scenario was modelled for the Petrel Sub-Basin SW 3D MSS using a stochastic approach. A total of 100 spill trajectories at three release locations (i.e. 300 in total) were simulated across all seasons using a number of unique environmental conditions sampled from historical met-ocean data. Each simulation was tracked for a period of 40 days.

Three release locations in the Operational Area were originally selected for stochastic modelling. Revision 1 of this OPEP includes a reduction of the Operational Area due to removal of Full-fold Acquisition Area C from the scope of the survey. As such, one release site (Release Site 3) is now located 23 km south-east of the Operational Area and, therefore, provides conservative model predictions of the hydrocarbon exposures that may occur in this area and towards NT waters. The other two release sites remain located on the boundary of the Operational Area.

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. Therefore, these are the results presented in this OPEP for primary consideration.

Modelling results for dissolved and entrained oil for the worst-case scenarios have not been included given there are limited response strategies that will reduce subsurface impacts. However, the results do indicate that there would be a scientific monitoring response, as entrained oil is predicted to reach some shorelines in WA and NT above the scientific monitoring threshold of 10 ppb.

The stochastic results identified that floating hydrocarbon concentrations above 10 g/m^2 may extend up to 27 km from the spill location. No shoreline contact above the low exposure value of 10 g/m^2 was predicted for any of the three release locations modelled. Refer to Section 7.1 of the EP for further description on selection of oil exposure values.

6.4 Deterministic Modelling

Given that no shoreline oiling was identified in the stochastic modelling, no deterministic modelling was undertaken. Stochastic modelling is considered suitable to inform the response strategies, given responses to surface hydrocarbons are limited to monitor and evaluate and mechanical dispersion for MDO.

6.5 Evaluation of Applicable Response Strategies

Based on the nature and scale of the credible spill scenario outlined in **Section 6.1** and spill modelling results (**Sections 6.3**) the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 6-3**).

Note that the information contained in **Table 6-3** has been developed by Santos for preparedness purposes. Santos may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering State/NT waters, the relevant Control Agency will ultimately determine the strategies and controls implemented for most State/NT water activities with Santos providing resources and planning assistance.

Table 6-3: Evaluation of applicable response strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Source Control	Spill kits	✔ 1	Relevant for containing spills that may arise on board a vessel
	Secondary containment	✔ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel. 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 marine environment.
	Shipboard Oil Pollution Emergency Plan (SOPEP)	✔ 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 cargo via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilled.
In-Situ Burning	Controlled burning of oil spill	X	Not applicable to diesel spills due to inability to contain marine diesel making it very difficult to maintain necessary slick thickness for ignition and sustained burning

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Monitor and Evaluate Plan (Operational Monitoring)	Vessel surveillance	✔ 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 hours only Limited to visual range from the vessel Limited capacity to evaluate possible interactions with sensitive receptors
	Aerial surveillance	✔ 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) Informs implementation of other response strategies
	Tracking buoys	✔ 1	Can be implemented rapidly – four Fastwave buoys held on Varanus Island, six Fastwave buoys held in Dampier Supply Base. Two met-ocean buoys available in Exmouth Freight and Logistics. 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).

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
	Trajectory Modelling	✔ 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 Relies on input of volume spilled, which may not be known accurately
	Satellite Imagery	✔ 1	Can work under large range of weather conditions (e.g. night, cloud cover, etc) Mobilisation likely to be >24 hours Requires processing May return false-positives
	Operational Water Quality Monitoring	✔ 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

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
	Shoreline and Coastal Habitat Assessment	X	Provides information on shoreline oiling (state of the oil, extent of pollution, etc.) Can provide information on amenability of shoreline response options (e.g. clean-up, protect and deflect) Provides information on status of impacts to sensitive receptors Considerable health & safety considerations Requires trained observers Constrained to daylight Delayed response time
Chemical dispersion	Vessel Application	X	Marine diesel is not considered a persistent hydrocarbon and has high natural dispersion rates in the marine environment. Chemical dispersant application is not recommended as a beneficial option for marine diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for increased impacts due to potential toxicity effects.
	Aerial Application	X	
Offshore Containment and Recovery	Use of offshore booms/skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	X	Not suitable for marine diesel given its rapid weathering nature. Marine diesel spreads quickly to a thin film, making recovery via skimmers difficult and ineffective. Skimmers also have reduced efficiency on very thin oils.
Mechanical Dispersion	Vessel prop-washing	✔ 2	Marine diesel is a light oil that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the vessel's propellers and wake to break up the slick

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy	Considerations
		MDO	
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✔ 2	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
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery from the oil spill and associated response activities.	✔ 1	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.

6.6 Identify Protection Priority Areas and Initial Response Priorities

Combined spill modelling results were used to predict the Environment that may be Affected (EMBA) for the Petrel Sub-Basin SW 3D MSS operations (refer Section 3.1 of the Petrel Sub-Basin SW 3D MSS EP). The EMBA is the largest area within which effects from hydrocarbons spills associated with this activity, could extend. Within the EMBA, Santos has determined Hot Spots (key areas of high ecological value that have the greatest potential to be impacted by a MSS operational spill) for which detailed oil spill risk assessment has been conducted (refer Section 7.1.6 of the Petrel Sub-Basin SW 3D MSS EP). From these Hot Spot areas, protection priority areas for spill response are typically identified. Protection priority areas are emergent features (i.e. coastal areas and islands) that would be targeted by nearshore spill response operations such as protection and deflection and shoreline clean-up. However, for the purposes of this OPEP no protection priority areas have been identified as the modelling does not predict any shoreline contact above threshold values (**Section 6.3**).

6.7 Net Environmental Benefit Analysis

The IMT uses a net environmental benefit analysis (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 Environmental Team Lead will use the information in **Section 6.6** 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, Operational 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 DoT/NT IMT, 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 credible spills identified in this OPEP, with the benefit or potential impact to each sensitivity identified (refer to **Table 6-4**). While not all spill response activities included in the strategic NEBA would be under the control of Santos during a spill incident, they have been included to assist the planning conducted by DoT/ NT IMT.

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

+ 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; and
+ assist in determining appropriate response strategies with support of real time met-ocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised (i.e. Operational NEBA). Operational NEBA Templates are filed within the Environment Team 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 socioeconomic sensitivities; and
+ 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. It should be possible to see how the NEBA evolves as new information and expertise comes to light.

Table 6-4: Strategic NEBA matrix – marine diesel oil spills

Receptors	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Open Ocean[1]										
Coral and other subsea benthic primary producers				N/A		N/A	NA	NA	N/A	
Seabirds				N/A		N/A	NA	NA		
Marine mammals				N/A		N/A	NA	NA		
Marine reptiles				N/A		N/A	NA	NA		
Fish, sharks and rays				N/A		N/A	N/A	N/A	N/A	
Fishing/charter boat tourism				N/A		N/A	N/A	N/A	N/A	
Legend										
	Beneficial impact									
	Possible beneficial impact depending on the situation (e.g., time frames and met-ocean conditions to dilute entrained oil)									
	Negative impact									
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type									

[1] No Protection Priority Areas are predicted to be contacted by hydrocarbons above threshold levels (Section 6.3). The NEBA is therefore based on open ocean receptors.

6.8 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 Procedures

For oil spill incidents, the OSC (Vessel Master or Company Site Representative) will notify Perth office for delegation of further notifications to relevant Regulatory Authorities and for further spill response assistance for Level 2/3 spills.

7.1 Regulatory Notification and Reporting

The Incident Commander (IC) is to delegate the following regulatory reporting requirements. Typical delegated parties will be the Safety Team Leader and the Environmental Team Leader.

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

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

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

The Santos 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 Oil Spill Response Organisations (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.

The Santos 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).

7.3 Environmental Performance

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

Table 7-1: External notification and reporting requirements (Commonwealth and State/NT waters)

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 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 Petrel Sub-Basin SW 3D MSS in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator) DMIRS (WA Department of Mines, Industry Regulation and Safety)	Written report to NOPTA and DMIRS within seven days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environmental Team Leader (or delegate)	Provide same written report as provided to NOPSEMA
AMSA, DoT and NT Government spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within two hours of incident	Under the MoU between Santos and AMSA	Santos to notify AMSA of any marine pollution incident[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Transport (WA DoT)[2] (Maritime Environmental Emergency Response (MEER) Duty Officer)	+ Verbal notification within two hours + Follow up with POLREP (**Appendix C**) as soon as practicable after verbal notification + If requested, submit SITREP (**Appendix D**) within 24 hours of request	Emergency Management Regulations 2006 State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos 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 IMT Environmental Team Leader (or delegate)	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
NT Department of Environment, Parks and Water Security	+ Notification via NT Pollution Response Hotline or via email to pollution@nt.gov.au + Follow up with a Harmful Substances Report - Oil as soon as practicable following notification	NT OSCP *Marine Pollution Regulations 2003* (NT)	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 Environmental Team Leader (or delegate)	Harmful Substances Report - Oil are to be emailed to pollution@nt.gov.au and marinesafety@nt.gov.au and rhm@nt.gov.au A Harmful Substances Report – Oil template is provided on the NT Government webpage: https://nt.gov.au/marine/marine-safety/make-a-report/report-marine-pollution

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Protected areas, fauna and fisheries reporting requirements					
Commonwealth Department of Agriculture, Water and the Environment (DAWE) (Director of monitoring and audit section)	Email notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	If Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (Kimberley Regional Office)	Verbal notification within two hours	DBCA consultation	Santos to notify AMSA of any marine pollution incident[1] Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (State Duty Officer and Kimberley Regional Office)	Verbal notification within two hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable To include: + titleholder details + time and location of the incident (including name of marine park likely to be affected) + proposed response arrangements as per the OPEP (e.g. dispersant, containment, etc.) + confirmation of providing access to relevant monitoring and evaluation reports when available; and + contact details for the response coordinator.	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT
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]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Australian Fisheries Management Authority	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

1. 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, as 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) and, in State/NT waters, WA DoT MEER and NT Department of Environment, Parks and Water Security.

Table 7-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
AMOSC, AMOSC Duty Manager	As soon as possible but within two hours of incident having been identified	Verbal Service Contract	Santos is a Participating Company in 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. E-mail confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment, and callout authorities will be required to supply their credentials to AMOSC. A signed service contract must also be completed by a call out authority and returned to AMOSC prior to mobilisation.	IMT Environment Team Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)
Babcock Helicopters	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place	Phone call	IMT Logistics Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Duty Officers/Incident Commanders (Woodside, BHP, Chevron)	Within two hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual Aid Arrangement)	Phone call	Incident Commander (or delegate)
Exmouth Freight & Logistics	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call	IMT Logistics Team Leader (or delegate)
North West Alliance – Waste	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	Scientific Monitoring Plan initiation criteria are met (**Section 14**)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1-12. This includes provision of personnel and equipment. Astron annually reviews the SMPs for continual improvement.	Step 1. Obtain approval from Incident Commander to activate Astron for Scientific Monitoring. Step 2. Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email. Step 3. Provide additional details as requested by the Astron Monitoring Coordinator on call-back. Step 4. Astron initiates Scientific Monitoring Activation and Response Process.	IMT Environment Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 10.6**)	Verbal	Oil analysis including GC/MS fingerprinting	Phone call	IMT Environment Team Leader (or delegate)
Oil Spill Response Limited (OSRL), 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	IMT Environment Team Leader (or delegate)

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

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

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

1. Understand the situation.
2. Establish incident 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 Santos IAP process is built on the phases described in **Figure 8-1**.

