Santos

Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey Oil Pollution Emergency Plan

PROJECT / FACILITY	Yoorn-1, Jelen-1 and Parnassus-1
REVIEW INTERVAL	60 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s Managerial/Technical/Site	Approver
0	Senior Oil Spill Response Coordinator	Environmental Approvals Team Leader	Manager – HSE Offshore Division

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IMT Room – Perth office		● x 4
AMOSC	●	
DoT	●	
AMSA	●	
OSRL	●	

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Abbreviation	Description
AIS	Automatic Identification System
ALARP	as low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
APASA	Asia-Pacific Applied Sciences Associates
APPEA	Australian Petroleum Production & Exploration Association
API	American Petroleum Institute
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Codes
C&R	containment and recovery
CHARM	chemical hazard and risk management
CMT	Crisis Management Team
CSR	company site representative
DAWE	(Australian) Department of Agriculture, Water and Environment
DAWR	Department of Agriculture and Water Resources
DBCA	Department of Biodiversity, Conservation and Attractions
DFAT	Department of Foreign Affairs and Trade
DISER	Department of Industry, Science, Energy and Resources
DMIRS	Department of Mines, Industry Regulation and Safety
DoE	(Australian) Department of the Environment (now DAWE)
DoEE	(Australian) Department of the Environment and Energy (now DAWE)
DoT	Department of Transport
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environment Regulation
EMBA	environment that may be affected
EP	Environment Plan
ER	emergency response
ESC	Environmental Scientific Coordinator
EUL	Environment Unit Leader
FOB	forward operating base
GIS	geographic information system

Abbreviation	Description
GPS	global positioning system
HMA	Hazard Management Agency
HR	human resources
IAP	Incident Action Plan
ICC	incident command centre
IMO	International Maritime Organisation
IMT	Incident Management Team
IR	industrial relations
IRT	Incident Response Team
IUCN	International Union for Conservation of Nature
LAT	lowest astronomical tide
LOWC	loss of well control
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response (DoT)
MNES	matters of national environmental significance (DoT)
MODU	mobile offshore drilling unit
MoU	Memorandum of Understanding
MP	marine park
MSA	Master Services Agreement
MSP	monitoring service providers
N/A	Not Applicable
N	north
NatPlan	National Plan for Maritime Environmental Emergencies
NC	No Contact
NEBA	net environmental benefit analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NW	north west
OPEP	Oil Pollution Emergency Plan
OPSSG Act 2006	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGS (S) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009

Abbreviation	Description
OSC	on-scene commander
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OSTM	oil spill trajectory modelling
OWA	Oiled Wildlife Advisor
OWR	oiled wildlife response
PMZ	Priority Marine Zone
PPA	Priority Protection Area
RCC	AMSA Rescue Coordination Centre
ROV	Remote Operated Vehicle
S	south
SCP	Source Control Plan
SDA	surface dispersant
SFRT	Subsea First Response Toolkit
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SIMA	spill impact mitigation assessment
SLA	Service Level Agreement
SMP	Scientific Monitoring Plans
SMPC	State Marine Pollution Coordinator
SMPEP	Shipboard Marine Pollution Emergency Plan
SOPEP	Shipboard Oil Pollution Emergency Plans
SW	south west
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicle
VI	Varanus Island
VOC	volatile organic compound
VOO	vessels of opportunity
VPO	Vice President Offshore Upstream WA
W	west
WA	Western Australia
WAOWRP	Western Australian Oiled Wildlife Response Plan
WOMP	Well Operation Management Plan
WSP	waste service provider

Abbreviation	Description
WWC	wild well control

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">Geophysical survey at WA-546-P (Jelen-1) and WA-208-P (Parnassus-1). A site survey will be undertaken over the combined Operational Area (Figure 3-1).
Drilling of three exploration wells at WA-499-P (Yoorn-1), WA-546-P (Jelen-1) and WA-208-P (Parnassus-1) using a jack-up mobile offshore drilling unit (MODU) with auxiliary activities including support vessels, helicopters and Remotely Operated Vehicle (ROV).</td><td>Section 2.0 of the Environment Plan (EP)</td></tr>
<tr><td>Locations
(Geodetic reference: GDA 94, UTM Zone 50)</td><td colspan="3"><u>Well top-hole locations (Operational Area centres):</u>
Yoorn-1:
+ Latitude: 20° 20’ 36.70” S
+ Longitude: 115° 47’ 12.30” E
Jelen-1:
+ Latitude: 20° 1' 35.62" S
+ Longitude: 116° 14' 33.58" E
Parnassus-1:
+ Latitude: 19° 59’ 37.61” S
+ Longitude: 116° 16’ 14.73” E</td><td>Table 2-1 of the EP</td></tr>
<tr><td>Petroleum Title/s (Blocks)</td><td colspan="3">WA-499-P, WA-546-P, WA-208-P (Commonwealth waters)</td><td></td></tr>
<tr><td>Water Depths</td><td colspan="3">Approximately 45 - 65 m</td><td></td></tr>
<tr><td rowspan="6">Worst-case Spill Scenarios</td><td>Scenario</td><td>Hydrocarbon[1]</td><td>Worst-case volume (m^3)</td><td rowspan="6">Section 6.1</td></tr>
<tr><td colspan="3">Yoorn-1 (reservoir spill modelling - GHD, 2020a; MDO spill modelling – GHD, 2019)</td></tr>
<tr><td>Loss of Well Control (LOWC) – subsea release</td><td rowspan="2">Yoorn condensate analogue (Linda condensate / Grader C)</td><td>317,750</td></tr>
<tr><td>LOWC – surface release</td><td>316,424</td></tr>
<tr><td>Surface diesel release</td><td>Marine Diesel Oil (MDO)</td><td>329</td></tr>
<tr><td colspan="3">Jelen-1 and Parnassus-1 (represented by Dancer-1 oil spill modelling: GHD, 2020b)</td></tr>
</table>

[1] Note Jelen-1 and Parnassus-1 LOWC modelling used Dancer-1 modelling, which uses Reindeer condensate as an analogue, which was modelled as Rev 2009 13 Grader C (Grader C), selected from within the SINTEF Oil Library. Yoorn-1 LOWC modelling used Linda condensate as an analogue, which was also modelled as Grader C.

<table>
<tr><th>Parameter</th><th colspan="4">Description</th><th>Further Information</th></tr>
<tr><td rowspan="3"></td><td>Loss of Well Control (LOWC) – subsea release</td><td colspan="2" rowspan="2">Jelen and Parnassus condensate analogue (Dancer and Reindeer condensate / Grader C)</td><td>43,423</td><td></td></tr>
<tr><td>LOWC – surface release</td><td>43,153</td><td></td></tr>
<tr><td>Surface diesel release</td><td colspan="2">MDO</td><td>329</td><td></td></tr>
<tr><td rowspan="2">Hydrocarbon Properties</td><td colspan="4">MDO:
Density at 25 °C = 829 kg/m^3
Dynamic viscosity = 4 cP @ 25° C
API Gravity = 37.6°
Wax content = 1%
Pour point = -14 °C
ITOPF Group II</td><td rowspan="2">Appendix A: Hydrocarbon Characteristics and Behaviour</td></tr>
<tr><td colspan="2">Yoorn condensate analogue (Linda condensate):
Specific gravity = 0.787
Kinematic viscosity @20 °C = 1.33 cSt
API Gravity = 48.2
Wax content = <0.5%
Pour point = -27 °C
ITOPF Group I</td><td colspan="2">Jelen and Parnassus condensate analogue (Reindeer condensate):
Specific gravity = 0.7862
Kinematic viscosity @13 °C = 0.841 cSt
API Gravity = 48.5
Wax content = <5%
Pour point = -36 °C
ITOPF Group I</td></tr>
</table>

<table>
<tr><th>Parameter</th><th colspan="2">Description</th><th>Further Information</th></tr>
<tr><td>Weathering Potential</td><td>Marine Diesel Oil
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 60% will generally evaporate over the first two days. Approximately 5% is considered “persistent”, which is unlikely to evaporate but will decay over time.
Under low winds (1 m/s), 60% of the surface slick is predicted to remain as surface oil after 120 hours (5 days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain as surface oil after 24 hours, decreasing further to ~10% after 48 hours and ~1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to almost entirely either evaporate (~20-25%) and disperse (~75-80%) after 12 hours.
MDO has a very low tendency to form an emulsion with only ~1% water content entrained into the surface slick after 120 hours across all wind scenarios.</td><td>Condensate
Yoorn, Jelen and Parnassus condensate were all modelled using an analogue hydrocarbon (Grader C) selected from within the SINTEF Oil Library. Evaporation is the primary weathering mechanism for highly volatile condensates such as Grader C.
Under low wind speeds of 1 m/s, approximately 90% of the surface slick is predicted to evaporate after 3 days (72 hours). Under moderate wind speeds of 5 m/s, approximately 82% of the surface slick is predicted to evaporate after 24 hours with the remaining ~18% dispersed in the water column and no surface slick under these conditions. High wind speeds of 10 m/s are predicted to rapidly (after only 6 hours) disperse (30%) and evaporate (70%) with no surface slick.</td><td>Appendix A: Hydrocarbon Characteristics and Behaviour</td></tr>
<tr><td>Protection Priorities</td><td colspan="2">+ Montebello Islands
+ Lowendal Islands
+ Barrow Island
+ Barrow-Montebello Surrounds
+ Muiron Islands
+ Ningaloo Coast North
+ Southern Islands Coast.</td><td>Section 6.6</td></tr>
</table>

2 First strike response actions

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

If the spill is related to the MODU, the Rig Offshore Installation Manager (hereafter referred to as the On-Scene Commander or OSC) will be notified, or in the case of a support vessel, the Vessel Master will be notified.

Following those initial actions undertaken by the On-Scene Commander or Vessel Master to ensure the safety of personnel on the vessel or MODU and to control the source of the spill, the Santos Company Site Representative will assess the situation based on:

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

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

Response information contained within this Oil Pollution Emergency Plan (OPEP) is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based Incident Management Team (IMT) and Santos Crisis Management Team (CMT) are engaged for support and implementation of response strategies. Level 1 spills are managed through on-site response and IMT is available to assist with regulatory requirements/notifications and support as required. Therefore, the immediate response actions listed in **Table 2-1** are relevant for any spill. Once sufficient information is known about the spill, the Incident Commander will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander.

Table 2-1: First strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (MODU Operator's Emergency Response Plan and Santos MODU Operator Emergency Response Bridging Plan) or vessel-specific procedures, as applicable	On-Scene Commander/Vessel Master
Immediate	Control the source using site resources, where possible	Control the source using available onsite resources (MODU/vessel) Refer to source control plan – **Section 9**	On-Scene Commander/Vessel Master
30 minutes of incident being identified	Notify Santos Offshore Duty Manager/ Incident Commander	Verbal communication to Offshore Duty Manager/Incident Commander's duty phone	On-Scene Commander via Company Site Representative (CSR)
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	On-Scene Commander via CSR
60 minutes	Gain situational awareness and begin onsite spill surveillance	If spill reaches marine waters gain further situational awareness by undertaking surveillance of the spill from vessel or MODU Refer to Monitor and Evaluate Plan – **Section 10**	On-Scene Commander via CSR Incident Commander
Refer timeframes Go to **Section 7**	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures – **Section 7**	Initial notifications by Environment/ Safety Unit Leaders – **Table 7-1**

<table>
<tr><th rowspan="2">When (indicative)</th><th colspan="2">Activations</th><th rowspan="2">Who</th></tr>
<tr><th>Objective</th><th>Action</th></tr>
<tr><td colspan="4">Level 2/3 spills (in addition to actions above)</td></tr>
<tr><td>Immediately once notified of spill (to Incident Commander)</td><td>Activate IMT, if required</td><td>Notify IMT</td><td>Offshore Duty Manager/ Incident Commander</td></tr>
<tr><td colspan="4">IMT actions (0 to 48 hours)</td></tr>
<tr><td rowspan="2">Within 90 minutes from IMT callout</td><td>Set-up IMT room</td><td>Refer to IMT tools and checklists for room and incident log set-up</td><td>Incident Commander
IMT Data Manager</td></tr>
<tr><td>Gain situational awareness and set incident objectives, strategies and tasks</td><td>Begin reactive Incident Action Planning process
Go to Section 8
Review First Strike Activations (this table)</td><td>Incident Commander
Planning Section Chief</td></tr>
<tr><td>Refer timeframes
Section 7</td><td>Make regulatory notifications as required
Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required</td><td>Go to Section 7</td><td>Initial notifications by Environment/ Safety Officer
Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC] and Oil Spill Response Ltd. [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)</td></tr>
</table>

When (indicative)	Activations		Who
	Objective	Action	
Refer timeframes **Section 10**	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Vessel Surveillance (**Section 10.1**) Aerial Surveillance (**Section 10.2**) Tracking Buoys (**Section 10.3**) Oil Spill Trajectory Modelling (**Section 10.4**) Satellite Imagery (**Section 10.5**) Initial Oil Characterisation (**Section 10.6**) Operational Water Quality Monitoring (**Section 10.7**) Shoreline Clean-up Assessment (**Section 10.8**)	IMT Operations Section Chief IMT Logistics Section Chief/Supply Unit Leader IMT Environment Unit Leader
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 Section Chief (IMT Relief Well Team Leader as appropriate to scenario) IMT Logistics Section Chief/Supply Unit Leader
Activate on Day 1 for applicable scenarios Refer **Section 11**	Reduce exposure of wildlife to floating oil through mechanical dispersion	Activate the Mechanical Dispersion Plan Go to **Section 11**	IMT Operations Section Chief IMT Logistics Section Chief/Supply Unit Leader
Day 1	Identify environmental sensitivities at risk and conduct Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review applicable response strategies and begin operational NEBA (**Refer to Sections 6.5 and 6.6.1**)	IMT Environment Unit Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan. **Appendix P: Forward Operations Guidance**	IMT Operations Section Chief IMT Logistics Section Chief/ Supply Unit Leader

When (indicative)	Activations		Who
	Objective	Action	
Day 1	Ensure the health and safety of spill responders	Identify relevant hazards controls and develop hazard register Begin preparation Site Health and Safety Management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	IMT Safety Officer
If/when initiated Refer **Section 12**	Protect identified shoreline protection priorities	Activate the Shoreline Protection and Deflection Plan Go to **Section 12**	IMT Operations Section Chief IMT Logistics Section Chief/ Supply Unit Leader IMT Environment Unit Leader
If/when initiated Refer **Section 14**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan Go to **Section 14**	IMT Environment Unit Leader IMT Operations Section Chief IMT Logistics Section Chief/ Supply Unit Leader
If/when initiated	Clean-up oiled shorelines	Activate Shoreline Clean-Up resources Go to **Section 13**	IMT Operations Section Chief IMT Logistics Section Chief / Supply Unit Leader
If/when initiated Refer **Section 15**	Safely transfer, transport and dispose of waste collected from response activities.	Activate the Waste Management Plan. Go to **Section 15**	IMT Operations Section Chief IMT Logistics Section Chief/ Supply Unit Leader
If/when initiated Refer **Section 16**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan Go to **Section 16**	IMT Environment Unit Leader IMT Logistics Section Chief/ Supply Unit Leader IMT Operations Section Chief

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, Australian Maritime Safety Authority (AMSA), or the Western Australia (WA) Department of Transport (DoT) may be relevant Control Agencies (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' support to the DoT (for a WA State waters response) is detailed in **Sections 4.6.2 and 4.6.3**, respectively.		Control Agency IMT Santos to provide the following roles to DoT MEECC/IMT for WA State waters response (Refer to **Table 5-5**): + CMT Liaison Officer + Deputy Incident Controller + Deputy Intelligence Officer + Deputy Planning Officer + Environment Support Officer + Deputy Public Information Officer + Deputy Logistics Officer + Deputy Waste Management Coordinator + Deputy Finance Officer + Deputy Operations Officer + Deputy Division Commander (Forward Operating Base [FOB])

3 Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey Environment Plan (the EP) (SO-00-BI-20003.1) 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 proposes to drill three exploration wells; Yoorn-1, Jelen-1 and Parnassus-1 located in petroleum exploration permits WA-499-P, WA-546-P and WA-208-P respectively (**Figure 3-1**). Water depth in the vicinity of the proposed exploration wells ranges from approximately 45-65 m.

Drilling will be undertaken using a jack-up MODU, with auxiliary activities including support vessels and helicopters. Specific activities will include well construction, formation evaluation and permanent abandonment activities related to exploration drilling. A 500 m circular exclusion zone will be applied around the MODU centred at the rig's surface location, with only one MODU operating in the exclusion zone at any point in time (multiple support vessels and helicopters may be operating in the same area at any one time). The wells covered under the EP are not planned to be drilled sequentially. The first well (Yoorn-1) is planned to be drilled in Q2 2022, after which the MODU will demobilise to undertake other work, outside of the scope of this EP. Following this, the MODU will mobilise to drill Parnassus-1 followed by Jelen-1, planned for by the end of 2023.

A geophysical survey under the EP will be undertaken at WA-546-P (Jelen-1) and WA-208-P (Parnassus-1). **Figure 3-1** shows the combined operational area of the survey. The geophysical survey in WA-546-P and WA-208-P is planned for a window between Q2 and Q4 in 2022. Allowing for potential down-time, for example due to weather, the activity may extend to up to 20 days. Note the geophysical survey for Yoorn-1 is covered under a separate EP and OPEP (Yoorn-1 Geophysical Environment Plan (Commonwealth and State Waters) (S0-91-RI-20058.01).

Refer to Section 2 of the Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey Environment Plan (the EP) for further detail on the activity.

3.2 Purpose

The purpose of this OPEP (YJP OPEP) is to describe Santos' response to a hydrocarbon spill during geophysical survey activities at Jelen-1 and Parnassus-1, and drilling activities at Yoorn-1, Jelen-1 and Parnassus-1.

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

This OPEP is to be read in conjunction with the Santos YJP EP (SO-91-BI-20003.01) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Santos YJP EP (SO-91-BI-20003.01) and will remain valid for the duration of life of the EP.

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 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 spill response strategies and mechanisms presented throughout this OPEP. Through their implementation, Santos will:

- initiate spill response immediately following a spill
- establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment
- assess the spill characteristics and understand its fate in order to be able to make informed and clear response decisions
- monitor the spill to identify the primary marine and coastal resources requiring protection
- remove as much oil as possible from the marine environment while keeping environmental impacts from the removal methods to ALARP
- reduce the impacts of the remaining floating and stranded oil to ALARP
- respond to the spill using efficient response strategies that do not damage the environment themselves
- comply with all relevant environmental legislation when implementing this OPEP
- conduct all responses safely without causing harm to participants
- monitor the impacts from a spill until impacted habitats have returned to baseline conditions
- remain in a state of 'Readiness' at all times for implementation of this OPEP by keeping resources ready for deployment, staff fully trained and completing response exercises as scheduled
- keep stakeholders informed of the status of the hydrocarbon spill response to aid in the reduction of social and economic impacts.

3.4 Area of operation

The Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey EP (SO-91-BI-20003.01) covers drilling three exploration wells located wholly within Commonwealth waters in petroleum exploration permits WA-499-P, WA-546-P and WA-208-P respectively. It also covers geophysical survey activities at Jelen-1 and Parnassus-1.

The Operational Area (OA) for Yoorn-1 is defined as a 2 km x 2 km square centred around the proposed well location while Jelen-1 and Parnassus-1 have a combined Operational Area. At each well location, a Petroleum Safety Zone (PSZ) of 500m radius will be established around the MODU.

The co-ordinates of the OAs are shown in **Table 3-1**; and location in **Figure 3-1**.

Table 3-1: Co-ordinates of Yoorn-1, Jelen-1 and Parnassus-1 Operational Areas

Operational Area	Point	Easting	Northing	Latitude	Longitude
Yoorn-1 (WA-499-P)	1	374,358.1	7,751,037.0	20° 20' 04.41" S	115° 47' 47.03" E
	2	374,358.1	7,749,037.0	20° 21' 09.46" S	115° 47' 46.52" E
	3	372,358.1	7,749,037.0	20° 21' 08.98" S	115° 46' 37.56" E
	4	372,358.1	7,751,037.0	20° 20' 03.93" S	115° 46' 38.07" E
Jelen -1 (WA-546-P) and Parnassus-1 (WA-208-P)	1	418,719	778,3841	20° 2' 26.029" S	116° 13' 22.054" E
	2	418,719	778,7841	20° 0' 15.913" S	116° 13' 22.694" E
	3	421,713	779,1041	19° 58' 32.262" S	116° 15' 6.218" E
	4	425,713	779,1041	19° 58' 32.828" S	116° 17' 23.846" E
	5	425,713	778,8507.1	19° 59' 55.255" S	116° 17' 23.477" E
	6	421,681.6	778,8507.1	19° 59' 54.684" S	116° 15' 4.749" E
	7	421,681.7	778,3841	20° 2' 26.468" S	116° 15' 4.033" E

Geodetic reference: GDA 94, UTM Zone 50.

The outer extent of the environment that may be affected (EMBA) for this EP and OPEP is based on the results of stochastic oil spill modelling of both LOWC scenarios (one representing Yoorn-1; and one representing Jelen-1 and Parsnuss-1); as this represents the largest spatial extent of potential changes to ambient environment conditions from an aspect. The EMBA is based on low exposure values (**Table 3-2**).

Biological impacts are expected to occur within the moderate and high exposure values. The moderate value exposure area (MEVA) has been identified by the outer extent of the 'moderate' exposure areas predicted for both modelled scenarios and is used for the purposes of impact assessment in the EP (shown in **Figure 3-1**).

Response thresholds have been developed for response planning to determine the conditions under which response strategies would be effective. These are shown in **Table 6-2**.

Table 3-2: Hydrocarbon Exposure Values

Hydrocarbon Phase	Exposure Value		
	Low	Moderate	High
Surface (g/m^2)	1	10	50
Shoreline accumulation (g/m^2)	10	100	1,000
Dissolved aromatics (ppb)	10	50	400
Entrained (ppb)	10	100	-

The nearest landmass to any of the OAs is the Montebello Islands (Trimouille Island), approximately 22 km west-south-west from the Yoorn-1 well top-hole location. The closest well to the Australian mainland (Jelen-1) lies approximately 85 km north-west of Dampier (**Figure 3-1**).