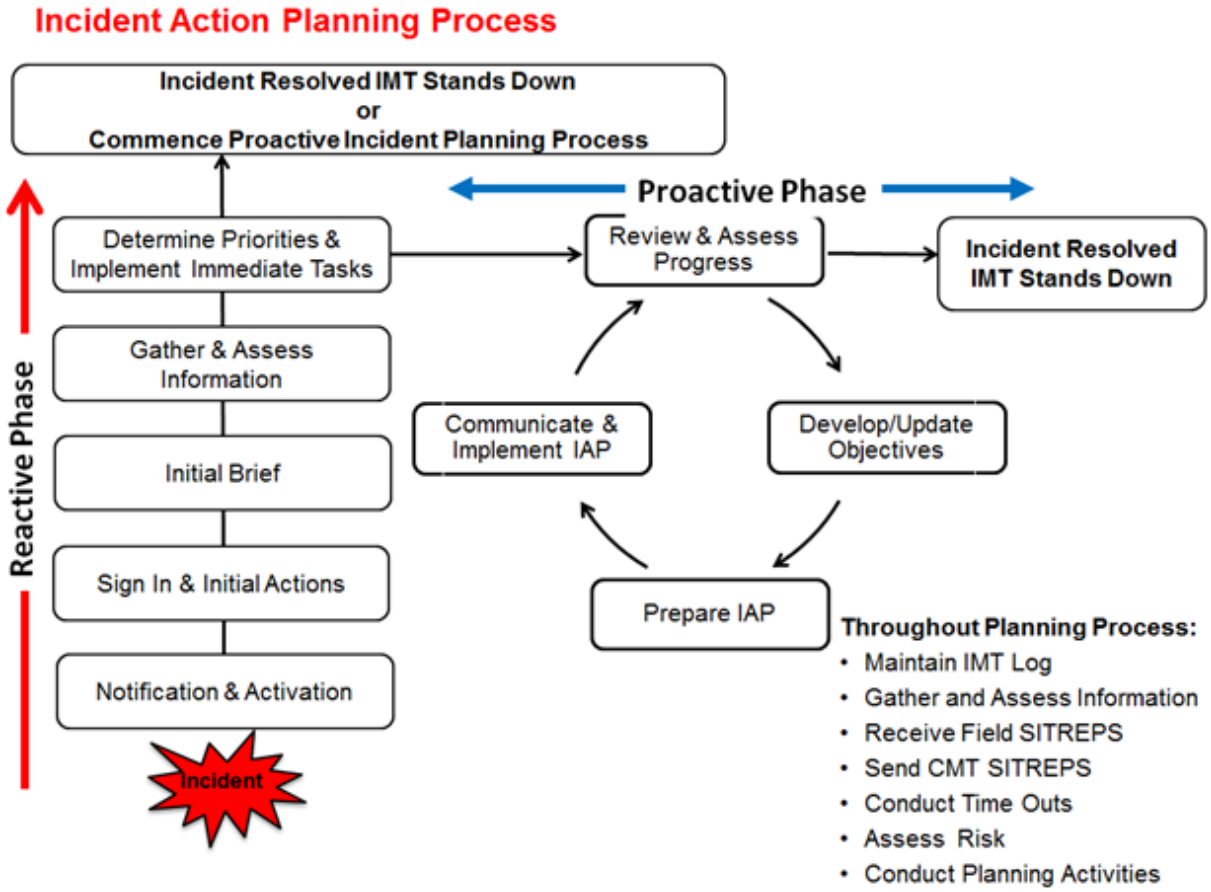

Figure 8-1: Incident Action Plan process

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 net environmental benefit analysis (NEBA) also referred to as a spill impact mitigation assessment (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 (**Section 6.7**). 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's response to the incident for regulatory and legal investigations that will follow the termination of the incident.

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

IAP forms and processes are documented in the Santos *Incident Command and Management Manual* (SO-00-ZF-00025) and in the 'Emergency Response' folder sets at *L:\Resource\Emergency Response\Incident-Exercise Number-Name*. Begin the response by copying and saving *Incident-Exercise Number-Name* folder set with a unique incident name and Id number on the lead folder; this is the Incident Log. Access subfolders to

display all forms required to conduct incident action planning. Each functional position within the IMT and CMT has subfolders carrying forms and processes unique to the functional position.

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
	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	Operational NEBA Incident Action Plan

9 Source Control Plan

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

For vessels with a Shipboard Oil Pollution Emergency Plan (SOPEP), the SOPEP will provide the relevant initial actions to control the source of the spill.

The sections below provide an outline of source control activities noting that Vessel SOPEP and Source Control Planning and Response Guideline (DR-00-ZF-10001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Hydrocarbon Storage or Fuel Tank Rupture

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control response of a hydrocarbon storage or 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: Fuel tank rupture – 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	Level 2/3 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
Termination criteria	The inventory in the ruptured fuel or storage tank is secured and release to the marine environment stopped

9.2 Implementation Guidance

Implementation guidance is summarised in **Table 9-2.** In the event hydrocarbon (MDO) is released from a vessel due to a ruptured fuel tank (the worst-case scenario defined for the Petrel Sub-Basin SW 3D MSS), the relevant vessel specific procedures will be applied. For vessels associated with the Petrel Sub-Basin SW 3D MSS, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident.

Section 9.3 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 Shipboard Oil Pollution Emergency Plan (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 immediately evaluated for implementation providing 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 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	☐

9.3 Environmental Performance

Table 9-3 indicates the environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-3 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**
Source control – vessel collision	**Response Preparedness**		
	Vessel Spill Response Plan (SOPEP/SMPEP)	Vessels associated with the Petrel Sub-Basin SW 3D MSS have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records. Inspection records
		Spill exercises on vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close out reports

10 Monitor and Evaluate Plan

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 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-1: Vessel 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 - may be deployed in a Level-1 incident (to be determined by OSC)
Applicable hydrocarbons	**MDO**
	✔
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 poses safety risks.

10.1.1 Implementation Guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-3** 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 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.

Section 10.9 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. AIS vessel tracking is available through ER intranet page	OSC Operations Lead	☐
	Source additional contracted vessels if possible need for assistance		Logistics Team Leader	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix E** and provide to OSC (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 OSC	☐
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Team Leader/GIS	☐
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate		Environment Unit Lead	☐

Action		Consideration	Responsibility	Complete
	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 (WA Vessel Monitoring System [VMS])	Availability dependent upon Santos and Vessel Contractor activities	Vessels mobilised from Operational Area / NT region. Locations verified through AIS Vessel Tracking Software (WA VMS)	Pending availability and location. Expected within 12 hours

Table 10-4: Vessel surveillance – First Strike response timeline

Task	Time from IMT call-out
IMT begins sourcing Santos contracted vessel or vessel of opportunity (VOO) for on-water surveillance	<90 minutes
VOO onsite for surveillance	<12 hours (daylight dependent)
Minimum Resource Requirements	
One vessel. No specific vessel or crew requirements.	

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**
	✔
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 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.

Section 10.9 lists the environmental performance standards and measurement criteria for this strategy.

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, utilise 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 prior to 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 (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 met-ocean conditions (e.g. sea state, wind, current) + photographic/video images	Operations Team Leader Logistics Team Leader	☐ ☐

Action		Consideration	Responsibility	Complete
	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 ER Intranet page	Operations Team Leader Logistics Team Leader	☐
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected that Two flights per day of the spill area are completed.	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 Team Leader/Aviation Superintendent	☐
	Pre-flight briefing		Aerial Observers Contracted aircraft provider/pilots	☐
	Aerial Observers to commence surveillance.	Consider procedure for interacting with marine fauna	Operations Team Leader	☐
	Determine the 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 (refer **Appendix F**: Aerial Surveillance Observer Log)	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 Team Leader Operations Team Leader	☐

Action		Consideration	Responsibility	Complete
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 Team Leader/Aviation Superintendent Planning Team Leader	☐
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities		Logistic Team Leader	☐
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider		Planning Team Leader 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 (primary provider currently Babcock)	Two contracted (one primary + one back-up) + additional as required	Darwin	Wheels up within one hour for Emergency Response Spill surveillance <6 hours (daylight dependent)
Aerial Surveillance Crew	Santos aerial observers AMOSC Industry mutual aid	7 x Santos staff 9 x AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual-aid personnel available	Perth & VI (Santos aerial observers) Australia wide	Santos trained personnel - next day mobilisation to airbase <24 hours
Drones and pilots ** secondary response to assist shoreline and vessel-based surveillance	AMOSC OSRL – Third-Party UAV provider Local WA hire companies	2 x pilots 2 x qualified remote pilots, however response is on best endeavour 10+	Geelong Perth 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

Task	Time from IMT call-out
Santos helicopter activated for aerial surveillance	<3 hours
Helicopter onsite for aerial surveillance	<6 hours (daylight dependent)
Trained Aerial Observers mobilised to airbase	<24 hours
Minimum Resource Requirements	
+ Santos contracted helicopter and pilots (based in Karratha) + Santos trained Aerial Observers	

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**
	✔
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.

Section 10.9 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 Varanus Island, Dampier Supply Base or Exmouth Freight and Logistics	Personnel and vessel safety is priority Current Santos on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page	OSC/Operations Team Leader	☐
	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 Team Leader/GIS	☐
	Use tracking buoy data to maintain Common Operating Picture	Data tracked online	IMT Planning Team Leader/GIS	☐
	Relay information to spill fate modelling supplier for calibration of trajectory modelling		IMT Planning Team Leader/GIS	☐

Action		Consideration	Responsibility	Complete
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 Team Leader	☐
	Mobilise additional tracking buoys if required from other Santos operations (Santos presently has 10 Tracker Buoys available located on the NWS) or from AMOSC stockpiles		Logistics Team Leader	☐
	Direct the deployment of the Tracker Buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction		Operations Team Leader	☐
	Deploy tracking buoys		Vessel Master	☐
	Monitor movement of tracking buoys		Planning Team Leader/GIS	☐
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling		Planning Team Leader/GIS	☐

Table 10-11: Tracking buoys resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Tracking buoys x 10	Santos	10	North-west shelf (Varanus Island, Dampier, Ningaloo Vision)	VI/Dampier buoys – 24 to 48 hours pending vessel availability NV buoys – <12 hours pending vessel availability
AMOSC tracking buoys	AMOSC	2 6	Broome 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**)

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
		4	Geelong	

Table 10-12: AMOSC equipment mobilisation timeframes

	Perth	Darwin	Exmouth	Dampier	Broome
Geelong	40 hrs 3,395 km	44 hr 3,730 km	64 hrs 4,520 km	70 hrs 4,840 km	68 hrs 4,970 km
Perth	NA	48 hrs 4,040 km	15 hrs 1,250 km	19 hrs 1,530 km	27 hrs 2,240 km
Exmouth	15 hrs 1,250 km	38 hrs 3,170 km	NA	7 hrs 555 km	16 hrs 1,370 km
Broome	27 hrs 2,240 km	22 hrs 1,870 km	16 hrs 1,370 km	11 hrs 855 km	NA

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

Task	Time from IMT call-out
Tracking buoys deployed from Varanus Island or Dampier	24 to 48 hours pending vessel availability
OR	
Tracking buoys deployed from Exmouth using vessel of opportunity	<12 hours 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**
	✔
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 met-ocean 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.

Section 10.9 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 Procedure Index). Request for 3-day forecast trajectory modelling		Environment Team 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 is to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Team Leader Environmental Team Leader	
	Operational surveillance data (aerial, vessel, tracker buoys) to be provided to modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy		Planning Team Leader/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 QA/QC procedures	Planning Team Leader/GIS	
	Place RPS Group modelling data into GIS/Common Operating Picture	RPS Group is to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly	Planning Team Leader/GIS	
	Identify location and sensitivities at risk, based on the trajectory modelling and inform IMT. Conduct Operational NEBA on proposed response strategies.		Environment Team 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 Team Leader/GIS	
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon as input data (if or when available) to improve model accuracy		Planning Team Leader/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	Two to four hours from activation

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

Task	Time from IMT call-out
RPS Oil Spill Trajectory Modelling (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**
	✔
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 (SAR) and visible imagery may both be of value.

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.

Section 10.9 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 Team Leader	☐
	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 Team Leader	☐
	Assess suitability and order imagery		Planning Team Leader	☐
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation		GIS Team Leader Planning Team Leader	☐
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Team Leader	☐
	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 Team Leader	☐

Table 10-20: Satellite imagery resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Satellite Imagery	KSAT – Activated through AMOSC GDS – Activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	KSAT: one hour – if satellite images available GDS: TBC on activation

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**
	✔
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

Given MDO has been previously assayed, the general physical and chemical characteristics of this hydrocarbon is known and have been presented in **Appendix A**.

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, such as recovery and pumping equipment suitability, hydrocarbon storage and hydrocarbon disposal requirements.

10.6.1 Implementation Guidance

Table 10-22 provides guidance to the IMT on the actions and responsibilities for 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.

Section 10.9 lists the environmental performance standards and measurement criteria for this strategy.

10.7 Oil Sampling and Laboratory Analysis

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

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/mass spectrometry (GC/MS) 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.

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 Team Leader Logistics Team Leader	☐
	Source sampling equipment Confirm sampling methodology Confirm laboratory for sample analysis Develop H&S requirements/controls	Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure	Environment Team Leader Safety Team Leader	☐
	Vessel directed to sampling location	Sampling of oil at thickest part of slick – typically leading edge	Operations Team Leader	☐
	Vessel crew to undertake sampling and delivery of samples for dispatch to laboratory Environmental Team Leader to confirm analysis of oil with lab	Darwin personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Team Leader Environmental Team Leader Logistics Team Leader	☐
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 once mobilised to site	Operations Team Leader Environment Team Leader Logistics Team Leader	☐

Table 10-23: 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	<48 hours
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	

10.8 Operational Water Quality Monitoring

10.8.1 Operational Water Sampling and Analysis

Table 10-24 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 10-24: 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**
	✔
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 10-25 presents the water quality sampling and analysis plan considerations.

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

10.8.2 Implementation Guidance

Refer to **Table 10-26** 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.

Section 10.9 lists the environmental performance standards and measurement criteria for this strategy.

Table 10-25*:* 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

Considerations for Operational Water Quality Sampling and Analysis	
Survey design	The operational water sampling activities will be conducted by experienced environmental scientists and managed through the IMT Incident Action Planning (IAP) process. The exact nature of the sampling activities will depend upon the objectives for each operational period; however, the sampling design and methodology will consider the following points: + Sampling locations will be moved with the slick and/or plume based on the observed or predicted location and movement of oil on water and subsea plumes. This will be informed by vessel/aerial surveillance, satellite tracking buoys and spill fate modelling. + At each discrete location, sampling will be conducted along a depth profile which captures the three-dimensional distribution of the oil. For a subsea release or where surface oil is present in shallow water (<5 m) this should involve a depth profile from the seabed to surface waters. Profiles should ensure that the full gradient of oil in water concentration can be determined. + Oil and oil in water samples are to be collected using suitable pumping or sampling apparatus. For samples at depth a Niskin bottle(s) or similar device that allows remote closing and discrete sampling at depth is to be used. Alternatively, water samples can be pumped from defined depths using a hose suspended vertically using a suitable pump for water sampling (e.g. a peristaltic pump). + Samples are to be collected in clean, fully labelled glass jars, filled to the top and refrigerated/kept cool and in darkness during storage and transport. Handling, storage and documentation requirements to be confirmed with laboratory but holding time <7 days is expected requirement. + Oil and oil in water samples will be replicated at each site to allow intra-site variability to be assessed and appropriate QA/QC samples incorporated into replicates. + Concurrent with collection of water samples a conductivity-temperature-depth (CTD) meter shall be deployed at each site along the same depth profile from which water samples are collected. The CTD will require fluorometry and dissolved oxygen (DO) sensors as part of the sensor package to record the presence of oil (fluorometry) and the activity of hydrocarbon degrading bacteria (dissolved oxygen). + Water samples also to be provided to an independent NATA-accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons (PAHs).
Analysis and reporting	+ All data collected on oil properties provided in spreadsheets (including GPS location, depth of sampling, timing, on water observations, in-situ readings and water sample label details) to IMT on an ongoing basis during spill response operations. + Daily field reports of results provided to the IMT. + Analytical analysis of oil properties following laboratory evaluation. + Final report detailing all data collected on oil properties throughout the monitoring program including relevant interpretation.

Table 10-26: Implementation guidance - operational water quality sampling and analysis

Action		Consideration	Responsibility	Complete
Initial Actions	Activate Santos Monitoring Service Provider for Operational Water Quality Monitoring		Environment Team Leader	
	Obtain spill trajectory modelling and provide to Monitoring Service Provider		Environment Team Leader Planning Team Leader 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 10-25** for considerations for Sampling and Analysis Plan	Monitoring Service Provider Environment Team 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 Team Leader	
	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 Team Leader	
	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 OSC Operations Team Leader Environment Team Leader Logistics Team Leader	

Action		Consideration	Responsibility	Complete
Ongoing Actions	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions		Planning Team Leader GIS Support Environment Team Leader	

Table 10-27: 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	<72 hours
Minimum Resource Requirements	
+ Water quality monitoring vessel/s – refer Santos ER Intranet for vessel specification + Water quality monitoring team (through monitoring service provider) + Water quality monitoring equipment (through monitoring service provider)	

10.9 Environmental Performance

Table 10-28: 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	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 Unmanned Aerial Vehicles (UAV) providers	Maintenance of contract for access to UAV providers	Maintenance of contract with service provider
	Aircraft charter companies for fauna observations	Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers
	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 is met	Incident log
	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the *Environment*	Vessel contractor procedures align with Santos's Protected Marine Fauna Interaction and Sighting Procedure

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**
		Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	
		Aircraft comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the *Environment Protection and Biodiversity Conservation Regulations 2000* which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos's 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 supplied from Day 2 of response	Incident log
		Flight schedules are maintained throughout response	Incident Action Plan
		Observers completed aerial surveillance observer log following completion of flight	Aerial Observer Logs
Monitor and Evaluate – tracking buoys	**Response Preparedness**		
	Tracking buoys available	Maintenance of 10 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests

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		
	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
	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	Maintain membership with AMOSC and OSRL to enable access and analysis of satellite imagery	Membership contracts with AMOSC and OSRL
	Response Implementation		
	Satellite imagery	Data incorporated into Common Operating Picture and provided to spill modelling provider	Incident Log; Incident Action Plan
Monitor and Evaluate – oil and oil-in-water monitoring	**Response Preparedness**		
	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider

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**
	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
	Response Implementation		
	Initial Oil Characterisation	Minimum requirements mobilised in accordance with **Table 10-23**	Incident Log
		Oil samples sent to laboratory for initial fingerprinting	Laboratory Sample Chain of Custody Record
		Oil samples to be sent immediately for laboratory ecotoxicity testing of oil	Laboratory Sample Chain of Custody Record
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum 5 species' tests) within 24 hours of receiving all results	Ecotoxicity report from Environmental contractor
	Operational Oil and Oil in Water Monitoring	IMT activates monitoring service provider within 4 hours	Incident Log
		Operational water sampling and analysis surveys mobilised within 72 hours of approval	Incident Log
		Fluorometry surveys mobilised within five days of initiation	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**
		Daily report including fluorometry results provided to IMT	Incident Log

11 Mechanical Dispersion Plan

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**
	✔
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; and
+ 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. 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 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, sea state, possible impacts to sensitive shorelines and/or wildlife before spill naturally disperses This activity is to be conducted during daylight hours only and once the safety plan has been developed	Operations Team Leader Environment Team Lead Planning Team Leader	☐
	Safety team lead to develop a safety plan for the activity with respect to potential dangerous gasses and VOCs (including applicable controls)		Operations Team Leader Safety Team Leader	☐
	Notify vessel-based responders to trial mechanical dispersion		Operations Team Leader	☐
	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 Team Leader for inclusion in Operational NEBA.		Vessel Master/s Santos AMOSC Core Group Responders	☐

11.3 Environmental Performance

Table 11-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 11-3: Environmental performance – mechanical dispersion

Environmental Performance Outcome			
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Mechanical Dispersion	**Response implementation**		
	Mechanical Dispersion Plan Safety Plan Operational NEBA	Mechanical dispersion is to be conducted during daylight only, once the safety plan has been developed and Operational NEBA confirms suitability and environmental benefit	Incident Log IAP

12 Oiled Wildlife Response Plan

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

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

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Northern Territory Oiled Wildlife Response Plan (NTOWRP) 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
Applicable hydrocarbons	**MDO**
	✔
Termination criteria	+ Oiling of wildlife have not been observed over a 48-hour period + Oiled wildlife has been successfully rehabilitated + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response

12.1 Overview

Santos will provide all necessary resources to assist the Control Agency in an oiled wildlife response in State and/or NT waters, mainly, and initially, through its access to AMOSC oiled wildlife resources. Timely provision of equipment and personnel will be provided by AMOSC to the Control Agency/Lead IMT through a combination of owned and operated equipment, call-off contracts with suppliers, and the management of industry OWR response personnel through an Industry Oiled Wildlife Advisor (OWA). This team will work in conjunction with the Control Agency OWR capability under the direction of the Incident Controller. Where Santos is the Control Agency for OWR in Commonwealth waters, AMOSC will also provide the above mentioned resources but would instead work under the direction of the Santos IC.

In the event OWR is required in WA State waters, the key plan for oiled wildlife response (OWR) in WA is the WA Oiled Wildlife Response Plan (WAOWRP). The WAOWRP has been developed by DBCA and AMOSC, on behalf of the petroleum industry, and DBCA and DEPWS to define the minimum standards for OWR in WA as a sub-plan to the State Hazard: SHP-MEE. The WA OWRP can also be used for guidance to OWR in Commonwealth waters adjacent to State waters. The Kimberley Region OWRP, which sits under the WA OWRP provides operational guidance to respond to injured and oiled wildlife in the Kimberley regions and covers the areas potentially contacted by a spill from MSS operations.