Water depths across the two operational areas range from approximately 45 – 65 m.

Section 3 of the Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey EP (SO-91-BI-20003.01) includes a comprehensive description of the existing environment. A summary of nearest key regional features and distances from the proposed well locations are provided in **Table 3-3**.

Table 3-3: Distances from proposed well locations to key regional features

Island / Mainland	Relative distance and direction from well top-hole location		
	Yoorn-1	Jelen-1	Parnassus-1
Montebello Islands (Trimouille Island)	22.1 km WSW	80.6 km SW	84.8 km SW
Lowendal Island	40.2 km SW	98.0 km SW	102.3 km SW
Barrow Island	49.9 km SW	108.8 km SW	113.3 km SW
Dampier Archipelago:			
- Enderby Island	76.5 km SE	67.3 km SSE	69.2 km SSE
- Rosemary Island	82.9 km ESE	61.0 km SE	61.8 km SE
- Legendre Island	109.2 km E	71.9 km ESE	71.0 km ESE
Dampier	102.1 km SE	85.5 km SE	86.4 km SE
Onslow	159.1 km SSW	213.7km SSW	217.9 km SSW
Closest State Waters boundary	3.7 km	43.2 km	45.4 km

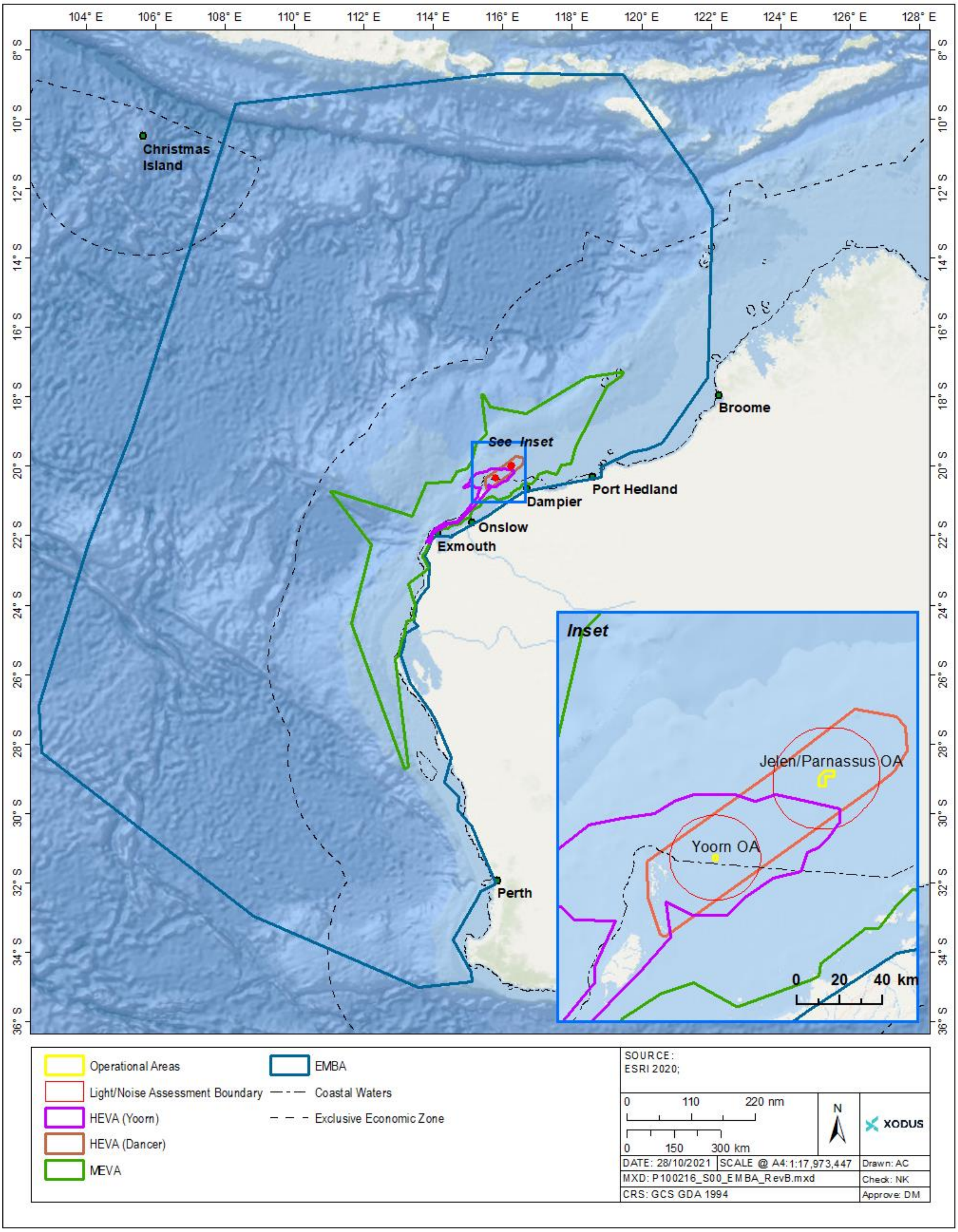


Figure 3-1: Location of Yoorn-1, Jelen-1 and Parnassus-1 Operational Areas, Light/Noise Assessment Boundary, MEVA, HEVA and EMBA

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)
+ Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey EP (SO-91-BI-20003.01)
+ MODU Operator's Emergency Response Plan
+ Santos-MODU Operator Emergency Response Bridging Plan
+ Incident Response Telephone Directory (SO-00-ZF-00025.020)
+ Refuelling and Chemical Transfer Management Standard (QE-91-IQ-00098)
+ Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)
+ Well Specific Source Control Plan(s)
+ Oil Pollution Waste Management Plan (QE-91-IF-10053)
+ Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
+ Santos Oiled Wildlife Response Framework Plan (SO-91-BI-20014)
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099)
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)
+ Oil Spill Scientific Monitoring Baseline Data Review (SO-91-RF-20022)
+ Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)
+ Santos Offshore - Oil Spill Response Readiness Guideline (SO-91-OI-20001).

3.6 Interface with external documents

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.
+ National Plan for Maritime Environmental Emergencies (NatPlan) 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).
- Western Australia Oiled Wildlife Response Plan:
  - Defines the steps, personnel, equipment and infrastructure required for the management of wildlife in an oil pollution response. Each region has a Regional Oiled Wildlife Response Plan that gives further details on sensitivities and available resources.
- Shipboard Oil Pollution Emergency Plans:
  - Under International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
- OSRL Associate Agreement:
  - Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
- Australian Government Coordination Arrangements for Maritime Environmental Emergencies:
  - Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

3.7 OPEP Administration

3.7.1 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.

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

- when major changes have occurred that affect oil spill response coordination or capabilities
- changes to the Environment Plan that affect oil spill response coordination or capabilities (e.g. a significant increase in spill risk)
- following routine testing of the OPEP if improvements or corrections are identified
- after a Level 2/3 spill incident.

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

3.7.2 OPEP custodian

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

4 Spill management arrangements

4.1 Response levels and escalation criteria

Santos uses a tiered system of three incident response levels consistent with the National Plan for Maritime Environmental Emergencies (National Plan) (AMSA 2020) and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT 2020a). 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/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

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

+ Jurisdictional Authority: the Authority 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.
+ Control Agency: the organisation assigned by legislation, administrative arrangements or within the relevant contingency plan, to control response activities to a maritime environmental emergency. Control Agencies have the operational responsibility of response activities but may have arrangements in place with other parties to provide response assistance under their direction.

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

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

+ A vessel is a ship at sea to which to which the *Navigation Act 2012* applies. Defined by Australian Government Coordination Arrangements for Maritime Environmental Emergencies (AMSA, 2020) as a seismic vessel, supply or support vessel, or offtake tanker.
+ A petroleum activity including a fixed platform, FPSO/FSO, MODU, subsea infrastructure, or a construction, decommissioning and pipelaying vessel. Defined by Schedule 3, Part 1, Clause 4 and & Volume 2, Part 6.8, Section 640 of the *OPGGS Act 2006*.

Table 4-2: Jurisdictional and Control Agencies for Hydrocarbon Spills

Jurisdictional boundary	Spill source	Jurisdictional authority	Control agency		Relevant documentation
			Level 1	Level 2/3	
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel[2]	AMSA	AMSA		Vessel SOPEP National Plan YJP OPEP
	Petroleum activities[3]	NOPSEMA	Titleholder		YJP OPEP
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	WA Department of Transport (DoT)	WA DoT	WA DoT	Vessel SOPEP State Hazard Plan: Maritime Environmental Emergencies Oil Spill Contingency Plan (OSCP) (WA DoT 2015) YJP OPEP
	Petroleum activities	WA DoT	Titleholder	WA DoT	YJP OPEP State Hazard Plan: Maritime Environmental Emergencies (WA DoT 2020a)
International waters	Petroleum activities	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		
	Vessel				

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

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

4.3 Petroleum activity spill in Commonwealth waters

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

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

Santos is responsible as Control Agency unless NOPSEMA identifies a requirement to delegate control. In this situation, Control Agency responsibility may be delegated to AMSA who will assume control of the incident and respond in accordance with AMSA's National Plan. In such an occurrence, Santos would assume a Support Agency role and make available all necessary resources to support AMSA in AMSA's performance of their Control Agency responsibilities.

4.4 Vessel spills

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

WA Department of Transport (DoT) manages the State Hazard Plan for Maritime Environmental Emergencies (WA DoT, 2020a) and is the Control Agency for all level 2/3 vessel-based spills in WA waters.

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

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a Supporting Agency throughout the response. This includes providing essential services, personnel, material or advice in support of the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (**Section 10**) and Scientific Monitoring Plan (**Section 16**).

4.5 Cross-jurisdictional spills

4.5.1 Cross-jurisdictional petroleum activity spills

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

Where a level 2/3 spill originating in Commonwealth waters moves into State waters two Control Agencies will exist: DoT and the Petroleum Titleholder (Santos), each with its own IMT and Lead IMT responsibilities. The arrangements between DoT and Santos for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in **Section 4.6.2**.

4.5.2 Cross-jurisdictional vessel spills

If a level 2/3 vessel spill crosses jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities will exist (AMSA for Commonwealth waters and DoT for WA State waters). Control Agency responsibilities will be determined by DoT and AMSA, with Santos providing all necessary resources (including personnel and equipment) as a Supporting Agency, as detailed in **Section 4.6**.

4.6 Integration with government organisations

4.6.1 Australian Maritime Safety Authority

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 the AMSA Rescue Coordination Centre (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, Australia's key maritime emergency contingency and response plan. All resources under the National Plan 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.

4.6.2 Western Australia - Department of Transport

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

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

+ Evaluation of situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder
+ Evaluation of resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Commonwealth government databases or other information sources
+ Evaluate shoreline types, habitat types and seasonality of environmental, socio-economic and cultural values and sensitivities
+ Consultation with the State Environmental Scientific Coordinator and other relevant State and Federal government departments with environmental responsibilities
+ Consultation with other relevant oil spill agencies, including the AMSA Environment, Science and Technology network or any other experts as necessary

+ All information is utilised in a NEBA/SIMA type process, to determine protection priorities and response strategies.

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

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

For petroleum activity 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 (WA DoT 2020b), 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 (WA DoT 2020b) 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 (WA DoT 2020b) 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 will be established. The Joint Strategic Coordination Committee will be jointly chaired between the SMPC and a nominated senior representative of Santos and will ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests.

For a cross jurisdictional response Santos will be responsible for ensuring adequate resources are provided to DoT as Control Agency, initially 11 personnel to fill roles in the DoT IMT or FOB (refer **Section 5.2**) 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 attend 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 4-1 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DoT's MEECC/IMT.

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

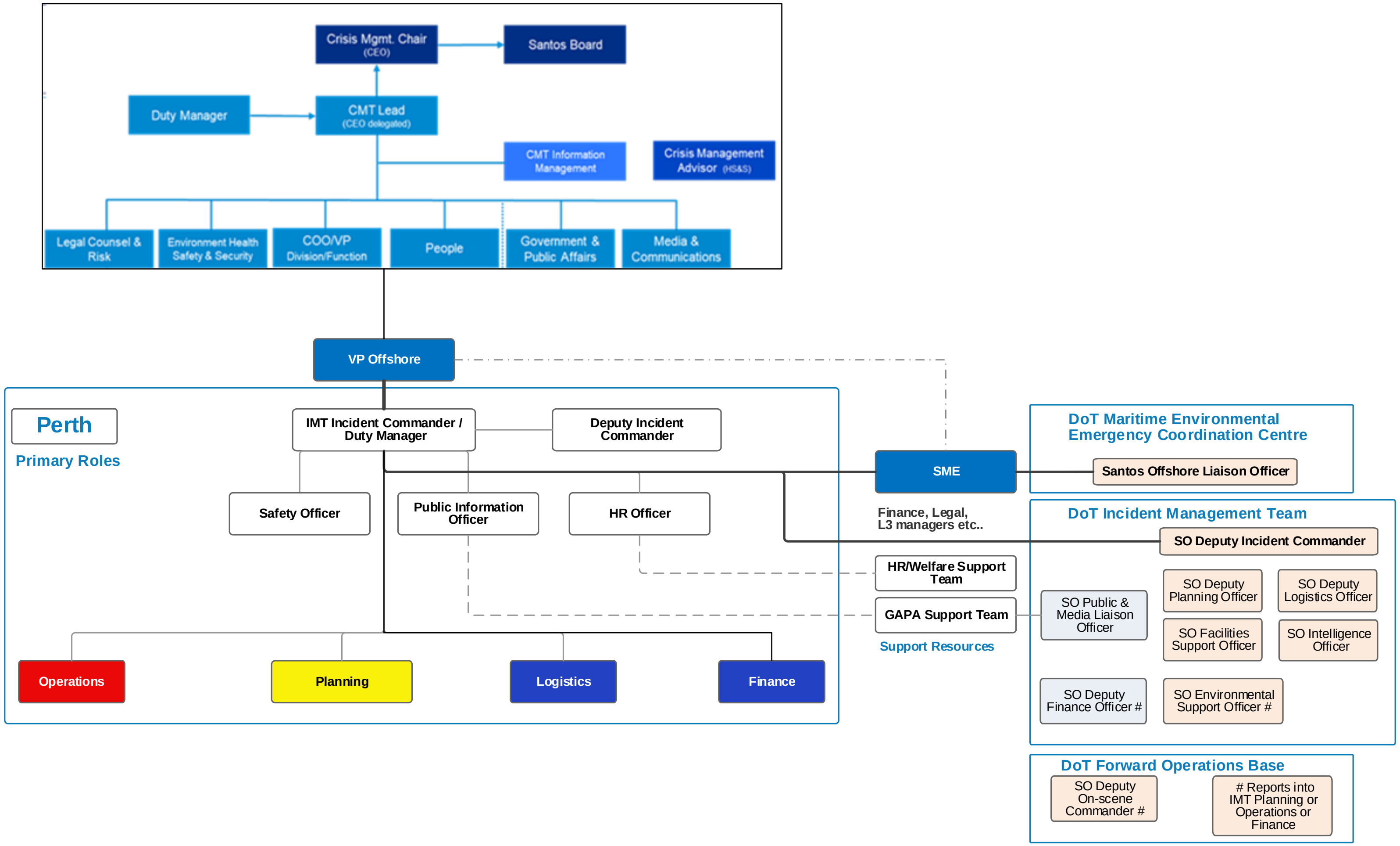


Figure 4-1: Santos cross jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering WA State waters

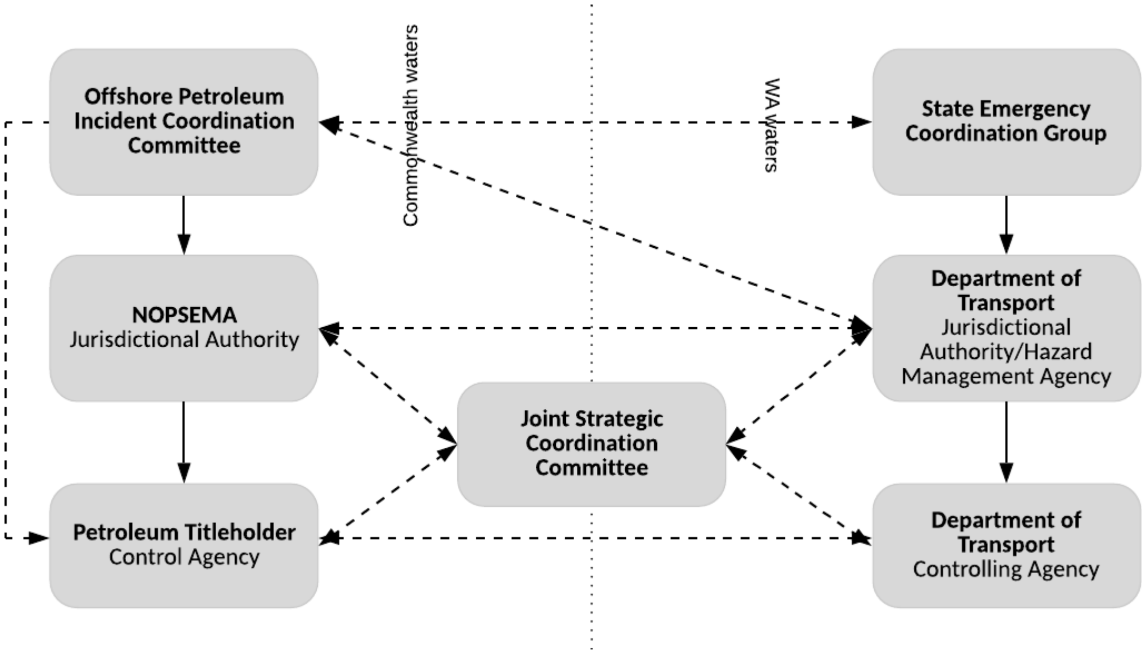


Figure 4-2: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident (WA State waters)

4.6.3 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 SMPC 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.

4.6.4 Department of Foreign Affairs and Trade

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

4.6.5 Department of Industry, Science, Energy and Resources

The 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 Offshore Petroleum Incident Coordination Committee, Liaison Officer/s will be deployed from DISER to the Petroleum Titleholders IMT.

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

4.7 Interface with external organisations

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

4.7.1 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.

4.7.2 Oil Spill Response Limited

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

Response equipment and personnel are allocated on a 50% of inventory basis under OSRL's Service Level Agreement.

4.8 Resourcing Requirements

The oil spill response resourcing requirements have been considered within this OPEP for each response strategy. To fulfill the required roles, resources have been selected from the various available OSROs and pools of specialist personnel available to Santos within the industry, based on the worst-case response needs which have been identified from the oil spill modelling results.

The resourcing requirements have focused on specialist roles requiring a minimum level of training and competence (i.e. supervisors/ team leaders). Other personnel required to execute a response have been considered, and are based on resourcing from general labour hire, with some requiring a minimum level of induction type training.

The resourcing requirements have been considered on a cumulative basis to ensure adequate availability of specialist response personnel, if all response strategies identified in this OPEP are required simultaneously. **Appendix S: Cumulative Response Capability Assessment** presents the cumulative response capability assessment for the YJP activities.

5 Santos' incident management arrangements

5.1 Incident management structure

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

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

The first priority of an escalating oil spill response to a level 2/3 spill is the formation of an IMT and establishment of an incident 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 a YJP drilling and survey incident includes:

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

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

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

+ Relief Well Team
+ Well Intervention Team.

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

+ coordination of engineering safety and operational activities
+ managing source control technical personnel from third parties (e.g. Wild Well Control)

- development of task-specific plans and procedures
- identification and sourcing of required tools and equipment
- approving source control components of IAPs.

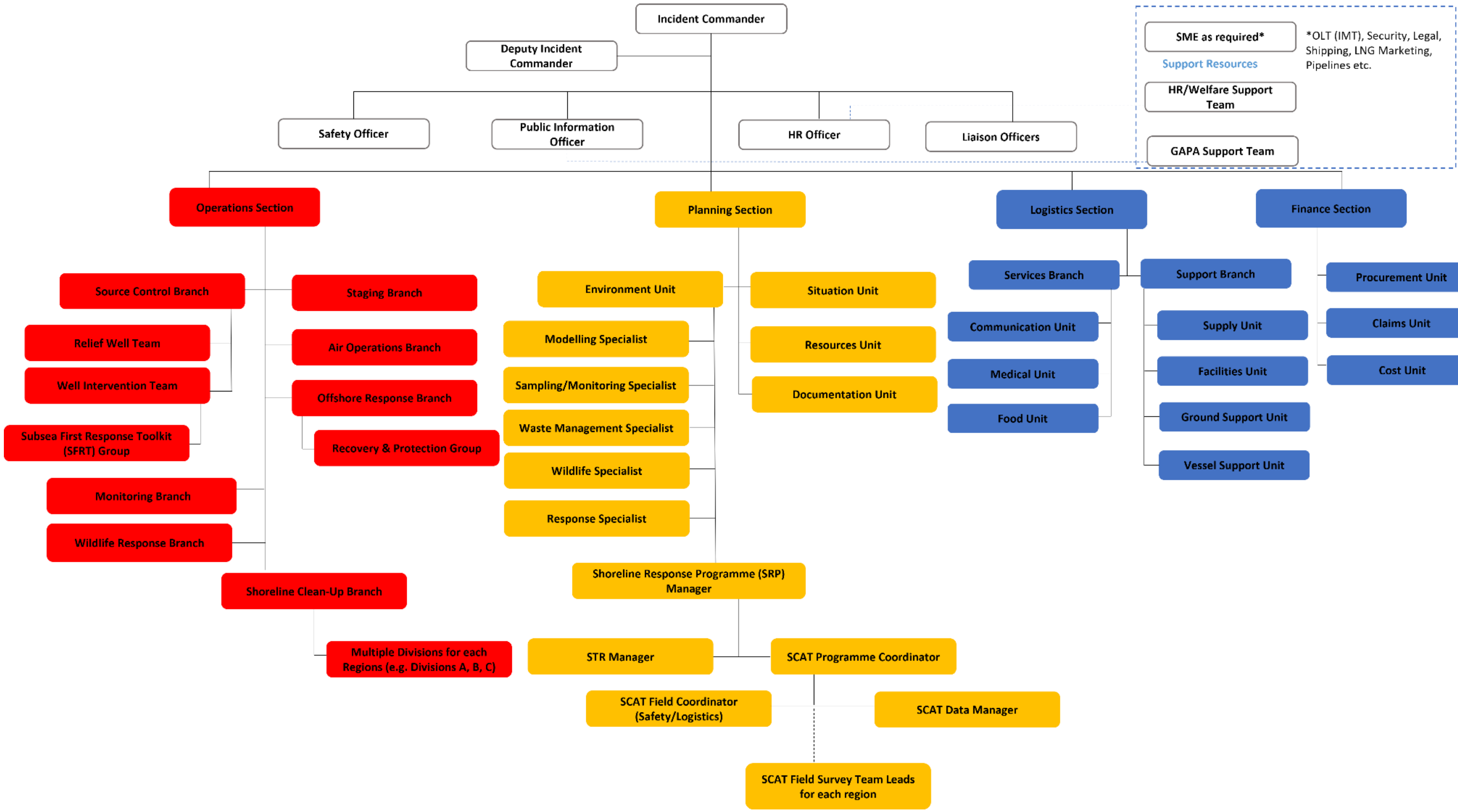


Figure 5-1: Santos' incident management team organisational structure

*Note: For a Level 2/3 Petroleum Activity spill whereby DoT is involved as a Control agency, either within a single jurisdiction (State water only spills) or cross-jurisdictional (spills from Commonwealth to State waters), Santos will work in coordination with DoT in providing spill response capability. Santos expanded organisational structure for these situations is detailed in **Section 4.6.2.***

Note: Due to the MODU type and BOP location, the BOP Group is not expected to be activated.