The Northern Territory Government have the following interim arrangements in place for OWR management:

+ The NT Emergency Management Council will delegate responsibilities associated with wildlife and relevant activities in National Parks, Reserves and Marine Parks; and
+ Direct coordination shall be managed through the designated NT Government Functional Group.

In 2019, AMOSC prepared the Northern Territory Oiled Wildlife Response Plan (NTOWRP) for Shell Australia, ConocoPhillips and Inpex (AMOSC, 2019). This plan also has application for other titleholders and may be used as a resource to help guide an OWR in NT.

The sections below provide guidance to the Santos IMT on OWR stages of response and implementation. The information below should be used in conjunction with the WAOWRP and/or NTOWRP as relevant.

12.2 Stages of Response to Oiled Wildlife

The stages of OWR are described in **Table 12-2**. If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 12-2: Oiled wildlife response stages (adapted from WAOWRP)

Stage	Description
Stage 1: Initial wildlife assessment and notifications	Gather situational awareness on whether an OWR impact has occurred or is imminent and complete notifications to Jurisdictional Authorities and external support agencies
Stage 2: Mobilisation of wildlife resources	Mobilise initial preventative measures and/or mobilisation of resources to deal with incident in early stages of development
Stage 3: Wildlife reconnaissance	Wildlife Reconnaissance for the OWR should occur as part of the implementation of surveys for the fauna related Operational Monitoring Plans (OMPs) undertaken to aid planning and decision making for executing spill response or clean-up operations. Wildlife Reconnaissance will be required for the duration of the wildlife response operations.
Stage 4: IAP wildlife sub-plan development	The Wildlife Response Sub-plan should include operational components (relevant to the scale of the OWR), being: + wildlife impact assessment + reconnaissance and monitoring + search and collection + carcass collection and necropsy storage + field stabilisation + wildlife transport + wildlife processing/admission + wildlife intake and triage + wildlife cleaning + rehabilitation/conditioning + release + post-release monitoring + OWR termination and demobilisation (It should be noted that separate strategies and protocols may be required for different species groups)

Stage	Description
Stage 5: Wildlife rescue and staging	This includes commencing actions such as hazing, pre-emptive capture, administering first-aid and holding and/or transportation of wildlife to oiled wildlife facilities If oiled birds or non–avian wildlife were to be observed at sea, on-water collection should be considered for the effective capture of oiled animals before they become so debilitated that their chance of survival is severely affected (IPIECA, 2017)
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the cleaning and rehabilitation of affected animals A vessel-based 'on-water' facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

12.3 Oiled Wildlife Response Levels and Resourcing

An impact assessment threshold of 10g/m^2 for impacts on fauna from floating hydrocarbons is provided in the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006). This conservative threshold is broadly accepted as being the minimal thickness of surface hydrocarbons that may result in adverse impacts to seabirds through ingestion from preening of contaminated feathers (French-McCay, 2016) and is also considered appropriate for turtles, sea snakes and marine mammals (NRDAMCME, 1997).

Review of the worst-case spill modelling indicates that floating hydrocarbon concentrations above 10 g/m^2 may extend up to 27 km from the spill location (within Commonwealth waters). No shoreline accumulation of hydrocarbons above threshold values was predicted by the modelling.

OWR level and personnel numbers required depends on the extent and duration of a spill. Personnel would be sourced through AMOSC, OSRL, DBCA, Universities and contractors. Additional personnel may also be sourced through labour hire agencies that can provide field workers that undergo an induction and basic training. Basic training (over one day) for OWR personnel can be delivered as just-in-time training through an arrangement with DBCA.

12.4 Implementation Guidance

Oiled wildlife response activities can be resource intensive and require additional personnel to be positioned within the IMT. The wildlife operations unit will contain all the field staff and activities, including oiled wildlife reconnaissance, who will work in close consultation with personnel undertaking relevant monitor and evaluate activities. The IAP Wildlife Response Sub-plan as outlined in **Table 12-3** will form the key management system which will provide control and oversight over the response.

Table 12-3 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing OWR. These actions are provided as a guide and should be read in conjunction with the WAOWRP or NTOWRP. In some cases, the Implementation Guidance (**Table 12-3**) will provide additional detail to the WAOWRP/ NTOWRP and has greater linkages to other aspects of the response operation and this OPEP (e.g. NEBA and aerial surveillance). Mobilisation times for the minimum resources that are required to commence initial oiled wildlife operations are listed in **Table 12-4**.

The IC of the Control Agency is ultimately responsible for the implementation of the response and therefore, depending on the circumstances of the spill, may determine that some tasks be varied, should not be undertaken or should be reassigned.

Further information on resource capability for this strategy is shown in **Appendix I.**

Table 12-3: Implementation guidance – oiled wildlife response

Action		Consideration	Responsibility	Complete
Stage 1: Initial wildlife assessment and notifications				
Initial Actions	Personnel conducting monitor and evaluate activities shall report wildlife sightings in or near the spill trajectory (including those contacted with hydrocarbons or at risk of contact) and report them to the IMT within two hours of detection	Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + location + access + number + species + condition of impacted animals (if available)	Surveillance personnel	☐
	If wildlife are sighted and are at risk of contact (or have been contacted), initiate oiled wildlife response by contacting AMOSC Duty Manager and DBCA State Duty Officer and NT DEPWS (who will then activate their respective Oiled Wildlife Advisors)	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Advisor and/or Control Agency Oiled Wildlife Advisor DoT will be the Control Agency for OWR in State waters and NT IMT will be the Control Agency in NT waters.	Environmental Team Leader	☐
	Notify DAWE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance [MNES])	Refer to **Table 7-1** for reporting requirements A list of MNES is provided in the Existing Environment Section of the EP (Section 3)	Environmental Team Leader	☐
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected		Environmental Team Leader Wildlife Division Coordinator	☐

Action		Consideration	Responsibility	Complete
	Use information from initial assessments to prepare an Operational NEBA. Use this information to help determine: Initial OWR Response Level (1 to 6), as defined in the WA OWRP.	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution alone. The Environmental Team Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether capture and cleaning of oiled wildlife will result in a net environmental benefit. This may be done in consultation with the Control Agency and AMOSC Oiled Wildlife Advisors and any SME's as relevant (if available, but an Operational NEBA should not be delayed if they are not immediately available)	Environmental Team Leader Wildlife Division Coordinator Wildlife Branch Director	☐
Stage 2: Mobilisation of wildlife resources				
Determine resources required to undertake Stage 3: Wildlife Reconnaissance and provide list to Logistics Section		Confirm best reconnaissance platform (e.g. vessel, aerial, shoreline). Consider ability to share resources (e.g. Shoreline Clean-up Assessment Teams, Monitor and Evaluate activities)	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA	☐
Determine number of Oiled Wildlife Responders and IMT Wildlife related positions required based on the likely number of oiled wildlife and arrange access to resources via AMOSC, DBCA and/or DEPWS		Consider need for veterinary care	Wildlife Division Coordinator Logistics Team Leader AMOSC OWA DBCA OWA NT OWA	☐
Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s			Wildlife Logistics Officer	☐
Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR			Environmental Team Leader	☐

Action	Consideration	Responsibility	Complete
Stage 3: Wildlife reconnaissance			
Determine reconnaissance plan including survey locations, techniques and priority species	Consult local experts, if available	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA DBCA OWA NT OWA Planning Team Leader	☐
Conduct reconnaissance activities and upon completion, submit report detailing: + area/s surveyed + estimated number of animals oiled or at risk of being affected + any deaths + species affected		Wildlife Division Coordinator Wildlife Operations Officer Wildlife Reconnaissance Officer OWR field personnel Operations Team Leader	☐
Stage 4: IAP wildlife sub-plan development			
Develop Wildlife Response Sub-plan for inclusion in the IAP IAP should include options for wildlife rescue and rehabilitation, including: + wildlife priorities for protection from hydrocarbons + any deterrence/hazing measures + anticipated number of oiled wildlife requiring rescue + reassessment of Oiled Wildlife Level + actions required for the collection, recovery,	Consider need for any permits to conduct activities	Wildlife Division Coordinator Wildlife Operations Officer AMOSC OWA DBCA OWA NT OWA Environmental Team Leader	☐

Action	Consideration	Responsibility	Complete
transport and treatment of oiled wildlife; including resourcing of equipment and personnel anticipated			
Stage 5: Wildlife rescue and staging			
Implement Wildlife Response Sub-plan for deterrence/hazing, pre-emptive capture, relocation	Trained personnel required to handle wildlife	Wildlife Division Coordinator Wildlife Operations Officer Wildlife Rescue Officer AMOSC OWA DBCA OWA NT OWA OWR field personnel Operations Team Leader	☐
Establish staging site/s	Wildlife first aid/stabilisation may be required at staging site if OWR treatment facility is more than two hours away	Wildlife Operations Officer Wildlife Staging/Holding Officer OWR field personnel Operations Team Leader	☐
Stage 6: Establishment of an oiled wildlife facility			
Implement Wildlife Response Sub-plan for oiled wildlife facility	Utilise OWR containers where possible. One container/kit can treat up to 150 OWR units, so will be adequate to treat oiled wildlife from the worst-case spill. If insufficient, additional OWR containers can be requested via the IAP to AMSA Should oiled wildlife treatment be set up on vessels rather than onshore, the vessel needs to have adequate deck space to house the oiled wildlife equipment and be able to provide continuous hot water at constant pressure and temperature.	Wildlife Division Coordinator Wildlife Operations Officer Wildlife Facilities Officer AMOSC OWA DBCA OWA NT OWA OWR field personnel	☐

Action	Consideration	Responsibility	Complete
	The vessel must have the ability to properly contain and dispose of contaminated wastewater. Most Support Vessels are likely to be appropriate as they have mud and other tanks for water storage and oil-water systems for treating water	Operations Team Leader	
Stage 7: Wildlife rehabilitation			
Implement Wildlife Response Sub-plan for rehabilitation	Animals need to be stable to withstand stress of washing. Oiled animals, particularly birds, cannot thermoregulate and need to be kept indoors in a temperature-controlled room. The room needs to be well ventilated to disperse the hydrocarbon fumes	Wildlife Division Coordinator Wildlife Veterinarian Wildlife Rehabilitation Officer AMOSC OWA DBCA OWA NT OWA OWR field personnel Operations Team Leader	☐
Stage 8: Oiled wildlife response termination			
Liaise with Jurisdictional Authorities regarding OWR termination, using endpoints established in the IAP and supplementary Wildlife Response Sub-plan (Termination and Demobilisation section)		Wildlife Division Coordinator AMOSC OWA DBCA OWA NT OWA Incident Commander	☐

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

Task	Time from oiled wildlife contact (predicted or observed)
IMT notifies regulatory authorities and AMOSC of oiled wildlife/potential for contact	<2 hours
Mobilise Santos personnel for oiled wildlife reconnaissance **this will be already occurring through Aerial Observer mobilisation**	<24 hours
Mobilisation of AMOSC/AMSA oiled wildlife equipment and industry OWR team to staging area	<48 hours
Minimum Resource Requirements	
The requirements for oiled wildlife response will be situation specific and dependent upon reconnaissance reports. Indicative minimum resource requirements below align with personnel requirements for a Level 1 response: + seven trained industry oiled wildlife response team personnel (AMOSC staff & contractors/AMOSC Industry OWR group) + one AMOSC OWR treatment container + one AMOSC Oiled Wildlife Deterrence Kit	

12.5 Environmental Performance

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

Table 12-5: Environmental performance – oiled wildlife response

Environmental Performance Outcome	Implement tactics in accordance with the WAOWRP and/or NTOWRP 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	**Response preparedness**		
	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 Oil spill Response Limited (OSRL) throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Labour hire onboarding procedure (for low skilled shoreline clean-up personnel)	Development of onboarding procedure for oil spill response labour hire	Onboarding procedure

Environmental Performance Outcome	Implement tactics in accordance with the WAOWRP and/or NTOWRP to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Santos Oiled Wildlife Response Framework	Development of a Santos Oiled Wildlife Response Framework	Santos Oiled Wildlife Response Framework
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 12-4** unless directed otherwise by DoT/DBCA or the NT Government	Incident log
	OWR managed in accordance with the WAOWRP/NTOWRP	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit (particularly in relation to hazing/pre emptive capture)	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Wildlife Response Sub-plan developed to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

13 Waste Management Plan

Table 13-1 provides the environmental performance outcome, initiation criteria 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, reusing and recycling waste where possible
Initiation criteria	Response activities that will be generating waste have been initiated
Applicable hydrocarbons	**MDO**
	✔
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 quickly to ensure waste management does not create a bottleneck in response operations. The worst-case oil spill modelling conducted for the Petrel Sub-Basin SW 3D MSS activities did not predict beaching of surface oil. Therefore, waste management requirements are 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.

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 the final disposal points. Santos's Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detailed guidance to the WSP in the event of a spill.

Where DoT or NT IMT is the Control Agency, Santos will provide a Facilities Support Officer to support the coordination of waste management services.

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 Santos Incident Response Telephone Directory (SO-00-ZF-00025.020) for contact details	Logistics Team Leader	☐
	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 Team Leader Planning Team Leader	☐
	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 DWER for WA and through the NT Department of Environment, Parks and Water Security (DEPSW) via the NT Environment Protection Authority (EPA) for NT.	Logistics Team Leader Planning Team Leader Environmental Team 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 Santos Oil Pollution Waste	Consider facilities for waste segregation at source	Logistics Team Leader Planning Team Leader	☐

Action		Consideration	Responsibility	Complete
	Management Plan [QE-91-IF-10053])			
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP	Waste management should be conducted in accordance with Santos's Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the relevant Control Agency waste management guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan.	Logistics Team Leader (or delegate) Planning Team Leader Deputy Waste Management Coordinator (DoT/NT IMT) WSP Location Responsible Person or Operations Supervisor	☐
	Mobilise waste management resources and services to agreed priority locations		WSP Location Responsible Person or Operations Supervisor Logistics Team Leader (or delegate) Deputy Waste Management Coordinator (DoT/NT IMT)	☐

Action		Consideration	Responsibility	Complete
Ongoing Actions	Provide ongoing point of contact between IMT and WSP	If DoT/NT IMT is the Control Agency, the Facilities Support Officer shall be the point of contact between DoT/NT IMT and the WSP	Deputy Waste Management Coordinator (DoT/NT IMT) Logistics Team Leader	☐
	Ensure all waste handling, transport and disposal practices comply with legislative requirements	Alert Logistics Team Leader (or delegate)/Deputy Logistics Officer (if DoT/NT is the Control Agency) if any non-compliance is anticipated or detected Site clean-up, removal and disposal of response waste should be conducted in accordance with the Santos Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT/NT Waste Management Guidelines, and 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 (including 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, removal and disposal of response waste should be conducted in accordance with Santos's Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the Control Agency waste management guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan.

The Santos Oil Pollution Waste Management Plan (QE-91-IF-10053) 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's activities.

13.4 Waste Service Provider Capability

Detailed guidance on Santos's Waste Service Provider responsibilities for spill response waste management is provided in the Santos Oil Pollution Waste Management Plan (QE-91-IF-10053).

Key responsibilities of the waste service provider include:

+ Maintain emergency response standby preparedness arrangements, including:
  - 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.
  - Participation in exercising undertaken by Santos.
+ Have the 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 Waste Management Resources

Santos has access to capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points.

13.6 Waste Management Environmental Performance

Table 13-3 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-3: environmental performance – waste management

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

14 Scientific Monitoring Plan

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 Scientific Monitoring Plans (SMPs) – **Appendix J**
Applicable hydrocarbons	**MDO**
	✔
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 scientific monitoring plan (SMP) in place for Petroleum activities in State, Territory and Commonwealth waters.

Santos will activate and implement scientific monitoring in State, Territory 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' Scientific Monitoring Plans (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 oil spills from the Petrel Sub-Basin SW 3D MSS across both State, Territory and Commonwealth waters. In the event that control of scientific monitoring in State/NT waters is taken over by DoT under advice from the State/NT Environmental Scientific Coordinator (ESC), Santos will follow the direction of 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 Scientific Monitoring Plan.

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 the Petrel Sub-Basin SW 3D MSS **(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 DoT or NT methodology, termination criteria and analysis/reporting requirements may differ.

Table 14-2: Oil spill scientific monitoring plans relevant to the Petrel Sub-Basin SW 3D MSS

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 prior to, 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 review 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 the baseline date assessment process.

14.6 Monitoring Service Providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos by a contracted Monitoring Service Providers (MSPs) and applies to the implementation of SMPs 1 to 12 (**Table 14-2**). These services are provided by Astron Environmental Services (Astron) and primary sub-contractor (BMT).

For whale sharks, in addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks within the foraging BIA will be undertaken (SMP12). Santos has historically and currently supports research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef conducted by AIMS. 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 within the foraging BIA. 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:

+ monitoring support 24 hours a day, seven days a week accessed through a 24-hour call-out number;
+ a suitably trained Monitoring Coordination Team including a Monitoring Coordinator, Monitoring Operations Officer, Planning and Logistics Officer and Safety Office;
+ Technical Advisors and Field Teams (staff and contractors) for first strike deployments;
+ maintenance of standby monitoring equipment;
+ monthly personnel capability reports;
+ Scientific Monitoring Sub-plans (provision and review);
+ Standby Service Manual (EA-00-RI-10162) and associated response activation forms (provision and review); and
+ participation in audits, workshops, drills and exercise to facilitate readiness.

Appendix L provides an overview of Santos's processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1 to 12 are fit for purpose to meet the worst case first-strike monitoring requirements associated with the Petrel Sub-Basin SW 3D MSS.

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 Procedures Index and IMT Environment Team Leader folder.

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

This process will identify monitoring operational objectives and resourcing/mobilisation requirements which the ETL 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 of SMP
Santos IMT approve initial monitoring plan	<24 hours
Santos to mobilise sampling platforms to deployment location	<96 hours (72 hours from monitoring plan approval)
SMP teams and monitoring equipment mobilised to deployment locations	<96 hours (72 hours from monitoring 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. The first strike response process for scientific monitoring field teams 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 **Appendix L**) + scientific monitoring equipment as detailed in the relevant SMP	

14.8 Scientific Monitoring 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
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Response implementation		

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**
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAPs and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log
		Monitoring Service Provider shall commence activation process within 30 mins of initial notification form being received from Santos	Monitoring Service Provider records
		Santos personnel to support Monitoring Service Provider through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident Log and Monitoring Service Provider records
	Mobilisation of minimum requirements for initial scientific monitoring operations	Minimum requirements mobilised in accordance with **Table 14-3**	Incident log

15 Spill Response Termination

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

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

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

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

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

16 OPEP Administration

16.1 Document Review and Revision

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 Environment Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to:

+ when major changes have occurred, which 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);
+ routine testing of the OPEP if improvements or corrections are identified; and
+ learning points from 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.

16.2 OPEP Custodian

The custodian of the OPEP is the Santos Senior Oil Spill Response Coordinator based in the Santos Perth Office.

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Appendix A: Hydrocarbon Characteristics and Behaviour

Marine diesel (MDO)

In the marine environment diesel 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 diesel from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance;
+ As wind increases, and breaking waves form, entrainment of diesel below the surface increases;
+ The evaporation rate of diesel will increase in warmer air and sea temperatures such as those present around the North West Shelf; 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.

ITOPF (2011) and Australian Maritime Oil Spill Centre-AMOSC (2011) categorises diesel as a light group II hydrocarbon. In the marine environment, a 5% residual of the total quantity of diesel spilt will remain after the volatilisation and solubilisation processes associated with weathering.

For full details on the properties of marine diesel, refer to Section 7.5 of the Petrel Sub-Basin SW 3D MSS EP (SO-00-BI-20006).

Table A1: Characteristics of diesel

Hydrocarbon	Initial density (kg/m³)	Viscosity (cP) @ 25°C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (°C)	<180	180–265	265–380	>380
Diesel	836.8	3.9	% of total	6	34.6	54.4	<5

Source: APASA (2013a)

Hydraulic oils

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

Lubricating fluid

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

Appendix B: Oil Spill Response ALARP Framework & Assessment

ALARP Assessment Framework

1 Rationale

As part regulatory approval requirements for petroleum activities, the Environment Plan (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 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.

2 Guidance Documents

Guidance documents used in the preparation of this framework include:

+ Oil Spill Risk Assessment and Response Planning Procedure QE-91-II-20003;
+ NOPSEMA Guidance Note ALARP N-04300-GN0166 Revision 6 June 2015;
+ 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 Revision 6 – November 2019;
+ NOPSEMA Guidance Note Risk Assessment GN0165 Revision 5 May 2017; and
+ NOPSEMA Oil Pollution Risk Management GN1488 Rev 2 February 2018

3 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 B1**.