5.2 Roles and responsibilities

The following tables provide an overview of the responsibilities of the Santos CMT (**Table 5-1**), IMT (**Table 5-2**), and field-based response team members (**Table 5-3**) in responding to an incident. Not all of the roles listed in **Table 5-2** are shown in **Figure 5-1**, as some of the roles in **Table 5-2** are support roles or specific to a particular response strategy. The IMT and field based teams are scalable to the nature and scale of the response i.e. one person can take on multiple roles or one role can be filled by multiple people, where circumstances permit.

Also provided are the roles and responsibilities of Santos personnel required to work within 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.

DoT will provide a Liaison Officer/Duty Incident Commander and the Santos IMT in a coordinated response, as outlined for reference (**Table 5-4**).

The details on IMT resourcing for roles identified in **Table 5-2** and **Table 5-5** are provided in **Appendix Q: IMT Resourcing.**

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

Santos CMT Role	Main Responsibilities
Crisis Management Chair (CEO)	The CM Chair (Santos Chief Executive Office) is responsible for the following: + Leads crisis management direction + Provides governance and oversight of CMT operations. + Provides enterprise and strategic direction to the CMT for the resolution of the crisis event. + Delegates the CM Lead role and accountability to the appropriate ExCom designee. + Engage with the CM Leader to endorse the crisis resolution plan. + Liaise with the Santos Board and strategic stakeholders. + Provide the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Leader / Duty Manager	The CM Leader is responsible for: + Determine the need for establishing a Level 3 response and for activating the CMT. + Determine which / if any Crisis Management Support Teams (CMSTs) are mobilized. + Leading the crisis resolution process. + Ensures internal and external notifications to key stakeholders. + Uses the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives. + Ensures a crisis resolution plan is developed and direct the CMT functions to implement strategies, action plans and tasks. + Determines when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.

Santos CMT Role	Main Responsibilities
CMT Information Management	The CMT Information Managers directly support the CMT as follows: + Support the CMT during crisis management operations. + Sets up the crisis management room, assist with set-up of communications, video conferences and information transfer within the CMT. + Advises on CMT operating processes and available resources. + Assisting with reserving break out rooms for the CMT functions and CMSTs. + Ensuring CMT crisis resolution forms are used and displayed on the monitors. + Provides incident action plan information when an IMT is established. + Monitoring and managing the welfare needs of the CMT.
Crisis Management Advisor	The CMT Management Advisor is responsible for the following: + Provides CMT process guidance and advice to CMT Leader, Function Leads, and CMST. + Supports and facilitates the crisis resolution planning process. + Acts as the liaison between the CMT and IMT. + Work with CMT Information Managers to manage roster and handovers for extended CMT operations. + Schedules and facilitates post crisis debriefs and after-action reviews. The CMT Advisor will support the CMT Leader as follows: + Facilitates CMT activation requirements with the CMT Leader. + Assists the CMT Leader in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts. + Advises the CMT Leader on CMT structure and requirements for CMST engagement. + Coordinates tasks delegated by CMT Leader. + Provide tools to the CMT Leader for review and crisis assessment meetings.

Santos CMT Role	Main Responsibilities
CMT Core Function Leaders	CMT Core Function Leaders include Leaders for the following areas: + Legal Counsel and Risk, + Environment Health Safety and Security, + COO/VP Division/ Function, + People, + Government and Public Affairs, + Media and Communications The CMT Core Function Leaders are responsible for the following: + Participate and contribute to the crisis resolution planning process. + Each Function Leader shall determine critical communications pertaining to their area. + Mobilize and coordinate activities of the function CMST. + Advise the CMT Leader on strategic impacts, threats and mitigation created by the crisis event. + Develop and execute strategies to meet objectives endorsed by the CM Chair. + Provide support and resources via the CMST to divisional IMTs. + Ensures critical actions, decisions or points of strategic criticality are included in the CMT log. + Participates in the crisis management debrief and after-action reviews.

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

Santos Management/ IMT Role	Main Responsibilities
Vice President Offshore (VPO) Upstream WA	+ 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	+ Incident Commander is responsible for the overall management of the incident. Will set response objectives and strategic directions and oversee the development and implementation of Incident Action Plans.
Safety Officer	+ Safety Officer is responsible to develop and recommend measure for assuring personnel safety and to assess and/or anticipate hazardous and unsafe situations. Safety Officer may have specialists as necessary.
Public Information Officer	+ Public Information Officer is responsible for developing and releasing information about the incident to media, incident personnel and to appropriate agencies and organisations.
Human Resources Officer	+ HR Officer is responsible for advising and assisting the Incident Commander, Command Staff and Section Chiefs on any HR related aspects of an incident.
Operations Section Chief	+ The Operations Section Chief leads the Operations Section within the IMT and is responsible for the management of all tactical operations directly applicable to the primary assignments. The Operations Section Chief activates and supervises operational elements in accordance with the IAP and directs its execution.

Santos Management/ IMT Role	Main Responsibilities
Source Control Branch Director	+ The Source Control Branch Director will be responsible for the implementation of the Source Control Plan (Santos Source Control Planning and Response Guideline - DR-00-OZ-20001). The Source Control Branch Director will activate and supervise source control elements in accordance with the Incident Action Plan and direct its execution.
Relief Well Team Leader	+ The Relief Well Team Leader is responsible for the management and coordination of relief well design and operations. The Relief Well Team Leader coordinates the development of the drilling plans and procedures, secures resources and manages relief well operations to ensure the relief well reaches its target.
Well Intervention Team Leader	+ The Well Intervention Team Leader is responsible for intervention activities including initial site survey, debris clearance, subsea dispersant application, direct BOP intervention and capping stack installation *(Note: Due to dispersant not being a relevant response strategy for this OPEP, responsibility for subsea dispersant application is not relevant).*
SFRT Group Leader	+ The SFRT Group Leader is responsible for the activation of the SFRT through AMOSC contract and mobilisation to site. Mobilisation includes sourcing two vessels for SFRT deployment according to vessel criterion in Santos Source Control Planning and Response Guideline. The Group Leader manages and coordinates SFRT functions including debris clearance survey and operations.
Staging Branch Director	+ The Staging Branch Director is responsible for supervising the Staging Area Managers as well as coordinating their activities including assigning Staging Area Managers, receiving, maintaining, checking in/out, storing and distributing resources.
Air Operations Branch Director	+ The Air Operations Branch Director is ground-based and is primarily responsible for the coordination of the air operations section (ICS 220) of the IAP and for providing logistical support to incident aircraft.
Offshore Response Branch Director	+ The Offshore Response Branch Director is responsible for leading the offshore response activities including dispersant application, protection, containment and recovery activities on water. Depending on the size and nature of the incident, various, groups, teams and task forces will be implemented including Dispersants Operations Group, Recovery & Protection Group etc. + The Recovery & Protection Group is responsible for the deployment of containment and diversion/protection booming and managing on water recovery operations in the designated locations in compliance with the IAP.
Monitoring Branch Director	+ Working closely with the Environmental Unit, the Monitoring Branch Director will be responsible for implementing the operational and scientific monitoring plans required based on the nature and scale of the incident.
Oiled Wildlife Response Branch Director	+ Working with relevant state authorities, the Wildlife Response Branch Director will be responsible for implementing the OWR plan for the incident including the deployment of equipment and personnel required.
Shoreline Clean-up Branch Director	+ The Shoreline Clean-up Branch Director is responsible for leading all shoreline response activities working closely with the Shoreline Response Program Manager and shoreline clean-up supervisors and various locations.
Planning Section Chief	+ Planning Section Chief will lead the Planning Section within the IMT and is responsible for the collection, evaluation, dissemination and use of incident information and maintaining status of assigned resources.

Santos Management/ IMT Role	Main Responsibilities
Situation Unit Leader	+ The Situation Unit Leader is responsible for collecting, processing, and organizing incident information relating to escalation, mitigation or intelligence activities taking place in an incident. The Situation Unit will be responsible for preparing future projections of incident growth, maps, and intelligence information.
Resources Unit Leader	+ The Resources Unit Leader is responsible for maintaining the status of all assigned tactical resources and personnel at an incident. The Resource Unit will oversee the check-in of all tactical resources and personnel, maintaining a status-keeping system indicating current location and status of all the resources.
Documentation Unit Leader	+ The Documentation Unit Leader is responsible for maintenance of accurate, up-to-date incident files including Incident Action Plans. Incident reports, communication logs, situation status reports etc.
Environment Unit Leader	+ The Environment Unit Leader is responsible for environmental matters associated with the response, including strategic assessment, modelling, surveillance and environmental monitoring and permitting.
Technical Specialists	+ Certain incidents may require the use of Technical Specialists who have specialized knowledge or expertise. Technical Specialists may function within the Planning Section or be assigned wherever their services are required. Santos will activate Technical Specialists, based on the requirements of the incident, through a range of arrangements and this may include, Modelling Specialist, Operational/Scientific Monitoring Specialist, Response Technology Specialist, Waste Management Specialist etc.
Shoreline Response Programme (SRP) Manager	+ The SRP Manager reports to the Environment Unit Leader and is responsible for managing shoreline response. + Provides input to Planning and Operations Section Chiefs on shoreline response program to minimize shoreline impacts and SCAT program.
SCAT Programme Coordinator	+ SCAT Program Coordinator is the primary point of contact, through SRP Manager, within the IMT for all SCAT activities. + SCAT Program Coordinator act as the project manager for SCAT program and will design and direct the SCAT program for any incidents. + SCAT Program Coordinator will implement and manage the day-today activities for the SCAT program including establishing good management practices and safety protocols for the field teams, chairing SCAT Field Survey Team briefings and debriefings and producing daily and weekly summaries of field reports.
SCAT Field Coordinator	+ SCAT Field Coordinator works with SCAT Program Coordinator to develop daily missions and rolling strategy for the field teams and to provide the necessary logistics and equipment support as required.
SCAT Data Manager	+ SCAT Data Manager reports to the SCAT Program Coordinator and is responsible for processing field data, quality assurance, data storage and dissemination within the IMT, and for providing the SCAT Field Survey Teams with the maps and data required to conduct their missions.

Santos Management/ IMT Role	Main Responsibilities
Shoreline Treatment Recommendations (STR) Manager	+ The STR Manager is responsible for the preparation of the Shoreline Treatment Recommendations (STRs). + STR Manager will work with the Environment Unit to obtain reconnaissance information to assess priority areas for initial SCAT surveys and gain approval for land access where appropriate. + STR Manager ensures all approvals are obtained (e.g. concerning any endangered species, cultural, historical resources etc.) prior to undertaking shoreline activities. + STR Manager will work with the Environment Unit's Technical Specialists, subject matter experts and stakeholders to ensure that their requirements and constraints are incorporated into shoreline treatment recommendations. + STR Manager will work with the Operations Section to obtain advice on the feasibility, practicality and effectiveness of potential treatment strategies and tactics. + STR Manager will track the progress of approved STRs to generate and update progress reports.
Logistics Section Chief	+ Logistics Section Chief is responsible for providing facilities, services and materials in support of the incident. The Logistics Section Chief participates in the development and implementation of the Logistics Section of the IAP.
Services Branch Director	+ Service Branch Director, when activated is under the supervision of the Logistics Section Chief and is responsible for the management of all service activities for the incident including the operations of the Communications, Medical and Food Units
Support Branch Director	+ Support Branch Director, when activated, is under the supervision of Logistics Section Chief and is responsible for the development and implementation of logistics plan in support of the IAP. The Support Branch supervises the operations of the Supply, Facilities, Ground Support and Vessel Support Units.
Finance Section Chief	+ Finance Section Chief is responsible for all the financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance Section.
Procurement Unit Leader	+ Procurement Unit Leader us responsible for administering all financial matters pertaining to vendor contracts and leases. The Procurement Unit Leader will execute all procurements in accordance with the policies and procedures of Santos.
Claims Unit Leader	+ The Claims Unit Leader is responsible for the management and direction of all administrative matters pertaining to compensation and claims related matters for any incident.
Cost Unit Leader	+ The Cost Unit Leader is responsible for collecting all cost data and providing cost estimated and any cost saving recommendations for the incident.

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

Field-Based Position	Main Responsibilities
On-Scene Commander	+ Assess facility-based situations / incidents and respond accordingly. + Single point of communications between facility/site and IMT. + Communicate the incident response actions and delegates actions to the Incident Commander. + Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan. + Coordinate medical evacuations as required. + Refer to the Facility Incident Response Plan for detailed descriptions of roles and responsibilities.
Company Site Representative	+ Notify the Perth based Incident Commander of oil spills. + Coordinate onsite monitoring of oil spill and ongoing communication with Incident Commander.
Off-Asset Oil Spill Response Teams	+ Respond to oil spills at sea to minimise the impacts to as low as reasonably practical. + Refer to activity specific Oil Spill Contingency Plans (OSCP) and OPEP for detailed descriptions of roles and responsibilities within the Off-Asset Oil Spill Response Team
Source Control Branch	+ Respond to incidents involving well loss of containment to stop the flow of oil to sea. + Refer to the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Branch.
Wildlife Response Branch	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife. + Refer to the Western Australia Oiled Wildlife Response Plan (WAOWRP) for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team.
Scientific Monitoring Branch	+ Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions. + Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities.

Table 5-4: Department of Transport roles embedded within Santos' CMT/IMT

DoT 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 role of Control agency)**	+ 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 Commander 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 WA State Maritime Environmental Emergency Coordination Centre/Department of Transport Incident Management Team

Santos roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
CMT Liaison Officer[4]	+ Provide a direct liaison between the Santos CMT and the State MEECC. + Facilitate effective communications and coordination between the Santos CMT Leader and the SMPC. + Offer advice to SMPC on matters pertaining to Santos' crisis management policies and procedures.
Deputy Incident Controller	+ Provide a direct liaison between the 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. + Assist in the interpretation of mapping originating from the Santos IMT. + Facilitate the provision of relevant mapping originating from the Santos IMT.

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

Santos roles embedded within 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. + 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 Intelligence Team, assist the Environment Coordinator in the performance of their duties in relation to the provision of environmental support into the planning process + Assist in the interpretation of the Santos OPEP and relevant Tactical Response Plan (TRPs). + Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos IMT. + Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos IMT.
Deputy Public Information Officer[5]	+ 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 the Contact Centre to the Santos IMT.

[5] 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 within the State MEECC/ DoT IMT	Main Responsibilities
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' 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 Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters. + Facilitate the acquisition of appropriate services and supplies through Santos' existing private contract arrangements related to waste management; and Collects Waste Collection Request Forms from DoT to action via the Santos IMT.
Deputy Finance Officer	+ As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through Santos' existing OSRL, AMOSC and private contract arrangements. + Facilitate the communication of financial monitoring information to Santos to allow 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.

Santos roles embedded within the State MEECC/ DoT IMT	Main Responsibilities
Deputy Division Commander (FOB)	+ As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. + Provide a direct liaison between Santos' Forward Operations Base/s (FOB/s) and the DoT FOB. + Facilitate effective communications and coordination between Santos FOB Operations Commander and the DoT FOB Operations Commander. + Offer advice to the DoT FOB Operations Commander on matters pertaining to Santos' incident response policies and procedures. + Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to Santos employees or contractors. + Offer advice to the Senior Safety Officer deployed in the FOB on matters pertaining to Santos' safety policies and procedures.

5.3 Cost recovery

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

5.4 Training and Exercises

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

To familiarise the IMT with functions and processes, an OPEP Desktop and Activation Exercise is undertaken as per the Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001). Exercise planning takes into consideration virtual/remote access requirements and government mandate border restrictions (e.g. Covid-19). All workshops and exercises undertaken are recorded in the Santos EHS Toolbox, with the key recommendations recorded and tracked.

5.4.1 Incident management team training and exercises

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

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

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

IMT Role	Exercise	Training
IMT Incident Commander IMT Operations Section Chief/Source Control Branch Director	One Level 3 exercise annually or two Level 2 desktop exercises annually[6]	+ PMAOMIR320 + PMAOMIR418 + AMOSC – IMO3 Oil Spill Command & Control
IMT Planning Section Chief IMT Logistics Section Chief IMT Environment Unit Leader		+ PMAOMIR320 + AMOSC – IMO2 Oil Spill Management Course
IMT Safety Officer IMT Supply Unit Leader IMT GIS Team Leader IMT Data Manager[7] IMT HR Officer		+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training

5.4.2 Oil spill responder training

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

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

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

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	11
Santos Facility Emergency Response Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents. for first strike response to incidents.	Internal Santos training and exercises as defined in each facility's Emergency Response Plan OSC to have AMOSC – Oil Spill Response Familiarisation Training.	One Emergency Response (ER) team per operational facility per shift
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually).	7
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[8] 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

[8] An average of 47 personnel plus 16 AMOSC staff members available as of September 2021.

Responder	Role	Training	Available Number
Santos Source Control Personnel	Management and coordination of source control strategies including relief well drilling and subsea intervention	Internal Santos training and exercises. International Well Control Forum (IWCF) Level 4 certification	60
Oiled Wildlife Response Roles	Refer **Section 14.**		
Monitoring Service Provider: Monitoring Coordination Team (MCT) and Scientific Monitoring Plan Teams	Monitoring Coordination Team (MCT) Scientific Monitoring Plan Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports. MCT – five personnel Scientific Monitoring Plan Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided.	Nominally over 1,000
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

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

+ National Plan: National Response Team – Trained oil spill response specialists, including aerial observers, containment and recovery crews, and shoreline clean-up personnel, deployed under the direction of AMSA and the IMT in a response. The National Response Team is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2021).
+ 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 DoT in State waters. SRT members remain trained and accredited in line with the State Hazard Plan (SHP-MEE) requirements.

In the event of a spill, the trained spill responders listed in **Table 5-7** would be required to undertake various roles in key spill response operations, including operational monitoring, shoreline protection, shoreline clean-up, oiled wildlife response and scientific monitoring.

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

5.5 Response Testing Arrangements and Audits

Santos has oil spill response testing arrangements in place in accordance with the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001) which provides a process for continual monitoring of OSRO capability. This also includes regular oil spill response equipment inventory checks from the various sources.

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

The testing arrangements are captured within the Testing Arrangements Plan in **Appendix R: Testing Arrangements Plan.**

5.5.1 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 objectives are set for each of the tests identified for various response arrangements and the effectiveness of the response arrangements against these objectives are examined using pre-identified Key Performance Indicators (KPI). The objectives and KPIs for testing the response arrangements specified in this OPEP are detailed in **Appendix R: Testing Arrangements Plan**.

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

Source control testing arrangements have been formulated with reference to recent industry guidelines including the APPEA Offshore Titleholders Source Control Guideline (APPEA, 2021) and the NOPSEMA Information Paper: Source Control Planning and Procedures IP1979 (NOPSEMA, 2021).

Source control objectives and KPIs are developed in order to test the response arrangements specified in this OPEP and the Source Control Planning and Response Guideline (DR-00-OZ-20001). In addition to objectives and KPIs, test frequency and type of test are also detailed in **Appendix R: Testing Arrangements Plan.**

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

Most recently, Santos conducted a desktop exercise for a drilling campaign in April 2021. Exercise objectives included:

+ Implement an IMT structure
+ Demonstrate the use of Santos Offshore response plans and activity specific documentation
+ Provide an opportunity for participants to:
    - Complete notification and activations as per plan requirements
    - Develop of an initial IAP

- Record information in exercise directory.

Consider the implication of government mandated border restrictions for activations and support arrangements (e.g. Covid-19).

5.5.2 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos 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 Service Level Agreement (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 Yoorn-1, Jelen-1 and Parnassus-1 drilling and geophysical survey activities. Of the credible spill scenarios identified in the YJP EP (SO-91-BI-20003.01), all have been selected to represent worst-case spills from a response perspective, taking into account the following characteristics:

+ They represent all hydrocarbon types that could be spilt during Yoorn-1, Jelen-1 and Parnassus-1 activities.
+ They represent maximum credible release volumes.
+ Those scenarios that represent the greatest spatial extent from a response perspective based on surface oil and shoreline accumulation as these are the key factors contributing to response.
+ Proximity to sensitive receptors, shorelines, State/Commonwealth boundaries etc.

The worst-case credible spill risks selected to inform this OPEP are presented in **Table 6-1**.

Detail on the derivation of these maximum credible spills is provided within the Yoorn-1, Jelen-1 and Parnassus-1 Exploration Drilling and Geophysical Survey EP (SO-00-BI-20003.01).

To identify the release scenarios that were considered credible for the activity, the following potential scenarios were considered as described below:

+ Surface release of MDO from refuelling of the MODU or vessel collision / external impact
+ Loss of Well Control (LOWC), resulting in a subsea or surface release of condensate.