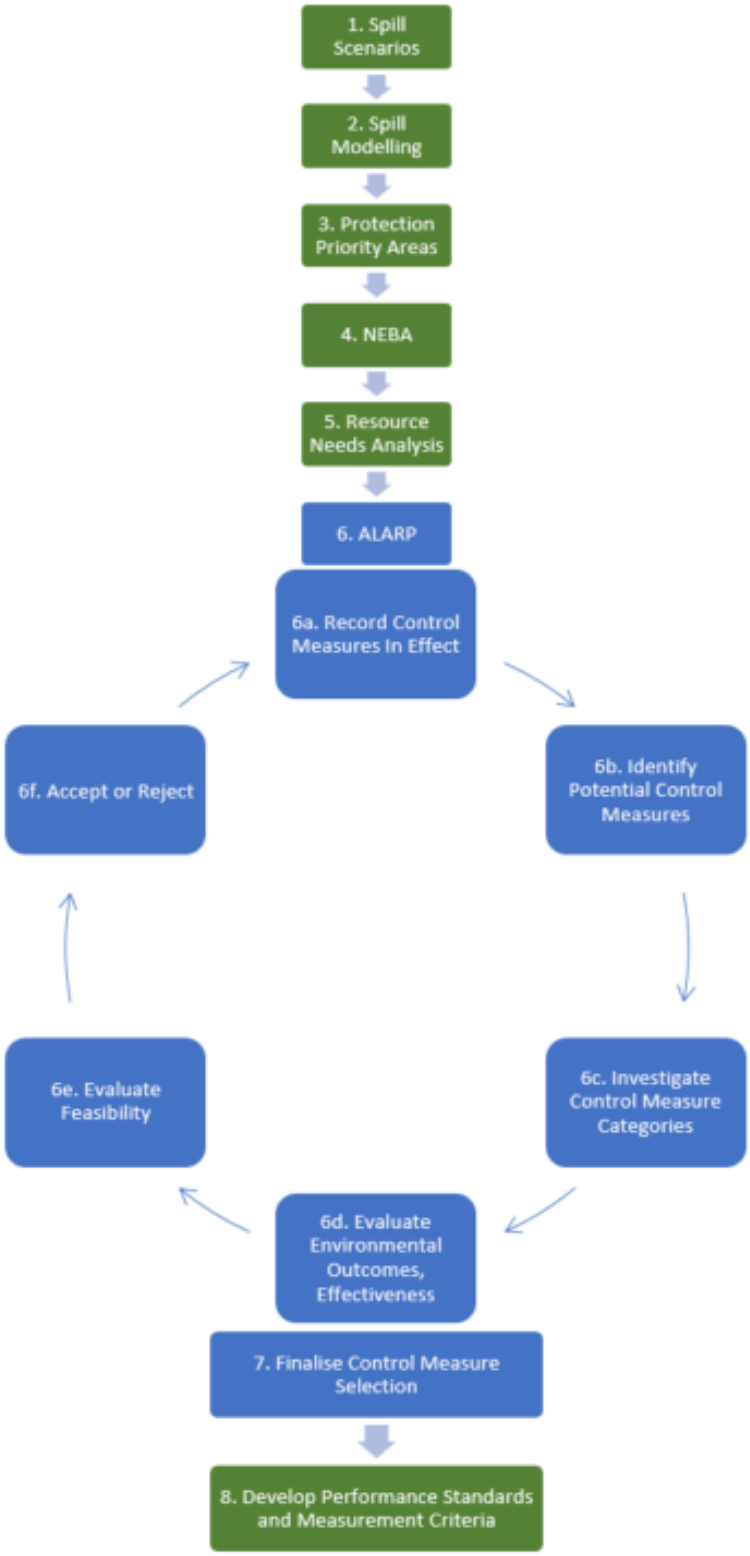


Figure B1: ALARP Assessment Framework

In **Figure B1**, 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 QE-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 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 1, Step 6 (in BLUE). Criteria and definitions used to evaluate control measures are shown in Table 1.

6a) Record Control Measures In Effect: The spill response control measures currently in place for Santos 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 practise 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 B1, 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.

4 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 B1**.

Table B1: 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 Revision 6 – November 2019
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 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. <u>Functionality</u> 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? <u>Availability</u> Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. <u>Reliability</u> 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.

Column	Description
	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

Petrel Sub-Basin SW 3D MSS Response ALARP Assessment

ALARP Assessment Summary - Source Control

Source control is limited to minimising potential volumes of MDO lost to the marine environment and no areas of improvement were identified.

No 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 the OPEP. The key performance requirements are to follow the response actions listed in the respective ships SOPEP and conduct spill exercises in line with the ships SOPEP.

ALARP Assessment Summary - Monitor and Evaluate

Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture of the incident. Areas of improvement for monitor and evaluate activities were the availability of aerial observers and SCAT trained personnel in initial 24 hours of incident occurrence and availability of vessels for water quality monitoring.

One potential Control Measure sought to make trained aerial observers available from Day 1 of a response, rather than Day 2, however an assessment of the Control Measure found that the cost was grossly disproportionate to the benefit. No potential Control Measures were identified to improve availability of SCAT trained personnel in the initial 24 hours of incident. A potential control measure to improve the availability of vessels for water quality monitoring by implementing more detailed vessel tracking parameters was evaluated and accepted. Six other potential Control Measures were also identified and assessed. Four were rejected as cost was grossly disproportionate to the reduction in risk, whilst two Control Measures around the provision of strategically located oil sampling kit and improved record keeping of service providers that could assist with fauna aerial observations were accepted as reasonably practicable.

Eight additional potential Control Measures were identified and assessed.

Three additional Control Measures were accepted as reasonably practicable. The accepted measures were:

+ Develop vessel specifications for operational water quality monitoring vessel
+ Purchase of First Strike oil Sampling kit to be positioned at Darwin
+ Maintain a list of providers that could assist with fauna aerial observations, e.g. whale shark spotting planes

Five additional Control Measures were rejected as grossly disproportionate. Rejected response measures were:

+ Purchase of oil spill modelling system and internal personnel trained to use system.
+ Ensure trained aerial observers based at strategic locations such as Darwin
+ Trained monitoring specialists on site
+ Ensure trained marine mammal/fauna observers based at strategic locations such as Darwin

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, focus on maintaining access to equipment and personnel through contractual arrangements with vessel providers, aircraft providers, aerial observers, UAV providers, tracking buoys, oil spill trajectory modelling providers, satellite imagery providers water quality monitoring providers and spill responders.

Additional key areas for effectiveness during preparedness are following relevant procedures such as the Protected Marine Fauna Interaction and Sighting Procedure, and limiting environmental impacts from response activity through personnel and vehicle management. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence monitor and evaluate operations. These key areas of effectiveness have been represented in Performance Standards for monitor and evaluate operations.

ALARP Assessment Summary - 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 the OPEP. The key areas of effectiveness for the identified Control Measures during a response are around the development of an operational NEBA to confirm suitability and environmental benefit, and the mobilisation of vessels. These key areas of effectiveness are reflected in the Performance Standards.

ALARP Assessment Summary - Oiled Wildlife

Oiled wildlife equipment including first strike kits and containers can be mobilised from regional locations and Perth. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst-case oiled wildlife operations identified in the OPEP. The availability of trained personnel in the initial stages of an incident is a limiting factor for this response strategy. Control Measures around the provision of trained personnel were reviewed to identify that trained Santos personnel could be based not just in the Perth Office but also at VI and DC facilities.

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. An additional area of improvement is clarity for how Santos will integrate with Control Agencies OWR. It has been identified that additional planning captured in a Santos Oiled Wildlife Response Framework is a practicable control measure to ensure that resources are deployed in a coordinated approach.

Five additional potential Control Measures were identified and assessed.
Two Control Measures were accepted as reasonably practicable. The accepted control measures were:

- Development of a Santos Oiled Wildlife Response Framework which will set the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response
- Develop labour hire onboarding procedure for spill response to clarify the labour hire process for the Santos IMT

Two Control Measures were rejected as grossly disproportionate. Rejected control measures were:

- Pre-hire and/or prepositioning of staging areas and responders
- Direct contracts with service providers

Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, the mobilisation of requirements for initial oiled wildlife response operations and the management of the oiled wildlife response in accordance with WA State and NT plans are both key elements for achieving this strategy and they are represented as a Performance Standards.

ALARP Assessment Summary – 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 the OPEP. Further detail is captured in the Santos Waste Management Plan - Oil Spill Response Support (QE-91-IF-10053). An area of improvement is the availability of vessels required for waste transport at sea. One potential Control Measure to address this area of improvement was identified and assessed but cost was grossly disproportionate to risk.

Three potential additional Control Measures were identified and assessed.
All were rejected as grossly disproportionate. Rejected control measures were:

- Maintain contracts with multiple service providers
- 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 the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to waste management equipment and services through contractual arrangements. During response, a key area for increasing effectiveness is the timely mobilisation of requirements

for initial response operations and defining critical management and reporting services to be provided by the waste service provider. These key areas of effectiveness are captured in the Performance Standards.

ALARP Assessment Summary - Scientific Monitoring

Oil spill scientific monitoring will be conducted on behalf of Santos by a contracted monitoring service provider as detailed in the Santos 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 Control Measures were identified and assessed.

A potential Control Measure on the purchase and standby of scientific monitoring resources was found to be grossly disproportionate in cost in comparison to the reduction in risk. Two potential Control Measures on improved record keeping for scientific monitoring consumable requirements and suppliers and the provision of oil sampling kits to be located at strategic regional locations were both found to be reasonable and practicable.

Four additional potential Control Measures were identified and assessed.

Two additional Control Measures were accepted as reasonably practicable. The accepted control measures were:

- Before planned activity commences, purchase of oil sampling kit for scientific monitoring personnel to be positioned at Darwin
- Determine required vessel specifications for Scientific Monitoring implementation

One Control Measure was rejected as grossly disproportionate. The rejected control measure was:

- Scientific monitoring personnel, plant and equipment on standby at the operational location

Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures during times of preparedness are around maintaining access to equipment and personnel through contractual arrangements, regular reviews of monitoring service provider capability and reviews of existing baseline data. During response, a key area for effectiveness is the mobilisation of requirements to commence scientific monitoring and ensuring that relevant approved manuals and plans are followed. These key areas of effectiveness are reflected in the Performance Standards.

Appendix C: POLREP

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: SITREP

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

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:

Santos

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)