For LOWC, Santos have identified two representative spill modelling reports for the three wells, based on their location and flow rate:

+ Yoorn-1: WA-499-P Exploration Drilling LOWC Spill Modelling (GHD, 2020a)
+ Jelen-1 and Parnassus-1: represented by the Dancer-1 Exploration Drilling Oil Spill Modelling report (GHD, 2020b). The Dancer-1 well is 8.3 km from the closest proposed well (Parnassus-1).

For an MDO release, two representative spill modelling reports were also identified – the same volume was modelled from two release locations:

+ Yoorn-1 well location: WA-499-P Geophysical and Geotechnical Surveys Diesel Spill Modelling Report (GHD, 2019)
+ Jelen-1 and Parnassus-1: represented by the MDO modelling undertaken in the Dancer-1 Exploration Drilling Oil Spill Modelling report (GHD, 2020b).

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

Rev 2009 13 Grader C (Grader C) was selected from within the SINTEF Oil Library as the modelling analogue for Reindeer Condensate, which was the analogue selected for the Dancer-1 modelling (GHD, 2020b).

Grader C was also selected as the modelling analogue for Linda condensate, which was the analogue identified for the Yoorn-1 modelling (GHD, 2020a).

Table 6-1: Maximum credible spill scenarios for Yoorn-1, Jelen-1 and Parnassus-1 drilling and geophysical survey activity

<table>
<tr><th>Worst-case credible spill scenario</th><th>Hydrocarbon type</th><th>Release location</th><th>Approx. depth of spill</th><th>Maximum credible volume released (m³)</th><th>Release duration</th><th>Spill modelling report reference</th></tr>
<tr><td>LOWC – subsea release</td><td rowspan="2">Yoorn Condensate analogue (Linda / Grader C)</td><td rowspan="3">Yoorn-1 well
20°20'34.09" S
115°47'25.01" E</td><td>47 m</td><td>317,750 m³</td><td>77 days</td><td rowspan="2">GHD, 2020a</td></tr>
<tr><td>LOWC – surface release</td><td>0 m</td><td>316,424 m³</td><td>77 days</td></tr>
<tr><td>Surface diesel release</td><td>MDO</td><td>0 m</td><td>329 m³</td><td>0.5 hours</td><td>GHD, 2019</td></tr>
<tr><td>LOWC – subsea release</td><td rowspan="2">Jelen and Parnassus Condensate analogue (Dancer/ Reindeer / Condensate Grader C)</td><td rowspan="3">Dancer-1 well
19° 58’ 19.30” S,
116° 20’ 56.51” E</td><td>63 m</td><td>43,423 m³</td><td>77 days</td><td rowspan="3">GHD, 2020b</td></tr>
<tr><td>LOWC – surface release</td><td>0 m</td><td>43,153 m³</td><td>77 days</td></tr>
<tr><td>Surface diesel release</td><td>MDO</td><td>0 m</td><td>329 m³</td><td>0.5 hours</td></tr>
</table>

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in Section 7.1.5 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 N: SMP Activation Process**)
>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 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.

6.3 Stochastic spill modelling results

As detailed in Section 7.1.3 of the EP, Rev 2009 13 Grader C (Grader C) was selected from within the SINTEF Oil Library as the modelling analogue for Reindeer Condensate, which was the analogue selected for the Dancer-1 modelling (GHD, 2020b). The Dancer-1 modelling was selected as a proxy for the Jelen-1 and Parnassus-1 wells, due to:

+ Close proximity, as the Dancer-1 well is 8.3 km from the closest proposed well (Parnassus-1)
+ The hydrocarbon analogue for all was identified as Reindeer condensate (modelled as Grader C)
+ The LOWC flow rate for Jelen-1 and Parnassus-1 prospects are expected to be similar to Dancer-1.

Grader C was also selected as the modelling analogue for Linda condensate, which was the analogue identified for the Yoorn-1 modelling (GHD, 2020a).

A comparison of the distillation curves of Grader C and the Reindeer Condensates and Linda-1 condensate shows that Grader C was well matched to the boiling point curve for both condensate types. The specific gravity/API gravity of the modelling analogue Grader C is slightly higher than Linda and Reindeer condensate (50.1 API compared to 48.2 API and 48.5 API respectively).

On this basis, and in view of the similarity in other factors influencing weathering and persistence in the environment (refer Section 7.1.3 of the EP), the modelling conducted is considered representative of how Yoorn, Jelen and Parnassus gas condensate would behave in the environment.

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 in this OPEP given there are limited response strategies that will reduce subsurface impacts. However, they are still useful for indicating where a scientific monitoring response may be needed. Refer to Section 7.1.5 of the EP for dissolved and entrained thresholds and Section 7.1.6 for impacts to receptors.

Grader C was the modelling analogue identified for both the Yoorn-1 and Dancer-1 LOWC modelling; therefore, the results of the weathering analyses shown in **Figure 6-1** is representative of condensate from all three wells. Evaporation is the primary weathering mechanism for highly volatile condensates such as Grader C. Under low wind speeds of 1 m/s, approximately 90% of the surface slick is predicted to evaporate after 3 days (72 hours). Under moderate wind speeds of 5 m/s, approximately 82% of the surface slick is predicted to evaporate after 24 hours with the remaining ~18% dispersed in the water column and no surface slick under these conditions. High wind speeds of 10 m/s are predicted to rapidly (after only 6 hours) disperse (30%) and evaporate (70%) with no surface slick.

Grader C has a tendency for low levels of emulsification with up to 10% water content in the surface slick over the range of wind conditions. A 10% water content in slick is classed as an unstable emulsion and does not significantly affect its persistence.

The worst-case shoreline loading and/or probability (percentage) of total contact at more than 1 g/m^2 for all emergent and intertidal receptors is presented in **Table 6-3** (Yoorn-1) and **Table 6-4** (Jelen-1 and Parnassus-1). For each scenario, these results represent the worst loading or floating oil contact probability for each receptor from all stochastic modelling runs (150 simulations) across all seasons.

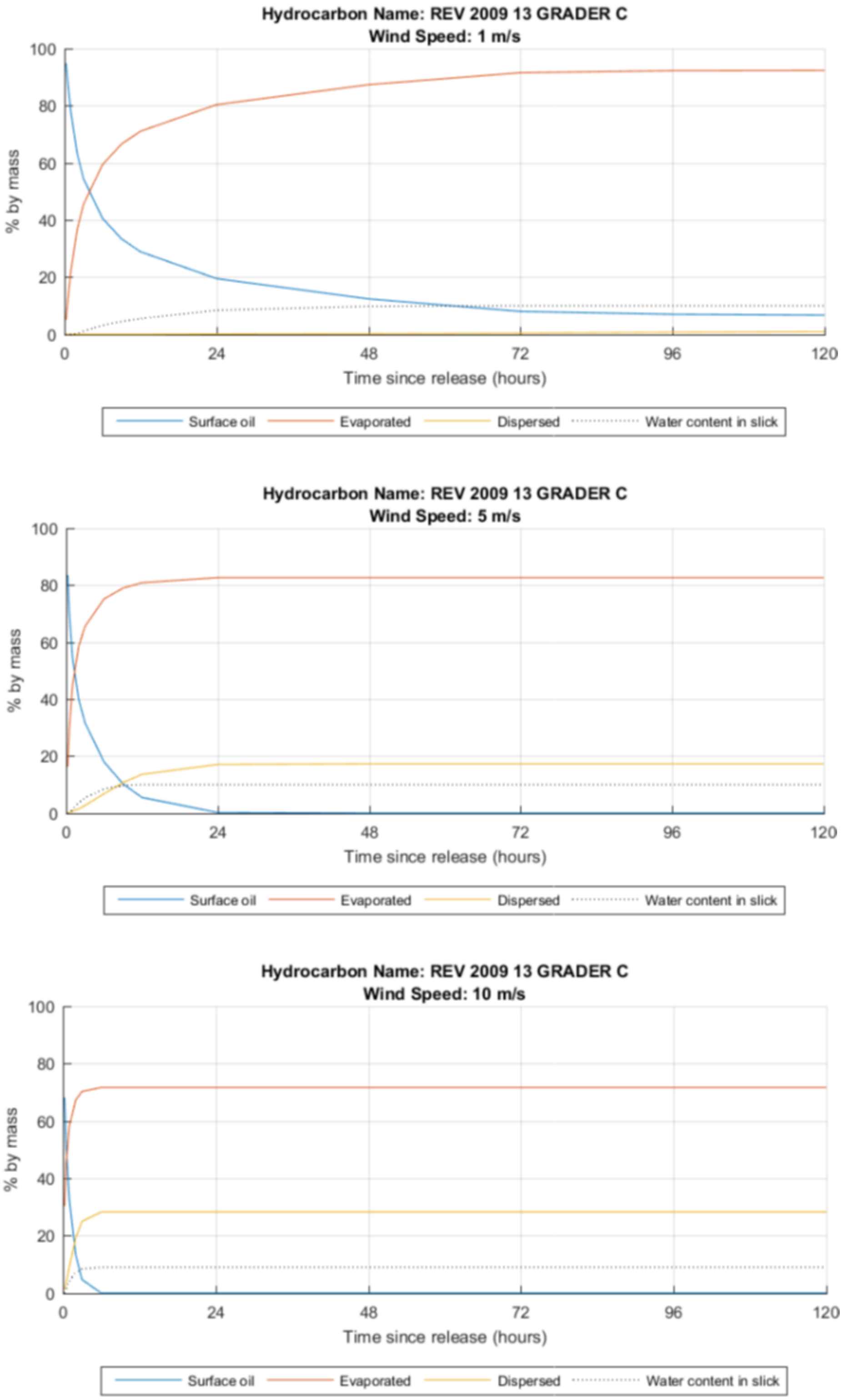


Figure 6-1 Simulated weathering of the SINTEF REV 2009 13 GRADER C hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2020a)

Table 6-3: Worst-case spill modelling results – Yoorn-1

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
LOWC – Surface Release Scenario (GHD, 2020a)								
Seringapatam Reef	NC	NC	0.8	96.7	NC	NC	NC	NC
Scott Reef South	NC	NC	3.3	82.2	NC	NC	NC	NC
Clerke Reef MP	NC	NC	6.7	56.4	1.7	56.4	2.2	8.5
Imperieuse Reef MP	NC	NC	12.5	35.7	4.2	43.5	1.2	4.2
Port Hedland-Eighty Mile Beach	NC	NC	0.8	63.0	NC	NC	NC	NC
Karratha-Port Hedland	NC	NC	1.7	31.9	NC	NC	NC	NC
Dampier Archipelago	NC	NC	36.7	9.0	16.7	9.0	9.0	17.0
Northern Islands Coast	5.0	7.8	6.7	18.9	1.7	70.8	1.8	4.2
Montebello Islands	99.2	0.3	100.0	0.3	100.0	0.3	2,163.6	38.2
Lowendal Islands	54.2	1.8	80.0	2.2	69.2	2.2	225.9	4.2

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Barrow Island	56.7	3.3	97.5	3.1	95.0	3.1	496.9	59.5
Middle Islands Coast	NC	NC	6.7	46.2	NC	NC	NC	NC
Thevenard Islands	NC	NC	25.0	7.4	9.2	7.4	5.8	8.5
Southern Islands Coast	NC	NC	75.0	5.9	57.5	5.9	52.5	12.7
Muiron Islands	1.7	33.2	71.7	7.0	60.0	7.0	86.7	12.7
Exmouth Gulf Coast	NC	NC	2.5	14.0	NC	NC	NC	NC
Ningaloo Coast North	1.7	34.1	81.7	7.3	62.5	7.3	68.9	80.7
Ningaloo Coast South	NC	NC	27.5	33.6	1.7	41.0	0.9	4.2
Carnarvon – Inner Shark Bay	NC	NC	0.8	62.8	NC	NC	NC	NC
Outer Shark Bay Coast	NC	NC	34.2	47.4	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Zuytdorp Cliffs - Kalbarri	NC	NC	3.3	54.7	NC	NC	NC	NC
Kalbarri - Geraldton	NC	NC	1.7	101.4	NC	NC	NC	NC
Abrolhos Island Wallabi Group	NC	NC	0.8	108.8	NC	NC	NC	NC
Abrolhos Islands Pelsaert Group	NC	NC	1.7	78.6	NC	NC	NC	NC
Indonesia – East	NC	NC	3.3	91.5	NC	NC	NC	NC
Jurien Bay – Yanchep	NC	NC	1.7	82.1	NC	NC	NC	NC
Bedout Island	NC	NC	7.5	32.9	NC	NC	NC	NC
Barrow-Montebello Surrounds	100.0	58.8	NC	NC	NC	NC	NC	NC
Montebello AMP	100.0	0.1	NC	NC	NC	NC	NC	NC
Outer Ningaloo Coast North	2.5	19.8	NC	NC	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Offshore Ningaloo	48.3	2.2	NC	NC	NC	NC	NC	NC
LOWC – Subsea Release Scenario (GHD, 2020a)								
Scott Reef South	NC	NC	0.8	108.6	NC	NC	NC	NC
Clerke Reef MP	NC	NC	6.7	57.2	NC	NC	NC	NC
Imperieuse Reef MP	NC	NC	6.7	42.9	NC	67.4	1.8	4.2
Karratha-Port Hedland	NC	NC	0.8	58.3	NC	NC	NC	NC
Dampier Archipelago	NC	NC	30.8	15.5	10.8	21.9	6.2	17
Northern Islands Coast	NC	NC	5.0	28.3	3.3	28.3	2.5	8.5
Montebello Islands	90.8	0.9	100.0	0.8	100	0.8	1,036.5	38.2
Lowendal Islands	1.7	15.9	84.2	2.6	72.5	2.6	38.1	4.2
Barrow Island	NC	NC	95.8	3.0	89.2	3.0	87.3	42.5
Middle Islands Coast	NC	NC	3.3	31.4	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Thevenard Islands	NC	NC	12.5	8.9	1.7	8.9	1.6	4.2
Southern Islands Coast	NC	NC	55.8	6.5	43.3	6.5	18.7	12.7
Muiron Islands	NC	NC	67.5	7.3	49.2	7.3	38.6	12.7
Ningaloo Coast North	NC	NC	76.7	7.3	47.5	7.3	22.6	51
Ningaloo Coast South	NC	NC	12.5	43.9	0.8	76.3	1.2	4.2
Outer Shark Bay Coast	NC	NC	18.3	60.8	0.8	65.9	1.6	4.2
Exmouth Gulf Coast	NC	NC	1.7	18.8	NC	NC	NC	NC
Zuytdorp Cliffs - Kalbarri	NC	NC	4.2	84	NC	NC	NC	NC
Abrolhos Islands – Pelsaert Group	NC	NC	0.8	88.9	NC	NC	NC	NC
Perth Southern Coast	NC	NC	0.8	104.3	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Jurien Bay - Yanchep	NC	NC	0.8	109	NC	NC	NC	NC
Bedout Island	NC	NC	0.8	21.3	NC	NC	NC	NC
Barrow-Montebello Surrounds	95.0	0.8	NC	NC	NC	NC	NC	NC
Montebello AMP	100.0	0.1	NC	NC	NC	NC	NC	NC
MDO (GHD, 2019)								
Dampier Archipelago	NC	NC	0.8	6.1	NC	NC	NC	NC
Montebello Islands	15.0	0.3	24.2	0.5	12.5	0.5	221.5	14.1
Lowendal Islands	2.5	1.3	1.7	1.5	1.7	4.5	10.6	2.8
Barrow Island	3.3	2.4	5.8	2.4	4.2	2.4	130	11.3
Muiron Islands	NC	NC	3.3	6.6	NC	NC	0.3	NC
Ningaloo Coast North	NC	NC	0.8	5.2	NC	NC	0.1	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Barrow-Montebello Surrounds	23.3	0.3	NC	NC	NC	NC	NC	NC
Dampier AMP	0.8	6.3	NC	NC	NC	NC	NC	NC
Montebello AMP	99.2	0.1	NC	NC	NC	NC	NC	NC
Outer NW Ningaloo	0.8	7.6	NC	NC	NC	NC	NC	NC
Offshore Ningaloo	15.0	1.8	NC	NC	NC	NC	NC	NC

Source: (GHD, 2020a; GHD, 2019)

NC = No Contact

Table 6-4: Worst-case spill modelling results – Jelen-1 and Parnassus-1

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
LOWC – Surface Release Scenario (GHD, 2020b)								
Clerke Reef MP	NC	NC	15.3	32.1	NC	NC	NC	NC
Imperieuse Reef MP	NC	NC	28.0	31.0	NC	NC	NC	NC
Dampier Archipelago	NC	NC	25.3	12.9	2.0	32.3	1.1	3.5
Northern Islands Coast	NC	NC	5.3	43.0	NC	NC	NC	NC
Montebello Islands	6.0	2.1	75.3	2.2	27.3	2.2	338.7	28.4
Lowendal Islands	2.0	12.9	18.7	12.9	4.7	12.9	34.3	3.5
Barrow Island	3.3	13.5	76.0	5.4	37.3	9.8	6.1	14.2
Middle Islands Coast	NC	NC	0.7	34.3	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Barrow-Montebello Surrounds	6.0	1.8	NC	NC	NC	NC	NC	NC
Thevenard Islands	NC	NC	28.7	14.7	1.3	38.9	0.8	3.5
Southern Islands Coast	NC	NC	48.7	7.4	24.7	7.4	4.1	10.6
Muiron Islands	NC	NC	57.3	8.5	15.3	8.5	3.7	10.6
Exmouth Gulf Coast	NC	NC	0.7	59.9	NC	NC	NC	NC
Ningaloo Coast North	NC	NC	58.7	16.4	NC	NC	NC	NC
Ningaloo Coast South	NC	NC	16.0	38.3	NC	NC	NC	NC
Outer Shark Bay Coast	NC	NC	4.7	59.2	NC	NC	NC	NC
Abrolhos Islands Pelsaert Group	NC	NC	0.7	74.8	NC	NC	NC	NC
Bedout Island	NC	NC	1.3	31.2	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Montebello AMP	30.7	1.1	NC	NC	NC	NC	NC	NC
LOWC – Subsea Release Scenario (GHD, 2020b)								
Clerke Reef MP	NC	NC	11.3	28.8	NC	NC	NC	NC
Imperieuse Reef MP	NC	NC	20.7	24.1	NC	NC	NC	NC
Dampier Archipelago	NC	NC	24.7	15.5	2.7	26.5	1.2	3.5
Northern Islands Coast	NC	NC	2.7	31.2	NC	NC	NC	NC
Montebello Islands	NC	NC	73.3	2.2	30.0	2.2	77.1	31.9
Lowendal Islands	NC	NC	20.0	9.1	8.0	12.9	8.8	3.5
Barrow Island	NC	NC	77.3	6.1	30.0	8.9	7.6	14.2
Middle Islands Coast	NC	NC	0.7	33.7	NC	NC	NC	NC
Thevenard Islands	NC	NC	20.7	12.5	0.7	29.5	0.7	3.5

Location	Total contact probability (%) floating oil >1 g/m²	Minimum arrival time floating oil > 1g/m² (days)	Total probability (%) shoreline oil accumulation >10g/m²	Minimum arrival time shoreline oil accumulation >10g/m² (days)	Total probability (%) shoreline oil accumulation >100 g/m²	Minimum arrival time shoreline oil accumulation >100 g/m² (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m²	Maximum length of shoreline oiled (km) >100 g/m²
Southern Islands Coast	NC	NC	50.0	7.9	20.0	9.4	4.6	7.1
Muiron Islands	NC	NC	54.7	8.5	10.0	8.5	2.7	10.6
Exmouth Gulf Coast	NC	NC	3.3	33.3	NC	NC	NC	NC
Ningaloo Coast North	NC	NC	52.0	14.6	NC	NC	NC	NC
Ningaloo Coast South	NC	NC	14.7	36.3	NC	NC	NC	NC
Outer Shark Bay Coast	NC	NC	3.3	49.0	NC	NC	NC	NC
Bedout Island	NC	NC	0.7	73.6	NC	NC	NC	NC
MDO (GHD, 2020b)								
Dampier Archipelago	NC	NC	1.3	2.5	0.7	2.5	0.6	1.4
Northern Islands Coast	NC	NC	0.7	5.5	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1 g/m^2	Minimum arrival time floating oil > 1g/m^2 (days)	Total probability (%) shoreline oil accumulation >10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Montebello Islands	1.3	1.8	2.0	6.6	0.7	6.6	152.9	25.5
Barrow Island	NC	NC	2.7	4.8	NC	NC	NC	NC
Southern Islands Coast	NC	NC	1.3	5.5	NC	NC	NC	NC
Glomar Shoals	6.7	2.3	NC	NC	NC	NC	NC	NC
Rankin Bank	0.7	3.3	NC	NC	NC	NC	NC	NC
Barrow-Montebello Surrounds	2.0	1.8	NC	NC	NC	NC	NC	NC
Montebello AMP	22.7	0.7	NC	NC	NC	NC	NC	NC
Offshore Ningaloo	7.3	3.2	NC	NC	NC	NC	NC	NC

NC = No Contact

Source: Dancer-1 modelling (GHD, 2020b)

6.4 Deterministic modelling

Deterministic modelling is a useful tool for response planning. It uses a single spill run from the group of stochastic runs to help understand the likely behaviour and impacts of a single simulation of a worst-case spill scenario. This allows for effective scaling of response strategies.

Deterministic runs were selected for both the subsea and surface LOWC scenarios based on the largest predicted oil mass accumulated on all shorelines.

To inform the first-strike scientific monitoring capability requirements, the stochastic outputs from the two LOWC scenarios were interrogated to determine the realisations with the maximum number of receptors contacted by floating oil within the first 7 days of an LOWC incident. Unlike stochastic modelling, deterministic modelling takes into account hydrocarbon weathering, degradation and dispersion. This results in a discrepancy between the maximum shoreline accumulation for a stochastic run and a deterministic run. This OPEP uses a mixture of worst-case stochastic and deterministic modelling results to help determine response planning needs.

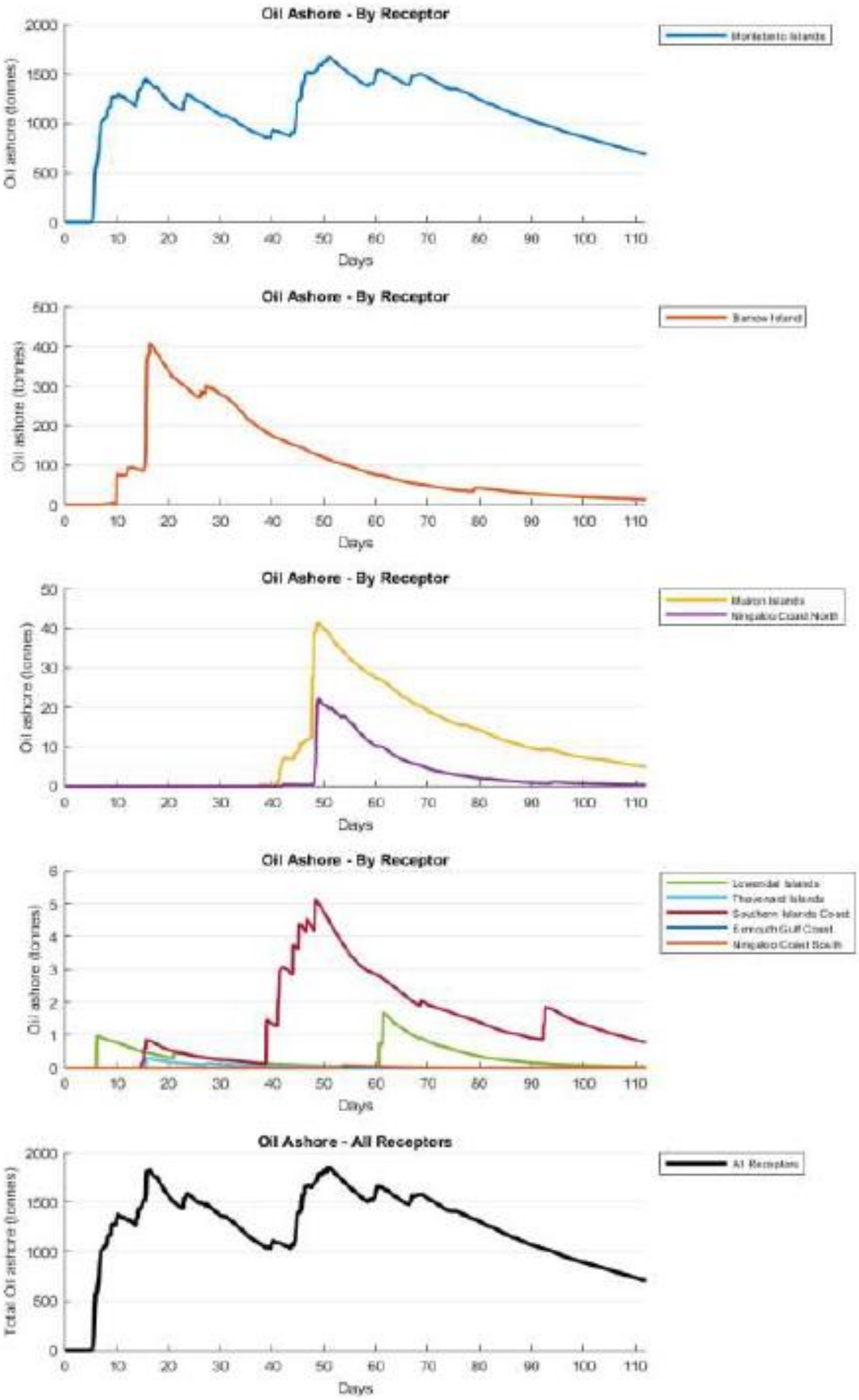
The results are summarised below.

Yoorn-1 (GHD, 2020a):

+ The worst-case simulation was stochastic realisation #111 of the surface LOWC scenario, resulting in resulting in the highest accumulated shoreline mass of 2,713 tonnes on all shorelines.
+ The highest load was at the Montebello Islands (2,164 tonnes), Barrow Island (394 tonnes), Muiron Islands (74 tonnes) and Ningaloo Coast North (54 tonnes) (**Figure 6-2**).
+ Shoreline contact times at key receptors ranged from between 5 days at Montebello Islands and 39 days at Ningaloo Coast North.

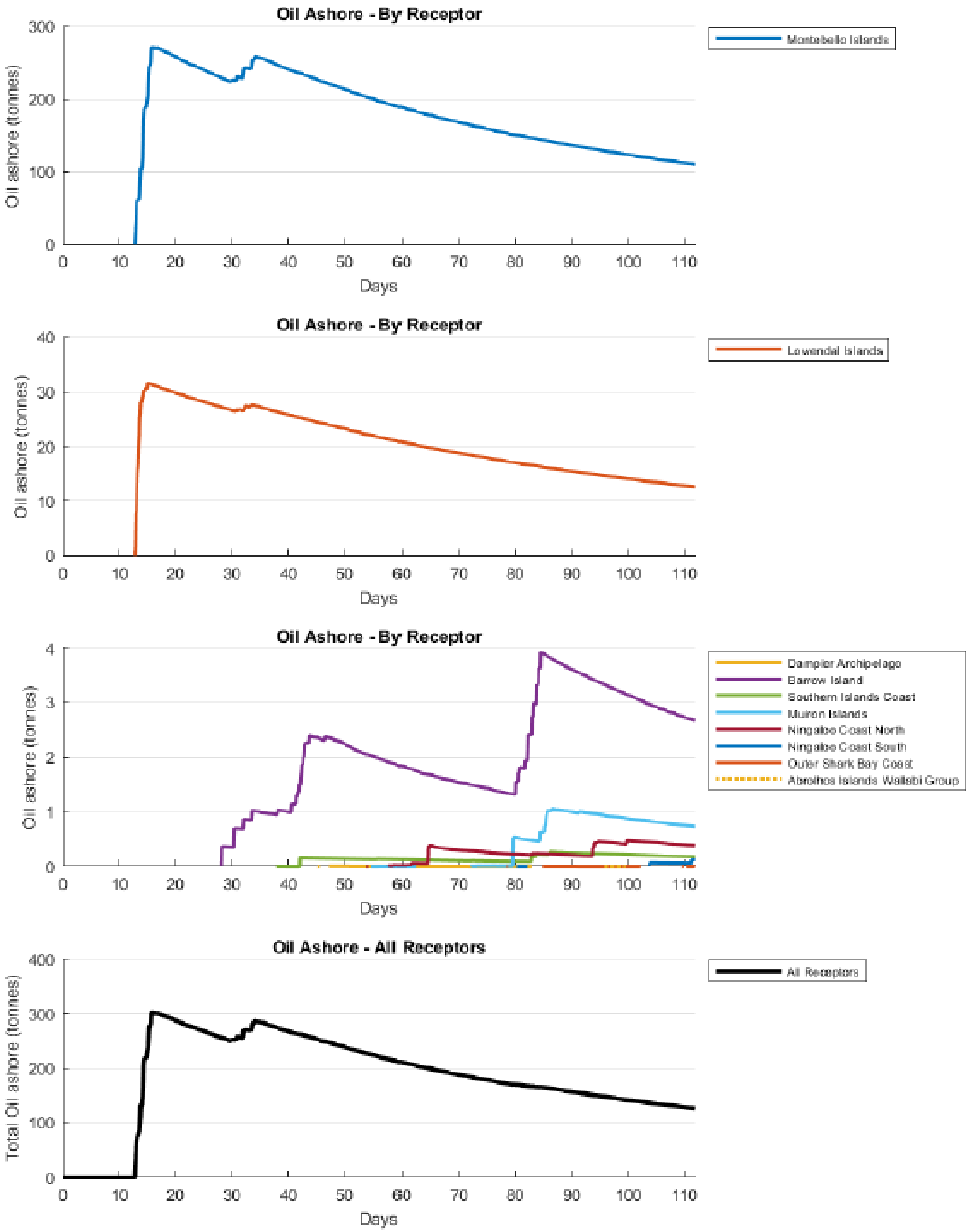
Jelen-1 and Parnassus-1 (Dancer-1) (GHD, 2020b):

+ The worst-case simulation was stochastic realisation #134 of the surface LOWC scenario; resulting in the highest accumulated shoreline load above 100 g/m^2 of ~377 tonnes with ~339 tonnes at Montebello Islands, ~34 tonnes at Lowendal Islands and ~4 tonnes at Barrow Island.
+ Oil was predicted to arrive at the shorelines of the Montebello Islands during day 12 and to reach peak loading of ~270 tonnes by day 16 (**Figure 6-3**). Loading also occurred at Lowendal Islands from day 12, reaching a peak of ~32 tonnes by day 15, while Barrow Island received a peak of ~4 tonnes of oil ashore from several loading events from days 28 to 84. The Muiron Islands also received a peak load of ~1 tonne on day 86. Several other shorelines received relatively low loadings (<0.5 tonnes).
+ For all shorelines combined, a peak load of ~302 tonnes occurred on day 16. By the end of 16 weeks (112 days) natural weathering processes were predicted to reduce the total shoreline load to ~125 tonnes.



Source: (GHD, 2020a)

Figure 6-2: Yoorn-1 deterministic modelling realisation #111 – Surface LOWC shoreline loading time series



Source: (GHD, 2020b)

Figure 6-3: Jelen-1 and Parnassus-1 (Dancer-1) deterministic modelling realisation #134 – Surface LOWC shoreline loading time series

6.5 Evaluation of applicable response strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 6.1** and spill modelling results (**Sections 6.3** and **6.4**) the following spill response strategies have been assessed for applicability for combatting a spill (**Table 6-5**).

Note: The information contained in **Table 6-5** 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 waters, DoT will ultimately determine the strategies and controls implemented for most State water activities with Santos providing resources and planning assistance.

Table 6-5: Evaluation of applicable response strategies for the Yoorn-1, Jelen-1 and Parnassus-1 activities

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
Source Control	Spill kits	✓ 1	✓ 1	Relevant for containing spills that may arise on board a vessel or MODU.
	Secondary containment	✓ 1	✓ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or MODU. Bunded areas will contain hydrocarbons, reducing the potential for a spill escaping to marine waters. Where applicable, open deck drainage will be closed to prevent hydrocarbon spills draining into the marine environment.
	Shipboard Oil Pollution Emergency Plan	✓ 1	✓ 1	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing fuel inventory 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 fuel tanks. These actions will aim to minimise the volume of fuel spilled.
	Surface well kill	✓ 1	✗	Considered during source control planning but may not be possible depending upon technical and safety constraints. Surface well kill is only considered when the estimated leak rate is small enough not to generate an explosive gas cloud and access to the MODU is still preserved. This methodology would not be considered should safe access to the MODU or ability to operate a vessel alongside the MODU not be achievable.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
	Capping stack	✗	✗	A subsea Capping Stack response strategy is not applicable given the petroleum activity will take place from a jack-up MODU. A semi-submersible drilling unit is not suitable for the Yoorn-1, Jelen-1 and Parnassus-1 drilling activities given the water depths at the well top-hole locations (which range from ~45 m - ~57 m); this precludes the use of Dynamically Positioned (DP) drilling units (drill ships and DP semi-submersibles) and moored semi-submersible drilling units. Under a credible loss of well control event subsea there are no connection points for Capping Stack installation.
	Relief well drilling	✓ 1	✗	Relevant to LOWC. Relief well drilling is the primary method for killing the blowing well if access to the MODU is not preserved. To be conducted as per the Source Control Emergency Response Plan (DR-00-OZ-20001) and Well-specific Source Control Plan. Given the shallow water depths at the Yoorn-1, Jelen-1 and Parnassus-1 locations (which range from ~45 m - ~57 m), a jack-up MODU would be used for a relief well; the water depths preclude the use of DP drill ships, DP semi-submersibles and moored semi-submersibles. The Well Specific Source Control plan(s) written prior to the activities commencing will specifically consider what MODUs are available when the activity commences and ensure that there will be at least one technically suitable jack-up drilling unit available to drill a relief well.
In-Situ Burning	Controlled burning of oil spill	✗	✗	Not applicable to wells with light hydrocarbons due to safety hazards. 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
		Condensate	MDO	
Monitor and Evaluate Plan (Operational Monitoring)	Vessel surveillance	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). Informs implementation of other response strategies. Vessel personnel may not be trained observers. Vessel observers on leaking vessel may not have capacity to observe oil during emergency response procedure implementation. Constrained to daylight. Limited to visual range from the vessel. Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance	✓ 1	✓ 1	Provides real-time information on spill trajectory and behaviour (e.g. weathering). May identify environmental sensitivities impacted or at risk of impact (e.g. seabird aggregations, other users such as fishers). Informs implementation of other response strategies.
	Tracking buoys	✓ 1	✓ 1	Can be implemented rapidly. Can provide indication of near-surface entrained/dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
	Trajectory Modelling	✓ 1	✓ 1	Can be implemented rapidly. Predictive - provides estimate of where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite Imagery	✓ 1	✓ 1	Can work under large range of weather conditions (e.g. night time, cloud cover, etc.). Mobilisation restricted to image availability. Requires post-processing. May return false positives.
	Operational Water Quality Monitoring	✓ 1	✓ 1	Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of a continuous subsea spill and validate the spill fate modelling predictions.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
	Shoreline Clean-up Assessment	✓ 1	✓ 1	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	✗	✗	*Condensate* YJP condensate (Grader-C analogue) is not considered a persistent hydrocarbon and has a very high natural evaporation and dispersion rates in the marine environment, reducing the volume of hydrocarbon remaining at the sea surface (refer to **Section 6.3** and **Figure 6-1**). Chemical dispersant is generally not considered suitable or beneficial for condensate spills of such high volatility given the high rates of evaporation and rapid spreading of this product. In addition, dispersants are ineffective on condensate spills as they will 'herd' the sheen rather than promote the formation of droplets in the water column (ITOPF, 2021). Under moderate wind speeds of 5 m/s, approximately 82% of the surface slick is predicted to evaporate after 24 hours, with the remaining ~18% dispersed in the water column and no surface slick under these conditions (GHD, 2020b). The gas component of the reservoir hydrocarbon means that applying subsea dispersant injection (SSDI) through an SFRT is not considered feasible due to access and safety constraints. The shallow water depths also indicate that SSDI is highly unlikely to have a significant effect on VOC reduction at the surface (OSRL, 2017). *MDO*
	Aerial Application	✗	✗	
	Subsea dispersant injection	✗	✗	

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
				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 diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for more chemicals into the marine environment.
Offshore Containment and Recovery	Use of offshore booms/skimmers or other collection techniques deployed from vessel/s to contain and collect oil	✗	✗	*Condensate* Given the fast-spreading and rapidly dispersing nature of diesel and YJP condensate (refer to **Section 6.3** and **Figure 6-1**), causing surface slicks to rapidly break up and disperse, this response is not considered to be effective in reducing the impacts of a reservoir hydrocarbon. The ability to contain and recover spreading condensate on the ocean water surface is extremely limited due the very low viscosity of the hydrocarbon and the limited presence of actionable oil thicknesses (i.e. >50 g/m^2). Traditional containment and recovery operations are not typically recommended for condensates which are best left in the marine environment to evaporate and dissipate at sea (ITOPF, 2021). *MDO* 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.

Mechanical Dispersion	Vessel prop-washing	✓ 2	✓ 2	Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission are not suitable. Mechanical dispersion may be applicable for the localised entrainment of surface oil but is not considered to have a significant effect on removing oil from the surface. Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of mechanical dispersion is to reduce the concentration of oil floating at the surface which could potentially contact receptors at the sea surface (e.g. sea birds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Marine diesel and Reindeer condensate are very light oils that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Given the condensate is predicted to have a high rate of natural volatility and a spill would originate in offshore waters, dispersing fresh condensate underwater would not be recommended. Dispersing weathered condensate away from the spill site (that has lost lighter products) may be beneficial if there was a potential for this hydrocarbon to impact on receptors at the sea surface or along shorelines. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass ad macroalgae). This is most likely in shallow water of a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave induced entrained so is most beneficial in calm conditions) and the type, proximity and depth (as applicable) of sensitivities in the area. Mechanical dispersion will be considered for petroleum activity sourced spills at the discretion of the OSC/IMT or by the relevant Control Agency. It is unlikely that vessels would be specifically allocated for mechanical dispersion but vessels undertaking primary strategies may be used opportunistically.
Protection and Deflection	Booming in nearshore waters and at shorelines	✓ 1	✓ 2	Considered if operational monitoring shows or predicts contact with sensitive shorelines. *Condensate*

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Condensate	MDO	
				For the worst-case modelling (Yoorn-1), 100% probability of shoreline oiling at moderate environmental values (100 g/m^2) is predicted at the Montebello Islands, with a maximum accumulated shoreline load of 2,164 tonnes. There are moderate-high contact probabilities predicted for Barrow Island (95%), Lowendal Islands (69%), Southern Islands Coast (58%), Muiron Islands (60%) and Ningaloo Coast North (63%). The effectiveness of this response will be dependent on local bathymetry, sea state, currents, tidal variations and wind conditions at the time of implementation. It is typically more effective in areas with low to moderate tidal ranges on low energy coastline types such as sandy beaches. Moderate to high tidal ranges generally include stronger currents and larger/longer intertidal areas that make it less effective and more difficult to keep booms in place. Protection and deflection are feasible in locations where access to the coastline allows vehicles and vessels to undertake operations. *MDO* For the worst-case modelling (Yoorn-1), shoreline oiling above the 100 g/m^2 threshold was confined to the proximal locations of Montebello Islands, Lowendal Islands and Barrow Island. The Montebello Islands was predicted to have the highest contact probability of 13%. Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. Given the relatively small volumes predicted to come ashore, and the high rates of natural biodegradation of marine diesel, it would be better to focus on high priority areas for protection. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact from marine diesel.

Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✓ 1	✓ 2	Considered if operational monitoring shows or predicts contact with sensitive shorelines. *Condensate* For the worst-case modelling (Yoorn-1), there are moderate-high contact probabilities predicted for the Montebello Islands, Barrow Island, Lowendal Islands, Southern Islands Coast, Muiron Islands and Ningaloo Coast North. Shoreline clean-up has the ability to reduce stranded oil on shorelines and/or reduce remobilisation of oil. However, this response has potential to cause more impacts than benefits, especially if oiling is light. The very light nature of the condensate means that natural dispersion (mainly through evaporation) and will continue after oil has stranded, meaning that actionable oil thicknesses for clean-up may not be present for extended periods of time. Shoreline assessments as part of operational monitoring provide site-specific guidance on the applicability of shoreline clean-up efforts and the likely benefits of different clean-up techniques. Intrusive activities such as physical removal of waste using manual labour or mechanical aids require careful site-specific planning to reduce secondary impacts of habitat disturbance, erosion and spreading oil beyond shorelines. Secondary impacts can be minimised through the use of trained personnel to lead operations. Logistically, clean-up operations will require site access, decontamination, waste storage, personal protective equipment, catering and transport services to support personnel working on shorelines. Flushing may be considered if the oil enters high priority/slow recovery habitats such as mangroves. Natural dispersion will occur as the hydrocarbon is remobilised from rock shelves and hard substrates, while residual hydrocarbons will biodegrade. *MDO* Modelling shows less than 24.3% probability of shoreline accumulation at more than 10 g/m^2 and less than 12.6% probability at more than 100g/m^2. Shoreline clean-up activities can result in physical disturbance to shoreline habitats. Given the smaller volumes predicted to come ashore, and the high rates of natural dispersion of marine diesel, it would be better to focus on high priority areas for clean-up. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where protection priority areas are at risk of impacts from marine diesel.

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

6.6 Identify priority protection areas and initial response priorities

Combined spill modelling results were used to predict the Environment that may be Affected (EMBA) for the drilling and geophysical survey activities (refer to Section 7.1.6 of the YJP 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 spill) for which detailed oil spill risk assessment has been conducted (refer Section 7.2 of the YJP EP). From these Hot Spot areas, Priority Protection Areas (PPAs) for spill response have been identified (as per Section 7.2.4 of the YJP EP). In the spill response preparedness strategy, it is not necessary for all Hot Spots to have detailed planning. For example, wholly submerged Hot Spots may only be contacted by entrained oil, and the response would be largely to implement scientific monitoring to determine impact and recovery. Hot Spots with features that are not wholly submerged (i.e., emergent features) are considered for Priority for Protection. This final determination of 'Priority for Protection' sites, for the oil spill response strategy, is based on the worst-case estimate of floating oil concentration, shoreline loading and minimum contact time at response threshold concentrations.

Receptors are evaluated in Section 7.2.4.1 and 7.3.4.1 of the EP for LOWC and MDO release respectively. LOWC poses the worst-case spill scenario.

Table 6-6 details the hotspots and PPAs from this list of contacted receptors from both the subsea and surface LOWC scenarios. Rationale is included in the table when a hotspot is included, or not included as a priority for protection.

Table 6-6: Determination and rationale for the priorities for protection

Hotspots	Type	HEV ranking	Yoorn-1		Jelen-1 and Parnassus-1		Rationale
			Hotspot	PPA	Hotspot	PPA	
Muiron Islands	Emergent	2	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 2
Ningaloo Coast North	Emergent	2	Y	Y	N	N	+ Shoreline accumulation + HEV rank 2
Barrow-Montebello Surrounds	Intertidal	3	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 3
Montebello Islands	Emergent	3	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 3
Lowendal Islands	Emergent	3	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 3
Barrow Island	Emergent	3	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 3
Dampier Archipelago	Emergent	3	Y	Y	Y	Y	+ Shoreline accumulation + HEV rank 3
Southern Islands Coast*	Emergent	5	Y	Y	N	Y	+ Shoreline accumulation + HEV rank 5

* Discretionary hotspots are further described in the EP, Section 7.6.4.1

Table 6-7 and **Table 6-8** list the key sensitivities and associated locations within the protection priority areas identified for both the subsea and surface LOWC worst-case spill scenarios for Yoorn-1 and Jelen-1 and Parnassus-1 respectively. For all scenarios, the LOWC modelling predicted worst-case minimum time to shore and worst-case shoreline loading volumes compared to the MDO release modelling (**Table 6-3** and **Table 6-4**). In addition, the MDO release Hotspot analysis identified three Hotspots, that were also identified for the LOWC scenarios (Montebello Islands, Barrow-Montebello Surrounds and Dampier Archipelago). Therefore, the LOWC modelling is considered the worst-case.