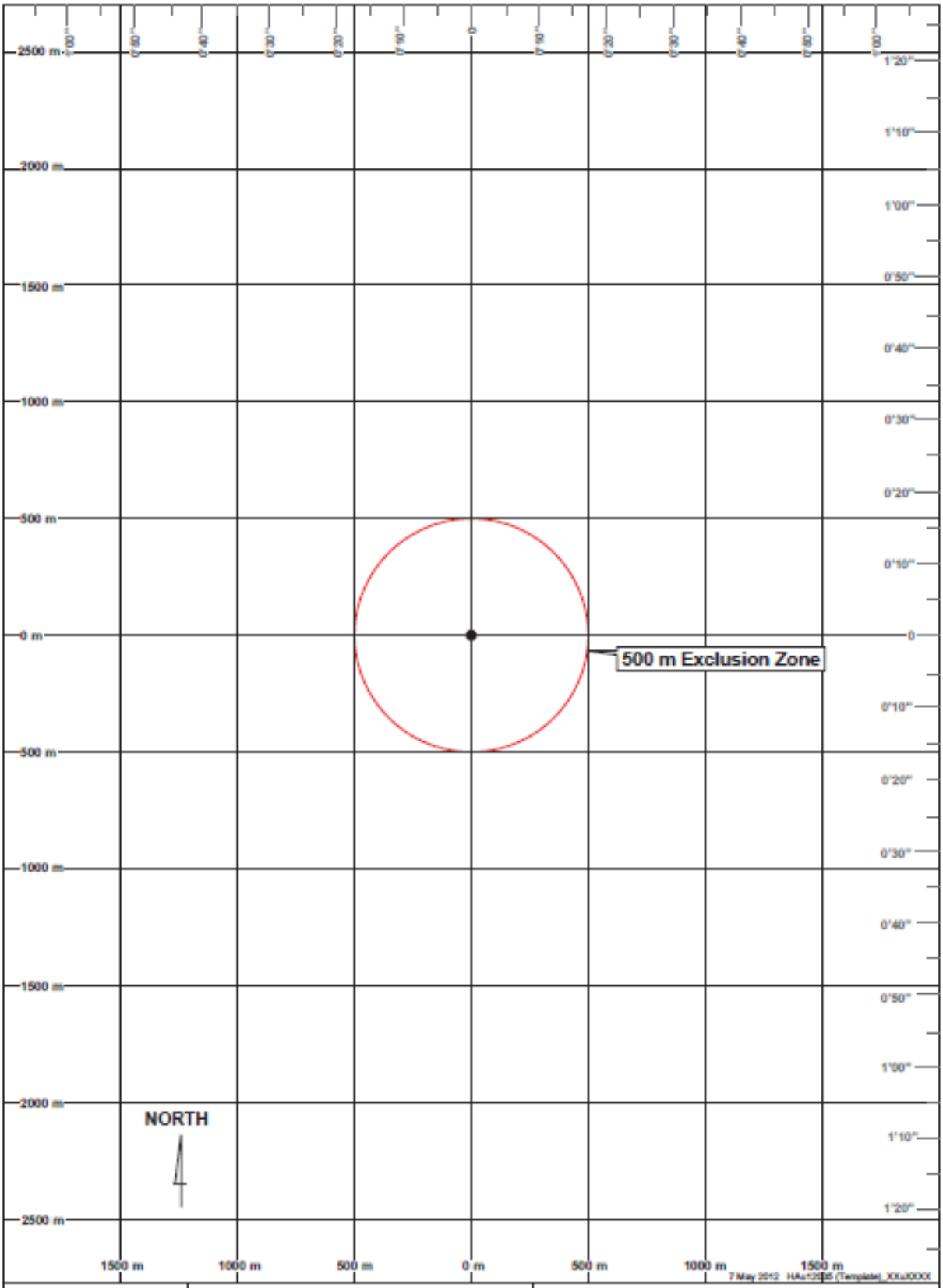
Santos

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

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Leatherback turtle

○ Turtle species unknown

Santos

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**Behaviour / Comments.** **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

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 WAOWRP and/or NTOWRP. An overview of sources of personnel is provided in Table 1 and an overview of 'first-strike' equipment for initial deployment is provided in Table 2.

In the event of large-scale OWR, further specialised OWR equipment and personnel will be provided by in-country and international organisations, as necessary, accessed through AMOSC (primary) and OSRL (secondary). Equipment and personnel required for the development and operation of staging areas/ treatment facilities can be provided locally (for example veterinary personnel and supplies). The East Kimberley regional operational OWR plan and the West Kimberley regional operational OWR plan (as per the WAOWRP) provide detail of local organisations and suppliers for personnel and equipment. The NTOWRP also provides the OWR resources available in NT.

In addition to OWR providers mobilised through AMOSC and OSRL/Sea Alarm, Santos maintains access to the workforce marketplace during an emergency response. Level 1 oiled wildlife responders, of which the WAOWRP indicates 90+ could be required for a Level 6+ event, could be provided through Santos workforce hire arrangements. On the job training requirements for Level 1 responders could be provided by DBCA, AMOSC or Sea Alarm personnel. Skilled but ubiquitous roles required for manning and maintaining facilities and staging areas, such as trades, technicians and vets, could also be filled through workforce hire arrangements. The East Kimberley regional operational OWR plan and the West Kimberley regional operational OWR plan (as per the WAOWRP) provide contact details for local trade personnel, vets and wildlife specialists that could be employed for manning/maintenance of forward response wildlife response facilities. The NTOWRP also provides the OWR resources available in NT.

Table 1: Sources of Oiled Wildlife Response Personnel

AMOSC / INDUSTRY RESPONDERS	**Activated through**	**Capability**
AMOSC Technical Advisor – Oiled Wildlife – assistant in IMT (as industry OWA if required)	AMOSC Duty Officer	1*
AMOSC OWR Industry Team– Level 2-4 responders (DBCA training)		18*
WA Petroleum industry personnel – Trained by individual petroleum industry companies – activated via mutual aid		~50*
AUSTRALIAN OWR EXPERTISE	**Activated through**	**Capability**
Blue Planet Marine (ACT and WA) – Oiled Wildlife Responders	AMOSC Duty Officer	10-20*
Phillip Island National Parks(VIC) – Oiled Wildlife Responders		~70 staff ~45 volunteers*

NatPlan Mutual Aid			50-100*
Perth Zoo – Duty Veterinarian	Wildlife care and rehabilitation advice, expertise and management	Personnel potentially available to petroleum industry (currently there is no formal arrangement)	
	Links to wildlife rehabilitation networks		
OWA		DBCA State Duty Officer	1 per shift
Personnel			
DBCA staff with wildlife and emergency management skill set who currently operate in fire preparedness and response			
INTERNATIONAL OWR EXPERTISE		**Activated through**	**Capability**
DwyerTECH NZ – Facilities Management Personnel (call-off contract)		AMOSC Duty Officer	2*
Wild base, Massey University (NZ) - Oiled Wildlife Responders			4-6*
International Bird Rescue (USA)- Oiled Wildlife Responders			4*
Sea Alarm (Belgium) – Expert assistance with organisational set-up and global OWR resourcing		OSRL Duty Officer	2/3** (Sea Alarm) + additional OWR responders accessed through global network

* As per AMOSC Capacity Statement 25 Jun 2020

** As per Sea Alarm/OSRL Service Level Agreement Statement

Table 2: First Strike Deployment-Ready OWR Equipment

AMOSC OWR Equipment*	**Activated through**	**Location**
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit	AMOSC Duty Officer	Fremantle
1 x AMOSC owned OWR container 1 x AMOSC owned box kit 1 x Fauna Hazing and Exclusion kit		Geelong
1 x AMOSC owned box kit		Exmouth
1 x AMOSC owned box kit		Broome
National Plan (NatPlan) OWR Equipment*	**Activated through**	**Location**
1 x NatPlan OWR container 1 x NatPlan/DBCA Box/trailer kit	AMSA RCC	Dampier
1 x NatPlan OWR container		Darwin
1 x NatPlan OWR container		Townsville
1 x NatPlan OWR container		Devonport
WA DBCA OWR Equipment*	**Activated through**	**Location**
1 x DoT OWR container	DoT Duty Officer	Fremantle
DBCA OWR trailer kit		Karratha
DBCA OWR trailer kit		Kensington
NSW Maritime OWR Equipment*	**Activated through**	**Location**
1 x NSW Maritime OWR container	AMSA RCC	Sydney
OSRL OWR Equipment**	**Activated through**	**Location**
1 x Search and rescue response package 2 x Cleaning and rehabilitation response package 1 x Cleaning and rehabilitation medical package	OSRL Duty Officer	UK
1 x Cleaning and rehabilitation response package		Singapore
2 x Search and rescue response package 1 x Cleaning and rehabilitation response package		Bahrain

1 x Wildlife Rehabilitation Unit 1 x Cleaning and rehabilitation response package		Fort Lauderdale, USA

* As per AMOSC capacity statement 25 June 2020
** As per OSRL SLA Equipment Report June 2021

Appendix J: Scientific Monitoring Plans

1 Scientific Monitoring Principles

1.1 Monitoring Design

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

Table 1: Guiding Principles for Oil Spill Monitoring Design and Methodologies.

Principle	Explanation	Key guiding references
Match baseline	Designs and methodologies should follow those used in appropriate baseline studies wherever possible.	N/A
Comprehensive sampling	Sampling methods should seek to sample the full range of taxa within each assemblage. This may require the use of several complimentary techniques (the exception is if indicator taxa are employed; see below).	N/A
Reliable indicator taxa	If indicator taxa are targeted then the choice of indicator should be defensible, and a link to the response of the broader assemblage demonstrated. Indicators of ecosystem function should also be considered.	Hilty and Merenlender (2000)
Appropriate sample area or volume	Size of sampling unit should be determined based on the level of clustering of individuals and whether the goal is to quantify this clustering, or establish low inter-sample variability (probably more the latter for oil spill studies).	Kenkel et al. (1989)
Reduce within sample variation over time	Wherever possible repeated measures are carried out on the same sample space in order to reduce within treatment variation.	N/A
Compositing of samples	Appropriate compositing to increase statistical power should be considered.	Carey and Keough (2002)
Account for environmental gradients and partition variations	Sources of variation are considered and compartmentalised to best reduce within treatment variation, and thereby maximise power to detect an impact. This is managed through several means:	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)

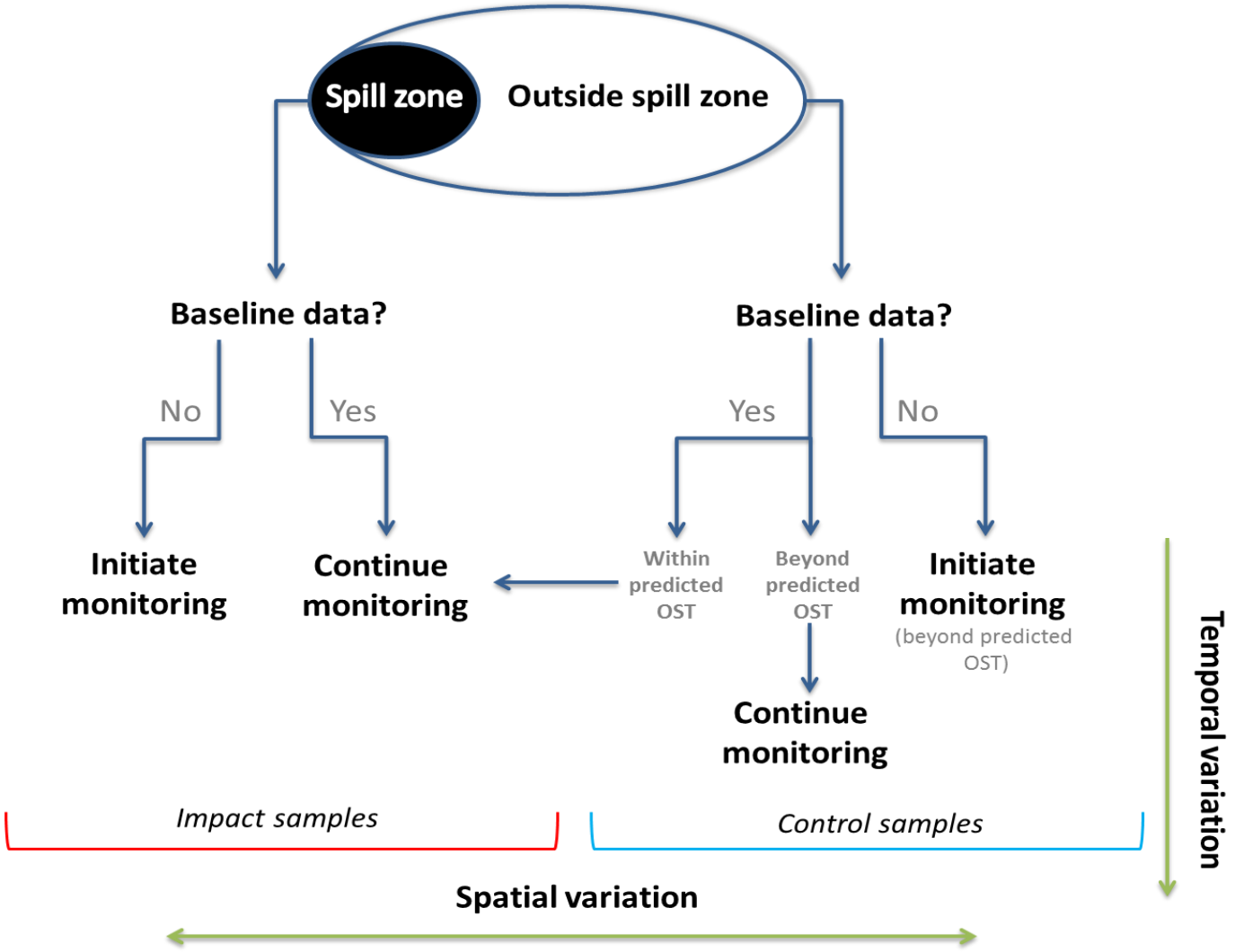


Figure 1: Structured Decision Making Process Based on Gregory et al. (2012) in Reference to Monitoring Programs, the Availability of Baseline Data, and Oil Spill Trajectory. An ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

Appendix B details the most important approaches to statistical analysis and related sampling design. These approaches are summarised in Table 2 (below). An important consideration is how this information is best summarised and communicated to guide further decision making and management. **Appendix B** also describes the reporting of environmental outcomes through the use of report card systems and includes a summary of their structure and design.