The ranking of these sensitivities (also referred to as receptors) are listed, which is consistent with the rankings in *Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara* (DoT, 2017). Using a combination of sensitivities, and their associated rankings; together with the modelled maximum total volumes ashore and minimum time to shoreline contact, an initial response priority is provided in **Table 6-7** and **Table 6-8.** This information is designed to aid decision making in the preliminary stages of the response operation, so that initial resources are used for best effect.

Table 6-7: Initial response priorities - Yoorn-1 subsea LOWC and surface LOWC

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
Dampier Archipelago	Mangroves	3	3	Widespread and present in lagoons. Important stands west Intercourse and Enderby	N/A	Subsea release – 6.2 Surface release – 9.0	Subsea release – 21.9 Surface release – 9.0	Medium
	Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles	4	3	Hawksbill turtle nesting north-west of Rosemary Island and Delambre. Flatback turtle nesting at Legendre, Huay and Delambre	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium
	<u>Marine mammals</u> Humpback whale (Vulnerable) migration area	3	2	N/A	Humpback whale migration: Jun-Jul			Low
	<u>Birds</u> Migratory and threatened seabirds – at least 14 species Significant nesting, foraging, breeding and resting areas	3	2	Breeding on Goodwyn, Keast Islands and Nelson Rocks.				Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	<u>Socio-economic</u> Recreational fishing/ charter boats, tourism related to	2	2	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway							
Montebello Islands	Mangroves	3	3	Widespread and present in lagoons. Important stands in Stephenson Channel	N/A	Subsea release – 1,036.5 Surface release – 2,163.6	Subsea release – 0.8 days Surface release – 0.3 days	Medium
	Turtles – loggerhead (Endangered) and green (Vulnerable) (significant rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles	4	3	Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green)	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium
	<u>Marine mammals</u> Pygmy blue whale (Vulnerable) and humpback whale (Vulnerable) migration area	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Low
	<u>Birds</u> Migratory and threatened seabirds – at least 14 species Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m²[2]	Minimum arrival time accumulated oil ashore >100 g/m² (days)[2]	Initial response priority
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Socio-economic Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism (Marine Management Area) Social amenities and other tourism Nominated place (national heritage)	2	2	Widespread	Year-round			Low
Lowendal Islands	Mangroves	3	3	Offshore	N/A	Subsea release – 38.1 Surface release – 225.9	Subsea release – 2.6 days Surface release – 2.2 days	Medium
	Coral and other subsea benthic primary producers	3	4	Deep-water benthic (soft-sediment) habitats Dugong Reef and Batman Reef (eastern side Island),	Coral spawning: Mar & Oct			Low
	Turtles Important hawksbill, loggerhead and green turtle nesting	4	3	Beacon, Parakeelya, Kaia and Pipeline Varanus pipeline, Harriet and Andersons Beaches	Nesting all year, peak Oct - Jan Significant flatback rookery, nesting season for flatback turtles peaks Dec - Jan			Medium
	Birds	2	1		Year round			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	Approximately 89 species of avifauna, 12 to 14 species of migratory and threatened seabirds							
	Marine mammals Dugong foraging	3	2	Seagrass beds	N/A			Low
	Socio-economic and heritage values Social amenities and other tourism, very significant for recreational fishing and charter boat tourism	2	2	Widespread	Year-round			Low
Barrow Island	Mangroves	3	3	Bandicoot Bay	N/A	Subsea release – 87.3 Surface release – 496.9	Subsea release – 3 days Surface release – 3.1 days	Medium
	Regionally and nationally significant green (western side) and flatback turtle (eastern side) nesting beaches, Turtle Bay north beach, North and west coasts- John Wayne Beach, loggerheads and hawksbill	4	3	Green turtles on the western side of Barrow Island and flatback turtle nesting on the eastern side. Turtle Bay north beach, North and west coasts and John Wayne Beach have loggerhead and hawksbill turtle nesting	Year-round, peaking Oct - Jan			Medium
	Birds Migratory birds (important habitat); 10th of top 147 bird sites, Highest population of	2	1	Double Islands, migratory birds at Bandicoot Bay and widespread on Barrow Island	Nesting: Sept-Feb			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	migratory birds in Barrow Island Nature reserve (south-south east island), Double Island has important bird nesting (shearwaters, sea eagles)							
	Coral and other subsea benthic primary producers	3	4	Eastern side – Biggada Reef	Coral spawning: Mar & Oct			Low
	Socio-economic Significant for recreational fishing and charter boat tourism, Nominated place (National heritage), Industry – Reverse Osmosis Plant and port operations Petroleum Activities such as BWI petroleum production	5	5	Reverse Osmosis plant and port on eastern side of Island (Port of Barrow Island)	N/A			Medium
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site, significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence	4	3	Loggerhead – south island	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan	Subsea release – 38.6 Surface release – 86.7	Subsea release – 7.2 days Surface release – 7 days	High
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low
Ningaloo Coast North	Mangroves	3	3	Yardie Creek, Mangrove Bay	N/A	Subsea release – 22.6 Surface release – 68.9	Subsea release – 7.3 days Surface release – 7.3 days	Medium
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium
	Marine mammals Pygmy blue whale (Vulnerable) Dugongs (Marine/ migratory) (breeding and foraging)	3	2	N/A	Pygmy blue whale migration: Apr-Aug			Medium
	Turtle nesting loggerhead (Endangered) site, significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable)	4	3	Graveyards (northern section of Ningaloo Reef) - important sites for mating aggregations. Green turtles tend to nest in higher proportions in the northern areas of the reserves.	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m² [2]	Minimum arrival time accumulated oil ashore >100 g/m² (days)[2]	Initial response priority
	Birds 33 species of seabirds and avifauna.	2	1	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura Wreck Site and Fraser Island	Nesting: Sept-Feb			Medium
	Protected Areas Includes 13 out of the 18 sanctuary zones under the state MP. National Heritage World Heritage Area	5	5	Widespread	Year-round			High
	Socio-economic Recreational fishing/ charter boats, tourism related to water-based activities and nature Camping beaches	2	2	Widespread	Year-round			Low
Southern Islands Coast	Seagrass meadows	1	2	N/A	-	Subsea release – 18.7 Surface release – 52.5	Subsea release – 6.5 days Surface release – 5.9 days	Low
	Birds Bird populations, including: Wedge tailed shearwater, Lesser crested tern, Fairy tern, Roseate tern.	4	3	N/A	-			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) $>100g/m^2$ [2]	Minimum arrival time accumulated oil ashore $>100\ g/m^2$ (days)[2]	Initial response priority
	Turtles Green turtle and hawksbill critical habitat (nesting)	4	3	-	Turtle nesting and breeding Nov to Mar with peak in late Dec/early Jan			Medium
	Marine mammals Humpback whale BIA	4	3	N/A	-			Medium

[1]Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (DoT, 2017)

[2]GHD, 2020a

Table 6-8: Initial response priorities - Jelen-1 and Parnassus-1 subsea LOWC and surface LOWC (represented by Dancer-1 modelling)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil) [1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) $>100g/m^2$ [2]	Minimum arrival time accumulated oil ashore $>100\ g/m^2$ (days)[2]	Initial response priority
Dampier Archipelago	Mangroves	3	3	Widespread and present in lagoons. Important stands west Intercourse and Enderby	N/A	Subsea release - 1.2 Surface release – 1.1	Subsea release - 26.5 Surface release – 32.3	Medium
	Turtles –hawksbill (Vulnerable) and flatback (Vulnerable) turtles	4	3	Hawksbill turtle nesting north-west of Rosemary Island and Delambre. Flatback turtle nesting at Legendre, Huay and Delambre	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil)[1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	Marine mammals Humpback whale (Vulnerable) migration area	3	2	N/A	Humpback whale migration: Jun-Jul			Low
	Birds Migratory and threatened seabirds – at least 14 species Significant nesting, foraging, breeding and resting areas	3	2	Breeding on Goodwyn, Keast Islands and Nelson Rocks.				Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Socio-economic Recreational fishing/ charter boats, tourism related to water-based activities and nature National Heritage Aboriginal sites Camping beaches Shipping fairway	2	2	Widespread	Year-round			Low
Montebello Islands	Mangroves	3	3	Widespread and present in lagoons. Important stands in Stephenson Channel	N/A	Subsea release – 3,673.5 Surface release - 15,605.8	Subsea release – 2.2 days Surface release – 2.2 days	Medium
	Turtles – loggerhead (Endangered) and green (Vulnerable) (significant	4	3	Northwest and Eastern Trimouille Islands (hawksbill)	Turtle nesting and breeding Nov-Mar			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil) [1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m² [2]	Minimum arrival time accumulated oil ashore >100 g/m² (days)[2]	Initial response priority
	rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles			Western Reef and Southern Bay at Northwest Island (green)	with peak in late Dec/early Jan			
	Marine mammals Pygmy blue whale (Vulnerable) and humpback whale (Vulnerable) migration area	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Low
	Birds Migratory and threatened seabirds – at least 14 species Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Socio-economic Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism (Marine Management Area) Social amenities and other tourism Nominated place (national heritage)	2	2	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil) [1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m[2] [2]	Minimum arrival time accumulated oil ashore >100 g/m[2] (days)[2]	Initial response priority
Lowendal Islands	Mangroves	3	3	Offshore	N/A	Subsea release – 8.8 Surface release – 34.3	Subsea release – 12.9 days Surface release – 12.9 days	Medium
	Coral and other subsea benthic primary producers	3	4	Deep-water benthic (soft-sediment) habitats Dugong Reef and Batman Reef (eastern side Island),	Coral spawning: Mar & Oct			Low
	Turtles Important hawksbill, loggerhead and green turtle nesting	4	3	Beacon, Parakeelya, Kaia and Pipeline Varanus pipeline, Harriet and Andersons Beaches	Nesting all year, peak Oct - Jan Significant flatback rookery, nesting season for flatback turtles peaks Dec - Jan			Medium
	Birds Approximately 89 species of avifauna, 12 to 14 species of migratory and threatened seabirds	2	1		Year round			Medium
	Marine mammals Dugong foraging	3	2	Seagrass beds	N/A			Low
	Socio-economic and heritage values Social amenities and other tourism, very significant for recreational fishing and charter boat tourism	2	2	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil) [1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
Barrow Island	Mangroves	3	3	Bandicoot Bay	N/A	Subsea release – 7.6 Surface release – 6.18	Subsea release – 8.9 days Surface release –8.9 days	Medium
	Regionally and nationally significant green (western side) and flatback turtle (eastern side) nesting beaches, Turtle Bay north beach, North and west coasts- John Wayne Beach, loggerheads and hawksbill	4	3	Green turtles on the western side of Barrow Island and flatback turtle nesting on the eastern side. Turtle Bay north beach, North and west coasts and John Wayne Beach have loggerhead and hawksbill turtle nesting	Year-round, peaking Oct - Jan			Medium
	<u>Birds</u> Migratory birds (important habitat); 10th of top 147 bird sites, Highest population of migratory birds in Barrow Island Nature reserve (south-south east island), Double Island has important bird nesting (shearwaters, sea eagles)	2	1	Double Islands, migratory birds at Bandicoot Bay and widespread on Barrow Island	Nesting: Sept-Feb			Medium
	Coral and other subsea benthic primary producers	3	4	Eastern side – Biggada Reef	Coral spawning: Mar & Oct			Low
	<u>Socio-economic</u> Significant for recreational fishing and charter boat tourism, Nominated place (National heritage), Industry	5	5	Reverse Osmosis plant and port on eastern side of Island (Port of Barrow Island)	N/A			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[1]	DoT Ranking (Dissolved oil) [1]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (tonnes) >100g/m^2 [2]	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)[2]	Initial response priority
	– Reverse Osmosis Plant and port operations Petroleum Activities such as BWI petroleum production							
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site, significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence	4	3	Loggerhead – south island	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan	Subsea release – 2.7 Surface release – 3.7	Subsea release – 8.5 days Surface release – 8.5 days	High
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low

[1]Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (DoT, 2017)

[2](GHD, 2020b)

6.6.1 Tactical Response Plans for Priority Protection Areas

Tactical Response Plans (TRPs) have been developed for selected receptors, identifying suitable response strategies, equipment requirements, relevant environmental information and access and permit requirements. TRPs are referenced in both the activity/facility Oil Pollution First Strike Plan and Operational Plans. TRPs are to be used by the IMT for first strike and ongoing activities and to assist in informing the appropriate responses for inclusion in an IAP.

Not all PPA's require TRPs in place. The requirement for a tactical response plan considers the predicted time to contact to a PPA from accumulated or floating hydrocarbons in <10 days (above the response planning thresholds defined in **Section 6.2**). Ten days allows two days to get services procured; six days to draft the TRP; and two days to implement. The Sensitivity ranking (HEV and DoT), and accessibility (i.e. on mainland compared to a remote island location) is also considered.

A TRP will also be considered should the impact from hydrocarbon be considerable (high accumulation, large floating oil contact). Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA. Additionally, TRPs for contacted receptors will be sought from other operators where possible.

Table 6-9: Tactical Response Plans for Priority Protection Areas for the Yoorn-1, Jelen-1 and Parnassus-1 activities based on LOWC oil spill modelling

PPA	TRP Evaluation	Existing TRP
Dampier Archipelago	Full TRPs already exist for: + Dampier 1: Legendres Island + Dampier 2: Rosemary Island + Dampier 3: Enderby Island - lagoon	Yes
Montebello Islands	Existing TRPs in place for: + Montebello 1: Claret Bay + Montebello 2: Sherry Lagoon entrance + Montebello 3: Hock Bay + Montebello 4: Stephenson Channel, north + Montebello 5: Hermite – Delta Island channel + Montebello 6: Champagne Bay – Chippendal Channel + Montebello 7: North Channel and Kelvin Channel	Yes
Lowendal Islands	+ Lowendal Islands – Small Vessel Operating Guidelines (includes beach landing points that can be used for SCAT/ Protect and deflect/ Shoreline clean-up responses)	Yes
Muiron Islands	Existing TRP in place for Muiron Islands	Yes

PPA	TRP Evaluation	Existing TRP
Ningaloo Coastline (North, South Middle)	Existing TRPs in place for: + Jurabi to Lighthouse Bay beaches + Mangrove Bay + Muiron Islands + Turquoise Bay + Yardie Creek	Yes
Barrow Island	In the event of an oil spill emergency where monitoring of the spill indicates potential for beaching at Barrow Island, Santos will utilise the Tactical Response Guides that Chevron Australia has in place to inform response planning. In addition: + NWS OSCP Volume 2: Environmental Resource Atlas- Barrow is covered	Yes
Southern Islands Coast	No existing TRP. However, the location is a priority for shoreline survey, which could be commenced within 3 days. This is less than the predicted minimum time to shore above the response threshold (5.9 days) (**Section 6.3**).	No

6.6.2 Additional data to inform first-strike monitoring

The standard stochastic outputs provide predictions of the number of receptors potentially contacted by floating oil, however this information is generated from the full suite of 150 realisations for a LOWC scenario over 77 days, and therefore overestimates the number of receptors contacted.

To inform first-strike monitoring, an assessment of the stochastic outputs identified the receptors that are predicted to potentially be contacted by floating oil within the first 7 days after the start of an LOWC incident. In comparison to the subsea LOWC, the surface LOWC scenario is predicted to have the largest number of contacted receptors. **Table 6-10** shows those receptors predicted to be contacted in within 7 days at 10 g/m^2 and 100 g/m^2 shoreline accumulation thresholds, for Yoorn-1 (GHD, 2020a), and Jelen-1 and Parnassus-1 (GHD, 2020b).

This information has been used to determine the first-strike scientific monitoring capability requirements (**Appendix O: Scientific Monitoring Capability**).

Table 6-10: Summary of number of contacted receptors from the surface LOWC within 7 days

Scenario	Receptors contacted within 7 days- minimum arrival time (days) for shoreline accumulation oil > 10 g/m^2	Receptors contacted within 7 days- minimum arrival time (days) for shoreline accumulation oil > 100 g/m^2
Yoorn-1[1]	Montebello Islands: 0.3 Lowendal Islands: 2.2 Barrow Island: 3.1 Southern Islands Coast: 5.9	Montebello Islands: 0.3 Lowendal Islands:2.2 Barrow Island: 3.1 Southern Islands Coast: 5.9
Jelen-1 and Parnassus-1[2]	Montebello Islands: 2.2 Barrow Island: 5.4	Montebello Islands: 2.2

[1]GHD 2020a

[2]GHD 2020b

6.7 Net environmental benefit analysis

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

The Environment Unit Leader will use the information in **Section 6.6** 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, NEBA is conducted by the Control Agency with responsibility for the spill response activity. Where there are different activities controlled by different IMTs, as in a cross-jurisdictional response between Santos and WA DoT, consultation will be required during the NEBA process such that there is consistency in the sensitivities prioritised for response across the Control Agencies.

A strategic NEBA has been developed for all response strategies identified as applicable to the spill scenarios, with the benefit or potential impact to each sensitivity identified for both scenarios (refer **Table 6-11**). The strategic NEBA for the identified PPAs for both LOWC scenarios in **Table 6-11** is also applicable for the MDO vessel spill scenario, given that these locations are the protection priority identified for this scenario (**Section 6.6**).

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

+ Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally).
+ Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority (**Table 6-8**).
+ Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

When a spill occurs, NEBA is applied to the current situation, or operationalised. Operational NEBA Templates are filed within the Environment Unit Leader folder on the Santos ER Intranet site. To complete the Operational NEBA:

+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are recorded.
+ Potential effects of response strategies on each sensitivity are assessed in terms of their benefit or otherwise to the socio-economic sensitivities.
+ All persons involved and data inputs have been considered for the analysis.

The Operational NEBA Form documents the decisions behind the recommendation to the Incident Commander on which resources at risk to prioritise, and the positives and negatives of response strategies to deploy. The Operational NEBA provides guidance to the IAPs and is revisited each Operational Period.

Table 6-11: Strategic net environmental benefit analysis matrix – LOWC (Yoorn-1, Jelen-1 and Parnassus-1 scenarios)

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection and Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Montebello Islands								
Turtle nesting – Northwest and Eastern Trimouille Islands (hawksbills), Western Reef and Southern Bay and Northwest Island (green)								
Mangroves – particularly Stephenson Channel							N/A	
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Seabird nesting								
Migratory shorebirds								
Marine mammals - Humpback and Pygmy blue whale migration					N/A	N/A		
Fishing and charter boat tourism								
Barrow Island								
Turtle nesting –particularly flatback (western side) and green (eastern side) turtles								
Mangroves and mudflats (shorebird foraging) – Bandicoot Bay							N/A	
Coral and other subsea benthic primary producers – incl. Biggada Reef					N/A	N/A	N/A	
Seabird nesting – incl. Double Island								
Migratory shorebirds – particularly Bandicoot Bay								
Aboriginal listed sites incl. pearling camps							N/A	N/A
Lowendal Islands								

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection and Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Turtle nesting – hawksbill, loggerhead and green								
Coral, seagrass (dugong habitat) and other subsea benthic primary producers					N/A	N/A	N/A	
Seabirds								
Migratory birds								
Mangroves							N/A	
Dugong foraging								
Tourism – charter boats, significant recreational fishing								
Dampier Archipelago								
Turtle nesting – hawksbill, flatback and green								
Coral, seagrass (dugong habitat) and other subsea benthic primary producers					N/A	N/A	N/A	
Seabird nesting/breeding								
Migratory birds								
Marine fish diversity – particularly Legendre Island					N/A	N/A	N/A	
Mangroves							N/A	
Socio-economic Fishing/charter boat, camping tourism National Heritage, Aboriginal sites								

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection and Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Muiron Islands								
Turtle nesting major loggerhead site, significant Green turtle nesting site								
Coral and other benthic primary producer					N/A	N/A	N/A	
Mangroves							N/A	
Seabird nesting								
Migratory birds								
Humpback whale migration					N/A	N/A		
Tourism – significant fishing and charter boat tourism								
Ningaloo Coast North								
Turtle nesting – hawksbill, green and loggerhead								
Coral and other subsea benthic primary producers – largest fringing reef in Australia, lagoonal, intertidal and subtidal corals, seagrass and macroalgae bed					N/A	N/A	N/A	
Seabird nesting - incl. breeding areas at Mangrove Bay, Mangrove Point, Point Maud, Mildura wreck and Fraser Island								
Migratory birds								
Mangroves – particularly Mangrove bay, Yardie Creek and Tidal creek							N/A	
Marine mammal - Humpback/pygmy blue whale migration					N/A	N/A		
Whale sharks and manta rays					N/A	N/A		

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection and Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Tourism – significant fishing/charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)								
Southern Island Coast								
Seagrass meadows								
Bird populations, including: Wedge tailed shearwater, Lesser crested tern, Fairy tern, Roseate tern.								
Green turtle and hawksbill critical habitat (nesting)								

Legend	
	Beneficial impact.
	Possible beneficial impact depending on the situation (e.g. time frames and metocean conditions to dilute entrained oil).
	Negative impact.
N/A	Not applicable for the environmental value.

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

7 External notifications and reporting requirements

For oil spill incidents, the OSC (of the MODU or Company Site Representative) will notify the Perth-based IMT 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 Officer and the Environment Unit 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), which is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

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

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

7.2 Activation of external oil spill response organisations and support agencies

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

The Santos Incident Response Telephone Directory (SO-00-ZF-00025.02) contains a more detailed contacts list and contact details for incident response support and is updated every six 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, state and international 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 activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage[9]	Notification by IMT Environment Unit Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
National Offshore Petroleum Titles Administrator (NOPTA) (Titles Administrator)	Written report to NOPTA within seven days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environment Unit Leader (or delegate)	Provide same written report as provided to NOPSEMA
AMSA Rescue Coordination Centre (RCC)[10]	Verbal notification within two hours of incident Written POLREP form, within 24 hours on request from AMSA	Under the MoU between Santos and AMSA	Santos to notify AMSA of any marine pollution incident[11]	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

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

[10] 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 waters, WA DoT MEER.