Table 2: 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.

2 Scientific Monitoring Plans by Receptor

Table 3 provides a glossary of an SMP as prepared in this report.

Table 3: 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 **Table 2**, detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)
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 as described in **Appendix C**.
Implementation	Mobilisation requirements for service provider(s).
Analysis and reporting	Summary of analysis, data management and reporting.

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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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. 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;

SMP1 – Marine Water Quality	
	3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied. See **Appendix B** 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. The laboratory(ies) will inform and supply the appropriate sample containers, storage requirements, holding times, detection limits/limit of reporting for required analytes and the analysis required for each sample. Water samples shall be analysed for key contaminants of concern including polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (including benzene, toluene, ethylbenzene, xylene), and nutrients, metals and chlorophyll-a. At each site, replicate water samples (at least three samples) will be collected to allow appropriate statistical analyses to be made including samples for quality assurance and quality control (QA/QC) purposes (i.e. split sample, triplicate sample, field blanks, transport blanks). Water sample collection and handling will align with Standard operating procedures found in the Oil Spill Monitoring Handbook (Hook et al., 2016), specifically the following sections: + Appendix A & B hydrocarbon analysis; + Appendix C Volatile Organic Compounds Analysis; and + Appendix D Surface Oil Analysis. Environmental DNA (eDNA) will also be collected to detect for the presence of marine species in the water column. Water samples will be collected in Nalgene bottles and sent to an appropriate laboratory for analysis. Sample processing will depend on holding times required (<8 hours ideal) and may involve filtering and freezing of each sample (Grochowsi and Stat 2017).

SMP1 – Marine Water Quality	
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. 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	
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.

SMP2 – Sediment Quality	
Baseline	Refer to the Baseline Data Review (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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 statistically significantly different from comparable non-impacted benthic infauna assemblages. Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in: + Taxonomic diversity + Assemblage composition + Abundance of indicator species Other pressures to these states are: + Discharge of other toxicants + Physical disturbance including dredging + Sedimentation + Introduction of marine pests

SMP2 – Sediment Quality	
	+ 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 B** 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. 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.

SMP2 – Sediment Quality	
	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 + 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

SMP2 – Sediment Quality	
	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	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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 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

SMP3 – Sandy Beaches and Rocky Shores	
	+ Over-collection + Nutrification + Climate change.
Methodological approach	Monitoring will be designed 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. 3. 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. 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.

SMP3 – Sandy Beaches and Rocky Shores	
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 – 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.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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). 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.

SMP4 – Shorelines and Coastal Habitats - Mangrove Communities	
	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 B** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)). 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 – Shorelines and Coastal Habitats - Intertidal Mudflats	
Rationale	Intertidal mudflat communities are primary producer habitats which support invertebrate fauna, which in turn provides a valuable food source for shorebirds. High diversity of infauna (particularly molluscs) occur within these habitats and may be affected by

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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: 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. 3. Where no baseline data sites are involved a post-spill pre-impact (preferable) or gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1**).

SMP5 – Shorelines and Coastal Habitats - Intertidal Mudflats	
	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	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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**.

SMP6 – Benthic Habitats	
Termination criteria	Benthic habitat cover and composition 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. Coral health and reproduction 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: 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. 3. Where no baseline data sites are involved, a gradient approach to quantifying impacts will be applied (See **Appendix B** for detailed description of these approaches and **Figure 1**). Benthic Habitat Cover and Composition 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.

SMP6 – Benthic Habitats	
	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. <u>Coral Health and Reproduction</u> Using divers, selected coral colonies will have tissue samples removed for the purpose of laboratory analysis of the concentration of accumulated hydrocarbons and for determining reproductive state, noting sampling for reproductive state will be dependent upon the timing of coral spawning. Reproductive state will be determined from measures of gamete size, stage and fecundity determined from in-field examination and laboratory analysis of histological samples. In addition to the standard suite of ecotoxicology testing done on the released hydrocarbon as part of the Operational Monitoring Program, 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.

SMP6 – Benthic Habitats	
Analysis and reporting	Digital imagery will be analysed using a point-count technique (using software such as AVTAS, Coral Point Count with Excel extensions (CPCe) or TransectMeasure (SeaGIS)) to estimate the percentage cover of biotic and abiotic categories (in line with the CATAMI classification scheme) comprising the benthic habitat. Biotic categories to include the following as applicable: corals; macroalgae and seagrass; and non-coral benthic filter feeders. Live, dead and bleached coral cover shall be recorded. The imagery collected will allow for the determination of percent cover, abundance, measurement of size (if scaling lasers are included in the image) and a visual assessment of health (Kohler and Gill 2006). NATA accredited laboratory analysis to determine the concentration of hydrocarbons within coral tissue. Reproductive output to be determined by complementary means, including in-field and laboratory analysis of gametes, including microscopic examination of histological samples preserved in the field. Coral larval competency tests to be conducted by 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	
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.

SMP7 – Seabirds and Shorebirds	
	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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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.
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.

SMP7 – Seabirds and Shorebirds	
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 B** for detailed description of these approaches and **Figure 1,** detailed in Baseline Data Review (Astron Environmental Services 2019) (QE-00-BI-20001)). 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).

SMP7 – Seabirds and Shorebirds	
	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	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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).

SMP8 – Marine Mammals	
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), **Appendix C8** + Marine surveys will follow the protocols of Watson et al. (2009), **Appendix C8** 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

SMP8 – Marine Mammals	
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.

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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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**.

SMP9 – Marine Reptiles	
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: + 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).

SMP9 – Marine Reptiles	
	Reproductive success Shoreline impacts – ground surveys (detailed tagging and/or nesting success studies). Design of ground surveys will be applied 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. 3. Where no baseline data sites are involved, and timing allows, a post spill pre-impact approach will be attempted. 4. 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) + 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.

SMP9 – Marine Reptiles	
	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	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). Human health benchmarks relating to the exposure of PAHs shall be used to determine health effects as per Yender et al. (2002). Flesh samples from non-impacted sites to be used as baseline for olfactory analysis for flesh taint.
Initiation criteria	+ Operational monitoring and results from SMP1 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.

SMP10 – Seafood Quality	
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) in **Appendix C10**, 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). 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	
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

SMP11 – Fish, Fisheries and Aquaculture	
	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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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 + 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), **Appendix C11**. Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas.

SMP11 – Fish, Fisheries and Aquaculture	
	Sampling design for fish assemblages 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. 3. If baseline data is not available, a gradient approach to quantifying impacts will be applied (See **Appendix B** 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 + 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.

SMP11 – Fish, Fisheries and Aquaculture	
	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	
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 (Astron Environmental Services 2021) (SO-91-RF-20022 Rev 0). 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.
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

SMP12 – Whale Sharks	
	+ 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 + 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.

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Appendix K: SMP Activation Process

Oil Spill Operational and Scientific Monitoring Activation Form

astron
astron.com.au

Instructions

In the event of a spill requiring a response from Astron follow these steps:

1. **Activate a response – call 1300 902 700**
2. **Immediately complete this Activation Form and email to spillresponse@astron.com.au**

You will receive a call back from the Monitoring Coordinator within 30 minutes. In the event that a call back is not received, please call 1300 902 700 again.

Note: If new information should become available after submitting this form, or the situation changes, please advise the Astron Monitoring Coordinator as soon as possible.

Section 1: Contact Details

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

Date and time of spill		Click here to enter a date.			Enter time, i.e. 1400 WST		
Spill source location (GDA94, MGA Zone 50)		Insert coordinates in GDA94 MGA Zone 50 format (easting and northing).					
		Insert location description					
Source of spill							
Cause of spill (if known)							
Status of spill		☐ Secured	☐Uncontrolled	☐Unknown			
Release rate	Instantaneous release						State units
	OR						
	Continuous release		per hour for		☐Hours	☐Days	
Description of spill	Estimated quantity						State units
	Incident tier	☐1	☐2	☐3			
	Direction of travel						
	Trajectory						
Modelling provider log in details							

Santos WA - Managed Information - Uncontrolled when printed

Oil Spill Operational and Scientific Monitoring Activation Form

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	

Section 5: Approval	
I authorise the activation of a response by Astron Environmental Services Pty Ltd in connection with the above incident under the terms of Contract # [insert contract].	
Signature:	
Date and Time:	

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Activate Our Team

In the event of a spill requiring scientific monitoring response call:

1300 902 700

Advise the operator:

1. **Your company**
2. **Your name and contact number**
3. **Brief reason for call (i.e. Exercise or Spill)**

A message will be relayed to our team to call you back.

Provide additional details as requested by the Monitoring Coordinator on call-back

Complete and submit the *Activation Form*

Astron initiates Oil Spill Scientific Monitoring Activation & Response Process – refer to next page

Oil Spill Scientific Monitoring Activation and Response Process

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

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

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

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

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

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

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

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

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

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

Abbreviations

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

Appendix L: Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

Assurance arrangements

Astron Environmental Services (Astron) is currently Santos' primary Monitoring Service Provider for the implementation of SMPs 1-12. A contractual arrangement exists with Astron to maintain standby arrangements as per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and have the resourcing capability to implement a first-strike response at all times. Astron maintains a relationship with a primary sub-contractor (BMT) for the provision of scientific monitoring for those SMPs where Astron does not have the required capability. Between Astron and BMT, capability exists to deliver first strike resourcing against SMPs 1-12.

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the Astron and BMT Planning and Logistics Officers and delivered to the Santos Spill Response Adviser along with a summary of any changes in resourcing or, and if required, how gaps in resourcing have been managed. Since the establishment of the scientific monitoring contract in 2015 Astron 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 Astron/BMT standby arrangements are adequate through its exercise and auditing program. Santos regularly conducts exercises and tests with Astron and BMT to ensure that Santos IMT roles and Astron/BMT monitoring roles are familiar with the SMP activation arrangements while providing spot checks on resource availability. Santos has previously also undertaken an audit of Astron 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 (OSMP) project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2021, 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.