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

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
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 Environment Unit Leader (or delegate)	Not applicable
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	*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 Environment Unit Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
	contact details for the response coordinator				
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[12] Fisheries within the environment that may be affected (EMBA) Consider a courtesy call if not in exposure zone	Notification by IMT Environment Unit Leader (or delegate)	Not applicable
If spill is heading towards WA waters					
Department of Mines, Industry Regulation and Safety (DMIRS) (Petroleum Environment Duty Officer)	Verbal phone call within two hours of incident being identified Follow up written notification within three days	Guidance Note on Environmental Non-compliance and Incident Reporting	All actual or impending spills in State waters	Notification by IMT Environment Unit Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx
WA Department of Transport (WA DoT) [13] (MEER Duty Officer)	Verbal notification within two hours	*Emergency Management Regulations 2006*	Santos to notify of actual or impending Marine Pollution	Notification by IMT Environment Unit Leader (or delegate)	WA DoT POLREP (**Appendix C: Pollution Report)**:

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

[13] 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 waters, WA DoT MEER

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
	Follow up with Pollution Report (**Appendix C: Pollution Report**) as soon as practicable after verbal notification If requested, submit Situation Report (**Appendix D: Situation Report**) within 24 hours of request	State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	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[14]	MEER Duty Officer contacted per Incident Telephone Directory	https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP (**Appendix D: Situation Report**): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
Department of Biodiversity Conservation and Attractions (Pilbara 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 Adviser)	Notification by IMT Environment Unit Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (State Duty Officer)	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 Adviser)	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

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

Agency or Authority	Type of Notification/ Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
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[15] Notify if spill has the potential to impact or has impacted fisheries in State waters	Notification by IMT Environment Unit Leader (or delegate)	Not applicable
If spill is heading towards international waters					
Department for Foreign Affairs and Trade (DFAT) (24-hour consular emergency centre)	Verbal notification within 24 hours of modelling suggesting trans-national migration of oil into Indonesian or Timor-Leste waters	Not applicable	NOPSEMA, DISER and DFAT will form an inter-agency panel; the Australian Government Control Crisis Centre	Notification by IMT Environment Unit Leader (or delegate)	Not applicable

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

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 Unit Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider	Within two hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place	Phone call.	IMT Logistics Section Chief (or delegate)
Duty Officers/ Incident Commanders	Within two hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual Aid Arrangement)	Phone call.	Incident Commander (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
(Woodside, BHP, Chevron)					
Exmouth Freight & Logistics	Within two hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call.	IMT Logistics Section Chief (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 Section Chief (or delegate)
Astron	Scientific Monitoring Plan initiation criteria are met (**Section 16** and **Appendix M**: Scientific Monitoring Plans)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1 to 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 Unit 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 Unit 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 gas chromatography/mass spectrometry fingerprinting	Phone call.	IMT Environment Unit Leader (or delegate)
Oil Spill Response Limited, OSRL Duty Manager	Within two hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form	Santos has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios At minimum OSRL will provide technical support to the IMT and place resources on standby Further details available on the OSRL webpage.	**Step 1**. Contact OSRL Duty Manager in Singapore and request assistance from OSRL. **Step 2**. Send notification to OSRL as soon as possible after verbal notification. **Step 3**. Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby.	Designated call-out authorities (including Incident Commanders)
RPS Group	As soon as possible but within two hours of incident having been identified	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos, if required, as	Contact RPS Group Duty Officer.	IMT Environment Unit Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
			part of contracting arrangements with RPS Group		
Wild Well Control (WWC)	Within four hours of a loss of well control incident having been identified	Loss of well control only Verbal	Well intervention services. Under contract.	**Step 1**. Following Santos management confirmation of a loss of well control (LOWC), Source Control Branch Director is to call the Wild Well Control 24-hour emergency hotline number to notify WWC of the incident. **Step 2**. As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form (saved in ECM) must be filled out, signed off by the authorised Santos Manger sent through to WWC. The form is located on the Santos Intranet Procedures Index under Emergency Procedures (http://ausintranet.enerylimited.com/dept_data/Procedure_data/index.htm). Email as directed by WWC point of contact provided by the emergency hotline attendant.	IMT Source Control Branch Director

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)	Santos 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 plan

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

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

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

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

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

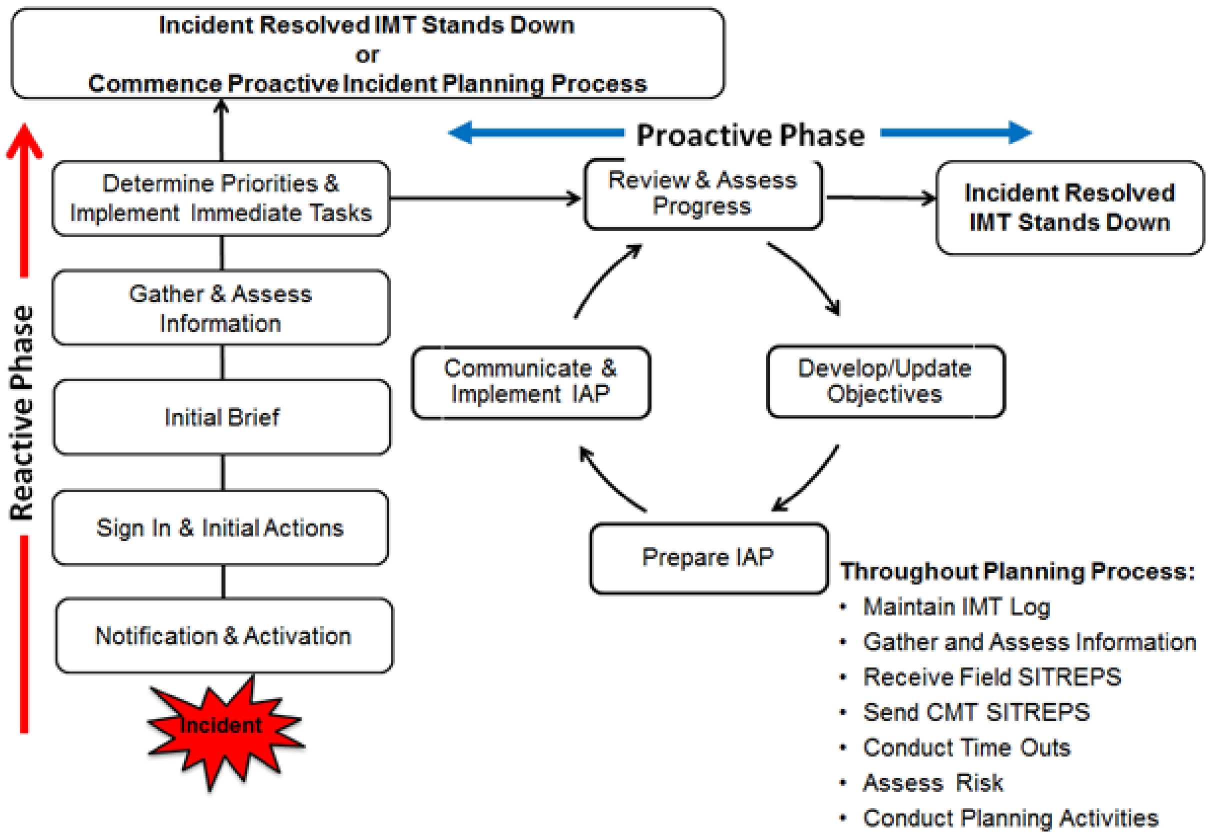


Figure 8-1: Incident Action Plan process

8.1 Reactive phase planning

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

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

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

8.2 Developing an Incident Action Plan

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

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

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

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

IAP forms and processes are documented in the *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
	Incident Management Personnel	Incident Management personnel are trained and available as per **Appendix Q: IMT Resourcing**.	Manual compliance check on IMT and CMT Membership contracts with AMOSC and OSRL
	Tactical Response Plans	If operational monitoring shows that shoreline contact of Protection Priority Areas is likely, TRPs will be developed or sought from other titleholders/ regional industries prior to shoreline contact.	TRP
	Response Implementation		
	Incident Action Plan	Incident Action Plan is completed for each operational period and approved by the Incident Commander	Incident Log Incident Action Plan/s
		Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident Log Incident Action Plan/s
	NEBA	An operational NEBA will be undertaken for each operational period of the incident	NEBA Incident Action Plan

9 Source control

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

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

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

The sections below provide an outline of source control activities noting that the MODU Operator's Emergency Response Plan, Vessel SOPEP and Santos Source Control Planning and Response Guideline (DR-00-OZ-20001), 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 to a fuel tank rupture. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-1: 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	Notification of a spill	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✗
Termination criteria	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbons	

9.1.1 Implementation guidance

Implementation guidance is summarised in **Table 9-2.** In the event MDO is released from a vessel due to a tank rupture, the relevant vessel specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident**. Table 9-6** lists the environmental performance standards and measurement criteria for this strategy.

Table 9-2: Implementation guidance – fuel tank rupture

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

9.2 Loss of well control

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

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

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

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

Yoorn-1 well:

+ a subsea LOWC with the release of 1,998,647 bbl (317,750 m^3) of liquid condensate and 45,892 MMscf of gas at seabed over 77 days
+ a surface LOWC with the release of 1,990,310 bbl (316,424 m^3) of liquid condensate and 45,696 MMscf of gas over 77 days.

Jelen-1 and Parnassus-1 wells:

+ a subsea LOWC with the release of 273,130 STB (43,423 m^3) liquid condensate and 54,618 MMscf (1,547 million sm^3) gas at seabed over 77 days
+ a surface LOWC with the release of 271,436 STB (43,153 m^3) liquid condensate and 54,289 MMscf (1,537 million sm^3) gas over 77 days.

9.2.1 Source control methods

9.2.1.1 Emergency BOP Activation

As part of the drilling programme, a blow-out preventer (BOP) stack will be installed prior to drilling of the reservoir well sections, in accordance with API Standard 53: *Well control equipment systems for drilling wells* (*API, 2018*). The purpose of a BOP is to provide a secondary barrier to hydrocarbons by providing a mechanical means of shutting in the well if primary well control is lost, and hydrocarbons enter the wellbore.

Manual Activation

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

The BOP choke and kill lines will be closed and the relevant BOP rams will be activated, via the BOP control panel located on the drill floor. There is an additional BOP control panel located inside the MODU accommodation. Available BOP rams commonly include:

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

One or more of the BOP rams may be activated depending on the status of the well and the severity of the well control incident. Once a BOP ram is closed, a secondary locking mechanism activates which serves to lock the BOP ram in the closed position, even in the event of a subsequent loss of electrical or hydraulic power.

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

9.2.1.2 Subsea first response toolkit (SFRT)

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

The Sub-sea Dispersant Injection (SSDI) component of the SFRT would not be used in a worst-case LOWC response to the YJP drilling activities. However, there is potential that the SFRT could be used for undertaking debris clearance. If the AMOSC SFRT is selected for use in the event of a LOWC incident, Santos will mobilise the AMSOC SFRT from Fremantle to Dampier for transport to, and deployment at the incident location.

The AMOSC SFRT is located at Oceaneering's facilities at Jandakot. If required, the equipment would be mobilised via road from Jandakot to Dampier. It is estimated this would take ten hours to arrange and up to five days to load and transport to Dampier, depending on the time of the year. A suitable vessel would be acquired by Santos during this timeframe and arrive in Dampier within eight days of call-out. Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day nine from call out. Specialist personnel to deploy the SFRT will be provided via Santos' contract with Oceaneering and will be available in Dampier within 72 hours (three days). Vessel specifications are outlined in the Santos Source Control Planning and Response Guideline (DR-00-ZF-20001).

9.2.1.3 Relief well drilling

Relief well drilling is the primary source control strategy to control a LOWC (subsea and surface) during drilling activities. The installation of a subsea Capping Stack is not considered applicable for YJP activities (refer to **Table 6-5**).

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

9.2.1.3.1 *Relief well planning*

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

+ SPE Calculation of Worst-Case Discharge Rev 1, 2016: This is used as part of the prospect screening review to generate a credible rate for oil spill modelling, as well as providing an input for the dynamic kill modelling as part of the Well Specific Source Control Plan.
+ United Kingdom Oil and Gas Relief Well Guidelines, Issue 2, 2013: This methodology is used to confirm a well complexity analysis and tailor required content for the well specific source control plan to the appropriate level of detail.

All wells drilled during YJP activities will have well-specific source control plans (SCPs). SCPs will be developed as required for individual wells or as campaign specific SCPs. The SCP is a Santos controlled document and is encompassed in the well operation management plan (WOMP) that relates to the specific drilling activity.

The SCP must contain relief well planning information, specifically:

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

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

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

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

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

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

9.2.1.3.2 Relief well schedule

An indicative relief well drilling schedule is provided in **Table 9-4**. This is based on control of the well by 11 weeks (77 days). This period is used as a base case well control timeframe by Santos across its wells and is based on indicative mobilisation durations, relief well planning and operations. It could take up to 41 days to have a MODU onsite ready to spud.

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

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

Table 9-4: Schedule for relief well drilling including MODU mobilisation

LOWC Relief Well		
Task	**Duration (in days)**	**Controls**
Event reported. Begin sourcing of rig for relief well drilling operations. Concurrently, stand up relief well drilling team and activate relief well specialists.	2	+ On-site communications + Active IMT on call including Operations Section Chief/Source Control Branch Director + Stood-up relief well team (as per Santos Offshore Source Control Emergency Response Plan) + Relief Well Drilling specialist services contract (Wild Well Control) + Regional MODU tracking + APPEA MoU: Mutual Assistance
Relief well MODU confirmed. Relief well MODU suspends operations and prepares to mobilise to relief well location. Demobilisation of equipment from previous operator Concurrently, prepare relief well MODU Safety Case Revision and submit to NOPSEMA. Concurrently, prepare relief well design and dynamic kill plan. Prepare relief well WOMP and submit to NOPSEMA.	7	+ Active IMT + Santos Offshore Source Control Emergency Response Plan (DR-00-OZ-20001) + Pre-completed well specific Source Control Plan complete with relief well study + Relief Well Drilling specialist services contract (Wild Well Control) + Regional MODU tracking + APPEA MoU: Mutual Assistance + Pre-verified access to relief well long lead equipment (e.g. casing and wellhead + Drilling services contracted.
Contract relief well MODU. Concurrently, continue preparations for rig mobilisation. Concurrently, NOPSEMA assessment of relief well MODU SCR and relief well WOMP. Mobilise relief well MODU to location.	24	+ Active IMT + Santos Offshore Source Control Emergency Response Plan (DR-00-OZ-20001) + Relief Well Drilling specialist services contract (Wild Well Control)
Total days prior to arrival, ready to spud/commence relief well operations	33	
Drill and construct relief well and execute dynamic well kill operations	44	+ Active IMT + Santos Offshore Source Control Emergency Response Plan (DR-00-OZ-20001) + Relief Well Drilling specialist services contract (Wild Well Control)

LOWC Relief Well		
Task	**Duration (in days)**	**Controls**
Total days from LOWC to well kill	**77**	

9.2.2 Source control implementation guidance

A high-level summary of LOWC control implementation actions is provided in **Table 9-5**.

Table 9-5: Implementation guidance – loss of well control

	Action	Responsibility	Complete
Initial Actions	**Relief well**		
	Implement the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001).	IMT Relief Well Team Leader	❑
	Notify Santos Drilling and Completions Team to assemble a Source Control Branch and immediately begin preparations.	IMT Relief Well Team Leader	❑
	Notify well control service provider personnel for mobilisation.	IMT Relief Well Team Leader and Source Control Branch Director	❑
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MoU.	IMT Source Control Branch Director	❑
	Refine, as necessary the relief well pre-planning work described in **Section 9.2.1.2**, as applicable, and have prepared in time to procure equipment and personnel before MODU arrival on location.	IMT Source Control Branch Director	❑
	Assess relief well equipment and personnel requirements. Procure and make ready.	IMT Logistics Section Chief	❑
	Deploy equipment and personnel to site to begin spud and drill.	IMT Relief Well Team Leader	❑
	SFRT (if selected)		
	Activate Subsea First Response Toolkit (SFRT) equipment. Activate Oceaneering personnel for deployment	IMT Designated call-out authority (Incident Commander) IMT Source Control Branch Director	❑
	Contract suitable vessel capable of deploying SFRT equipment.	IMT Logistics Section Chief IMT Source Control Branch Director	❑
	Arrange road transport of SFRT equipment from Jandakot to Dampier.	IMT Logistics Section Chief IMT Source Control Branch Director	❑

	Action	Responsibility	Complete
	Arrange equipment to be loaded on to vessel once in Dampier and authorise transit to field.	IMT Logistics Section Chief IMT Operations Section Chief IMT Source Control Branch Director	❑
	Conduct initial ROV survey at the release point to determine the nature of the release, behaviour of the oil, and estimate the oil and gas flow rates.	IMT Operations Section Chief IMT Source Control Branch Director	❑
Ongoing actions	**Relief Well**		
	Design Relief Well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel before MODU arrival on location.	IMT Source Control Branch Director	❑
	Assess relief well equipment and personnel requirements. Procure and make ready.	IMT Logistics Section Chief	❑
	Deploy equipment and personnel to site to begin spud and drill.	IMT Relief Well Team Leader	❑
	Monitor progress of relief well drilling and communicate to IMT.	IMT Relief Well Team Leader	❑

9.3 Environmental performance

Table 9-6 indicates the environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-6: 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 Measure**	**Performance Standards**	**Measurement Criteria**
Response Preparedness			
Source control – BOP Activation	BOP Unit	BOP rams pressure/function tested as per latest edition of API Standard 53 on deployment, and then at regular intervals throughout the drilling programme.	BOP pressure and function tests recorded in Daily Drilling Report. Pressure tests charted.
Source control – SFRT	Arrangements to enable access to SFRT equipment and personnel	Maintenance of access to SFRT equipment and personnel	AMOSC SFRT participating member OTA Agreement with Oceaneering
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers	Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
Source Control – Relief Well Drilling	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001	The Santos Source Control Planning and Response Guideline (DR 00 OZ 20001) is in place and up to date during the activity	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)
	Relief Well MODU Capability Register	Relief Well MODU Capability Register is maintained during the activity through monthly monitoring	Relief Well MODU Capability Register
	Well specific Source Control Plan developed prior to drilling.	Source control plan will identify suitable MODU availability for relief well drilling	Well specific Source Control Plan

	Relief well design assessment to identify and screen relief well top-hole locations prior to drill campaign	Well specific source control plan will identify/screen potential relief well top-hole locations	Well specific Source Control Plan
	Contract and Equipment Access Agreement with WWC	Contract and Equipment Access Agreement with WWC are maintained providing technical support and equipment	Contract with WWC
	Arrangements for source control emergency response personnel	Arrangements for access to source control personnel are maintained during the activity	Contract/ Memorandums of Understanding for source control personnel
	Pre-Purchase relief well supplies	Long lead equipment for a relief well drilling will be pre purchased as part of the WOMP commitments for each well drilled.	WOMP
Source Control – Vessel Collision	Vessel Spill Response Plan (SOPEP/SMPEP)	Support vessels have a SOPEP or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records. Inspection records
		Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close-out reports
Response Implementation			
Source control – BOP Activation	BOP installed in accordance with API Standard 53	BOP is activated manually in accordance with MODU Operator's Emergency Response Plan	Incident Log
Source control – SFRT	Access to suitable SFRT vessel	Vessel mobilised to Dampier within 8 days of IMT call-out	Incident Log
	Access to personnel for the deployment of the SFRT	Oceaneering to mobilise personnel to Dampier within 8 days of IMT call-out	Incident Log
Source Control – Relief well drilling	Source Control Branch	Source Control Branch mobilised within 24 hours of the well release	Incident Log

	Equipment/Services for Relief Well drilling	Equipment/Services for Relief Well drilling sourced within five days of the well release	Incident Log
	Well Control Specialists	Well control specialists mobilised within 72 hours of the well release	Incident Log
	Relief Well MODU	MODU for relief well drilling to be onsite by day 33 from the start of the well release.	Incident Log
	Relief Well	Relief well completed within 77 days from the start of the well release	Incident Log
	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001)	Relief well drilling implemented in accordance with the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) during a well release	Incident Log
Source Control – Vessel Collision	As per the vessel SOPEP	Actions to control spill associated with a vessel incident followed in accordance with SOPEP	Vessel logs

10 Monitor and evaluate

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

+ vessel surveillance
+ aerial surveillance
+ tracking buoys
+ oil spill trajectory modelling
+ satellite imagery
+ initial oil characterisation
+ operational water quality monitoring
+ shoreline clean-up assessments.

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**	**Gas Condensate**
	✓	✓
Termination criteria	+ Vessel-based surveillance is undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, OR + NEBA is no longer being achieved, OR + Agreement is reached with Jurisdictional Authorities to terminate the response	

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon spill, 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.

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-2: Implementation guidance – vessel surveillance

	Action	Consideration	Responsibility	Complete
Initial Actions	Notify nearest available Support Vessel to commence surveillance.	Current Santos on hire vessels or Vessels of Opportunity (VOO) can be used. Automatic Identification System (AIS) vessel tracking is available through ER intranet page.	IMT On-Scene Commander IMT Operations Section Chief	❑
	Source additional contracted vessels if required for assistance.		IMT Logistics Section Chief	❑
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix E: Vessel Surveillance Observer Log** and provide to On-Scene Commander (Level 1 spills) or IMT (Level 2-3 spills).	Photographic images are to be taken where possible and included with surveillance forms. Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	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.	IMT Vessel Master and/or IMT On-Scene Commander	❑
Ongoing Actions	Review surveillance information to validate spill fate and trajectory.		IMT Planning Section Chief / GIS	❑
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate.		IMT Environment Unit Leader	❑
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Surveillance data is useful in updating the Common Operating Picture	IMT Planning Section Chief	❑

Table 10-3: Vessel surveillance resource capability

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Contracted vessels and vessels of opportunity	Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Availability dependent upon Santos and Vessel Contractor activities (Santos on-hire vessels include Ningaloo Vision Supply Vessel and Varanus Island Field Support Vessel).	Vessels mobilised from Dampier, Varanus Island, Exmouth or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.

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

Task		Time from IMT call-out
IMT begins sourcing Santos-contracted vessel or 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.		
Approximate steam times (from deployment location to field)		
Route	Approx. distance (nm)[16]	Approx. steam time (hrs)[17]
Dampier to Yoorn-1	57	~6
Dampier to Jelen-1 and Parnassus-1	56	~6
Varanus Island to Yoorn-1	25	~2.5
Varanus Island to Jelen-1 and Parnassus-1	57	~6
Exmouth to Yoorn-1	144	~14.5
Exmouth to Jelen-1 and Parnassus-1	176	~18

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**	**Gas Condensate**
	✓	✓
Termination criteria	+ Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, OR + As directed by the relevant Control Agency	

[16] Measured to proposed well locations

[17] Based on an average speed of 10 nautical miles per hour (10 knots)

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

10.2.1 Implementation guidance

Table 10-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 10-7** provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence initial aerial surveillance operations are listed in **Table 10-8**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-42 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 before deployment. There should be an attempt to obtain the following data during initial surveillance: + name of observer, date, time, aircraft type, speed and altitude of aircraft + location of slick or plume (global positioning system [GPS] positions, if possible) + spill source + size of the spill, including approximate length and width of the slick or plume + visual appearance of the slick (e.g. colour) + edge description (clear or blurred) + general description (windrows, patches etc.) + wildlife, habitat or other sensitive receptors observed + basic metocean conditions (e.g. sea state, wind, current) + photographic/video images.	IMT Operations Section Chief IMT Logistics Section Chief	❑

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 Offshore ER Intranet page.	IMT Operations Section Chief IMT Logistics Section Chief	❑
Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected that two overpasses 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.	IMT Operations Section Chief / IMT Aviation Superintendent	❑
Pre-flight briefing.		IMT Aerial Observers IMT Contracted aircraft provider/ pilots	❑
Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna.	IMT Operations Section Chief	❑
Determine the spill extent by completing Aerial Surveillance Log (**Appendix F: Aerial Surveillance Observer Log**) and Aerial Surveillance Surface Slick Monitoring Template (**Appendix G: Aerial Surveillance Surface Slick Monitoring Template**). Calculate volume of oil (**Appendix G: Aerial Surveillance Surface Slick Monitoring Template.** Take still and/or video images of the slick.	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code (**Appendix F: Aerial Surveillance Observer Log**).	IMT Aerial Observer	❑
Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H:**		IMT Aerial Observer	❑

Action		Consideration	Responsibility	Complete
	Aerial Surveillance Marine Fauna Sighting Record).			
	Record shoreline habitat type and degree of oiling by completing the Aerial Surveillance Shoreline Observation Log (**Appendix I: Aerial Surveillance Shoreline Observation Log**).	Thickness estimates are to be based on the Bonn Agreement Code (Santos Procedure Index).	IMT 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	IMT Aerial Observer IMT Planning Section Chief IMT Operations Section Chief	❑
Ongoing Actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Subplan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	IMT Operations Section Chief/ IMT Aviation Superintendent IMT Planning Section Chief	❑
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities		IMT Logistic Section Chief	❑
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider		IMT Planning Section Chief IMT 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	Karratha Learmonth Onslow	Wheels up within 1 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 5 x AMOSC Core Group Additional trained industry mutual aid personnel available	Perth and Varanus Island (VI) (Santos aerial observers) AMOSC and Core Group - 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
Aircraft activated for aerial surveillance	<3 hours
Aircraft 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	

Route	Approx. distance (nm)[18]	Approx. flight time (hrs)[19]
Port Hedland – Yoorn-1	165	~1.5
Port Hedland – Jelen-1 and Parnassus-1	140	~1.25
Karratha – Yoorn-1	61	~0.5
Karratha – Jelen-1 and Parnassus-1	56	~0.5
Learmonth – Yoorn-1	148	~1.25
Learmonth – Jelen-1 and Parnassus-1	182	~1.5

[18] Measured to proposed well locations

[19] At average ground speed of 120 knots

10.3 Tracking buoys

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

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

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Notification of a Level 2 or 3 spill May be deployed for a Level 1 spill if deemed beneficial by the OSC	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	+ Tracking buoy deployment will continue for 24 hours after the source is under control and a surface sheen is no longer observable, OR + As directed by the relevant Control Agency	

10.3.1 Implementation guidance

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

Table 10-11 provides a list of resources that may be used to implement this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-10: Implementation guidance – tracking buoys

	Action	Consideration	Responsibility	Complete
Initial Actions	Organise vessel to mobilise two tracking buoys from MODU.	Personnel and vessel safety is priority. Current Santos on hire vessels or VOOs can be used. AIS vessel tracking is available through ER intranet page.	IMT OSC/Operations Section Chief	❑
Initial Actions	Deploy two tracking buoys at leading edge of slick.	Note deployment details and weather conditions in incident log.	IMT Vessel Master	❑
Initial Actions	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.	IMT OSC IMT Planning Section Chief /GIS	❑
Initial Actions	Use tracking buoy data to maintain Common Operating Picture.	Data tracked online.	IMT Planning Section Chief / GIS	❑
Initial Actions	Relay information to spill fate modelling supplier for calibration of trajectory modelling.		IMT Planning Section Chief / GIS	❑
Ongoing Actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	Incident Action Plan to provide guidance regarding any additional deployments of tracking buoys.	IMT Planning Section Chief	❑
Ongoing Actions	Mobilise additional tracking buoys if required from other Santos operations (Santos presently has 12 Tracker Buoys located on the North West Shelf) or from AMOSC stockpiles.		IMT Logistics Section Chief	❑
Ongoing Actions	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.		IMT Operations Section Chief	❑

Action	Consideration	Responsibility	Complete
Deploy tracking buoys.		IMT Vessel Master	❑
Monitor movement of tracking buoys.		IMT Planning Section Chief /GIS	❑
Relay information to spill trajectory modelling supplier for calibration of trajectory modelling.		IMT Planning Section Chief /GIS	❑

Table 10-11: Tracking buoys resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Tracking buoys	Santos	2	MODU / support vessels	MODU / support vessel buoys – <2 hours for incident
		2	Exmouth	Exmouth buoys - <24 hours pending vessel availability
		8	Varanus Island, Dampier	VI/Dampier buoys – 12 hours pending vessel availability
AMOSC tracking buoys	AMOSC	6 4	Fremantle Geelong	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**)

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

	Perth	Exmouth	Dampier
Geelong	40 hrs 3,395 km	64 hrs 4,520 km	70 hrs 4,840 km
Perth	NA	15 hrs 1,250 km	19 hrs 1,530 km
Exmouth	15 hrs 1,250 km	NA	7 hrs 555 km

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

Task	Time from IMT call-out
Tracking buoys deployed from MODU / Support vessels	<2 hours
OR	
Tracking buoys deployed from VI/ Dampier using VOO	<12 hours to site pending vessel availability
OR	
Tracking buoys deployed from Exmouth using VOO	<24 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**	**Gas Condensate**
	✓	✓
Termination criteria	+ Spill fate modelling will continue for 24 hours after the source is under control and a surface sheen is no longer observable, or until no longer beneficial to predict spill trajectory and concentrations, OR + As directed by the relevant Control Agency	

Oil spill trajectory modelling uses computer modelling (e.g. OILMAP, SIMAP) to estimate the movement, fate and weathering potential of spills. Santos has engaged RPS Group to provide forecast spill fate modelling. RPS Group use SIMAP and OILMAP modelling systems that comply with Australian Standards (ASTM Standard F2067 “Standard Practice for Development and Use of Oil Spill Models”). RPS Group also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

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

10.4.1 Implementation guidance

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

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

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

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

<table>
<tr><th colspan="2">Action</th><th>Consideration</th><th>Responsibility</th><th>Complete</th></tr>
<tr><td rowspan="6">Initial Actions</td><td>Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos Procedure Index). Request for three-day forecast trajectory modelling.</td><td></td><td>IMT Environment Unit Leader</td><td>❑</td></tr>
<tr><td>Determine requirement for gas/VOC modelling and request initiation.</td><td>Hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.</td><td>IMT Safety Officer
IMT Environment Unit Leader</td><td>❑</td></tr>
<tr><td>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.</td><td></td><td>IMT Planning Section Chief / GIS</td><td>❑</td></tr>
<tr><td>Login to the RPS Group data sharing website and maintain connection. Download modelling results.</td><td>Data should be stored digitally and backed up on to independent digital storage media. All datasets should be accompanied by a metadata summary and documented quality assurance and control procedures.</td><td>IMT Planning Section Chief / GIS</td><td>❑</td></tr>
<tr><td>Place RPS Group modelling data into GIS/Common Operating Picture.</td><td>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.</td><td>IMT Planning Section Chief / GIS</td><td>❑</td></tr>
<tr><td>Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct Operational NEBA on proposed response strategies.</td><td></td><td>IMT Environment Unit Leader</td><td>❑</td></tr>
</table>

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.		IMT Planning Section Chief / GIS	❑
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy.		IMT Planning Section Chief / GIS	❑

Table 10-16: Oil spill trajectory modelling resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
RPS OST modellers and software	RPS under direct contract to Santos, also available through AMOSC	Daily OSTM reports	Perth – digital	2 to 4 hours from activation

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

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

10.5 Satellite imagery

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

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

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

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

Suitable imagery may be available via satellite imagery suppliers. This can be done through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar and visible imagery may both be of value.

10.5.1 Implementation guidance

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

Table 10-42 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.		IMT Planning Section Chief	❑
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery.	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required.	IMT Planning Section Chief	❑
	Assess suitability and order imagery.		IMT Planning Section Chief	❑
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation.		IMT GIS Team Leader IMT Planning Section Chief	❑
Ongoing Actions	Review surveillance information to validate spill fate and trajectory.		IMT Planning Section Chief	❑
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required.	Use surveillance data when updating the Common Operating Picture.	IMT Planning Section Chief	❑

Table 10-20: Satellite imagery resource capability

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Satellite Imagery	KSAT – activated through AMOSC MDA – activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	AMOSC: one hour if satellite images available OSRL: Within 4 hours of satellite image acquisition (i.e. latest pass with no cloud)

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**	**Gas Condensate**
	✓	✓
Termination criteria	+ Oil sample and analysis to terminate once enough data has been collected to profile the oil characteristics and dispersant amenability throughout weathering and to provide oil for toxicity testing, OR + As directed by the relevant Control Agency	

10.6.1 Overview

Given MDO is a common fuel type with known properties and the gas condensate analogues (Linda and Reindeer condensate) are hydrocarbons that have been previously assayed, the general physical and chemical characteristics of these hydrocarbons are known and have been presented in **Appendix A: Hydrocarbon Characteristics and Behaviour**.

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, including hydrocarbon storage and hydrocarbon disposal requirements.

10.6.2 Implementation guidance

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

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

10.6.3 Oil sampling and analysis

Laboratory analysis

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

Laboratory analysis of the chemical and physical properties of the recovered oil, including gas chromatography/mass spectrometry for the purpose of fingerprinting the oil constituents, is to be undertaken. Fingerprinting of the released hydrocarbon potentially allows contamination to be traced back to the source where this is otherwise unclear or in dispute.

Ecotoxicology assessment of the oil is to be conducted at an ecotoxicology laboratory following the revised Australian and New Zealand Water Quality Guidelines. The quantity of oil required for analysis will be confirmed by the laboratory but is expected to be in the order of 6 to 10 L of oil. Testing results will provide the concentrations at which toxicity endpoints consistent with revised Australian and New Zealand Water Quality Guidelines are met for each test. Overall species protection concentrations, including 90%, 95% and 99% species protection trigger levels are then to be generated using a species sensitivity distribution fitted to the data (e.g. by using the Burrlioz software program).

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.	IMT Operations Section Chief IMT Logistics Section Chief	❑
	Source sampling equipment. Confirm sampling methodology. Confirm laboratory for sample analysis. Develop health and safety requirements/controls.	Refer **Table 10-23** for resource availability. Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure.	IMT Environment Unit Leader IMT Safety Officer	❑
	Vessel directed to sampling location.	Sampling of oil at thickest part of slick – typically leading edge.	IMT Operations Section Chief	❑
	Vessel crew to undertake sampling and delivery of samples to Exmouth or Dampier for dispatch to laboratory. Environment Unit Leader to confirm analysis of oil with lab.	Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis.	IMT Operations Section Chief IMT Environment Unit Leader IMT Logistics Section Chief	❑
Ongoing Actions	Continue sample collection post release where oil is available.	Initial sampling 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.	IMT Operations Section Chief IMT Environment Unit Leader IMT Logistics Section Chief	❑

Table 10-23: Initial oil characterisation – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Oil sampling kits	AMOSC/Santos	3	Exmouth, Varanus Island, Dampier	Within 12 hours
Bulk oil sampling bottles	Intertek/Santos	As required	Perth Exmouth, Varanus Island, Dampier	Within 12 hours
Santos Contracted Vessel Providers Vessels of Opportunity identified through AIS vessel tracking system	Availability dependent upon Santos and Vessel Contractor activities.	Availability dependent upon Santos and Vessel Contractor activities.	Pending availability and location. Expected within 12 hours	Santos-contracted vessel providers Vessels of Opportunity identified through AIS Vessel Tracking
National Association of Testing Authorities (NATA) accredited laboratory/ personnel for analysis	Intertek	NA	Perth	24+ hours

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

Task	Time from IMT call-out
Oil sample collection	<12 hours (daylight dependent)
Oil samples arrive at lab for analysis	<36 hours
Minimum Resource Requirements	
+ 1x vessel. No special requirements. Oil sampling can be done concurrently with other tasks. + 1x oil sampling kit. + Sampling jars for bulk oil collection.	

10.7 Operational water quality monitoring

10.7.1 Operational water sampling and analysis

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

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

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Notification of a Level 2 or 3 spill	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	+ Operational water sampling and analysis will continue for 24 hours following control of the source provided oil is no longer detectable, OR + As directed by the relevant Control Agency, OR + Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.	

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

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

This monitoring is complimentary to scientific water quality monitoring (SMP1) delivered through the Oil Spill SMP in terms of methodology and required skillset and can be provided through Santos' Scientific Monitoring Provider (**Section 16**).

10.7.1.1 Implementation guidance

Refer to **Table 10-27** for the Operational Water Quality Sampling and Analysis implementation guide. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-29 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-26: Operational Water Quality Sampling and Analysis Plan considerations

Considerations for Operational Water Quality Sampling and Analysis	
Scope of work	The work scope for operational water quality monitoring will be driven by the IMT, confirming objectives for each operational period.
Survey design	The operational water sampling activities will be conducted by experienced environmental scientists and managed through the IMT Incident Action Planning process. The exact nature of the sampling activities will depend upon the objectives for each operational period; however, the sampling design and methodology will consider the following points: + Sampling locations will be moved with the slick and/or plume based on the observed or predicted location and movement of oil on water and subsea plumes. This will be informed by vessel/aerial surveillance, satellite tracking buoys and spill fate modelling. + At each discrete location, sampling will initially be conducted using a conductivity-temperature-depth (CTD) meter along a depth profile which captures the three-dimensional distribution of the oil. The CTD would require fluorometry and dissolved oxygen sensors as part of the sensor package to record the presence of oil (fluorometry) and the activity of hydrocarbon degrading bacteria (dissolved oxygen). Fluorometers appropriate to the hydrocarbon type will need to be selected. + The CTD would help inform the depth at which water samples would be taken. + For a subsea release or where surface oil is present in shallow water (<5 m) sampling 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 quality assurance and control samples incorporated into replicates. + Water samples also to be provided to an independent National Association of Testing Authorities (NATA)-accredited laboratory in Perth for hydrocarbon suite analysis including polycyclic aromatic hydrocarbons.
Analysis and reporting	+ All data collected on oil properties provided in spreadsheets (including GPS location, depth of sampling, timing, on water observations, in-situ readings and water sample label details) to IMT on an ongoing basis during spill response operations.

Considerations for Operational Water Quality Sampling and Analysis	
	+ 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 10-27: Implementation guidance – operational water quality sampling and analysis

Action		Consideration	Responsibility	Complete
Initial Actions	Activate Santos Monitoring Service Provider for Operational Water Quality Monitoring.		Environment Unit Leader	❑
	Obtain spill trajectory modelling and provide to Monitoring Service Provider.		Environment Unit Leader Planning Section Chief GIS Support	❑
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring. Plan to also consider oil characterisation sampling (**Section 10.6**)– Monitoring Service Provider to take over this sampling once mobilised.	Sites to be selected using oil spill trajectory modelling and distribution of oil from surveillance tactics. Refer **Table 10-26** for considerations for Sampling and Analysis Plan.	Monitoring Service Provider Environment Unit Leader	❑
	Develop health and safety plan including potential exposure to volatile gases/VOCs.	Refer Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016).	Monitoring Service Provider Safety Officer	❑
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment.		Monitoring Service Provider	❑
	Organise Vessels, accommodation and transport requirements to mobilise monitoring team/s to site.	Monitoring Service provider to outline requirements in resource request form.	Logistics Section Chief	❑

Action		Consideration	Responsibility	Complete
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with OSC and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.		Monitoring Service Provider On-Scene Commander Operations Section Chief Environment Unit Leader Logistics Section Chief	❑
Ongoing Actions	Monitoring results to be conveyed to IMT through Common Operating Picture and provided to spill trajectory modeller to validate predictions.		Planning Section Chief GIS Support Environment Unit Leader	❑

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

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Water quality monitoring personnel	Monitoring Service Provider (currently Astron/BMT)	Approx. 15 (based on capability reports)	Perth based	Personnel and equipment within 72 hours from approval of work scope – pending vessel availability
Water quality sampling equipment and water quality meters	Third-party suppliers via Monitoring Service Provider (currently Astron/BMT)	Multiple providers	Australia based	
Contracted water quality monitoring vessels	Santos Contracted Vessel Providers	Availability dependent upon Santos and Vessel Contractor activities; suitable vessels identified through AIS Vessel Tracking	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS Vessel Tracking Software	<72 hours

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

Task	Time from IMT call-out
IMT activates monitoring service provider.	<4 hours
Operational water quality monitoring personnel, equipment and vessel deployed to spill site.	<72 hours
Minimum Resource Requirements	
+ Water quality monitoring vessel/s – refer Santos Offshore ER Intranet for vessel specification. + Water quality monitoring team (through monitoring service provider). + Water quality monitoring equipment (through monitoring service provider).	

10.7.2 Continuous fluorometry surveys

Table 10-30 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this strategy.

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

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

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

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

Fluorometers towed behind vessels will be used as an alternative or complementary approach for a subsea release and would be preferred for surface spills and to monitor the effect of dispersant application at surface.

10.7.2.1 Implementation guidance

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

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-31: Continuous fluorometry surveys – implementation guidance

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

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

Table 10-32: Continuous fluorometry surveys – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Towed fluorometers	OSRL	Towed Fluorometers: 4 Turner C3 fluorometers globally[20]	1 in Southampton, 2 in Singapore and 1 in Fort Lauderdale	<72 hours
Glider mounted fluorometers	OSRL	Subsea glider: Qty subject to availability from OSRL contractor – one engineer from OSRL contractor to deploy and operate the Glider	Gliders based in Perth OSRL towed fluorometers out of Singapore, Southampton and Fort Lauderdale	<72 hours dependent upon availability
Water quality monitoring personnel to operate towed fluorometers	Monitoring Service Provider (currently Astron/BMT)	Approx. 15 (based on capability reports)	Perth based	<72 hours
Glider (remote) pilot/s and deployment crew	Third-party provider via OSRL	Subsea glider: Qty. subject to availability from OSRL contractor – one engineer from OSRL contractor to deploy and operate the glider	Perth based pilot and deployment crew	<72 hours dependent upon availability

[20] As per OSRL equipment stockpile status report, October 2021.

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

Task	Time from IMT call-out
IMT activates OSRL and Monitoring Service Provider.	<4 hours
Monitoring Service Provider water quality monitoring personnel deployed to site.	<72 hours
Towed fluorometers deployed to site.	<72 hours
Glider and pilot/s and deployment crew deployed (if gliders available and appropriate).	<72 hours (if gliders available and appropriate)
Minimum Resource Requirements	
+ Water quality monitoring vessel/s – refer Santos Offshore ER Intranet for vessel specification. + Water quality monitoring team (through monitoring service provider). + OSRL towed fluorometer (Turner C3).	

10.8 Shoreline clean-up assessment

Table 10-34 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this strategy.

Table 10-34: Shoreline clean-up assessment – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making	
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by OSC)	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	As directed by the relevant Control Agency	

To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character (topography, complexity, exposure, etc), degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna, etc) and information on shoreline processes and access routes that could aid or hamper response efforts. This detailed information can be collected from on-ground shoreline clean-up assessments. A well-established systematic approach known as Shoreline Clean-up Assessment Technique (SCAT) will be used to document the status of oiled shorelines in the event of a worst-case release and their subsequent treatment recommendations. The information collected through SCAT is used to inform appropriate shoreline response techniques and termination criteria (end-points) for clean-up activities.

DoT are the designated Control Agency for shoreline response within WA waters and will direct resources provided through Santos for the purposes of on-ground shoreline clean-up assessments and shoreline response activities. Santos will provide additional information on shoreline character and oiling collected as part of aerial surveillance activities carried out under its control (refer **Table 4-2**). DAWE are the designated Jurisdictional Authority for all spills that contact the shorelines of AMPs identified in this OPEP; the Santos IMT (as Control Agency for these islands as they are in Commonwealth waters) will liaise with DAWE to direct resources for the purposes of shoreline clean-up activities.

Existing information on shoreline character, distribution of habitats/fauna and access/safety constraints can be obtained from:

+ Santos Energy GIS, including habitat/fauna distribution layers and aerial imagery
+ Oil Spill Response Atlas Web Map Application
+ Pilbara Region Oiled Wildlife Response Plan
+ WA Marine Oil Pollution Risk Assessment Web Map Application (rankings and general information on protection priorities).

10.8.1 Implementation guidance

The information provided below is included for planning purposes and represents how Santos would approach shoreline clean-up assessments to support the Control Agency. In the event of a spill with the potential for shoreline contact in WA waters, DoT will control shoreline assessments and ultimately personnel supplied through Santos will follow the direction of DoT. This may differ from that included below and therefore, depending on the circumstances of the spill, may determine that some tasks be varied, should not be undertaken or should be reassigned.

Table 10-35 presents considerations for planning and conducting the assessments.

The implementation guide for Shoreline Clean-up Assessment is found in **Table 10-36**.

Table 10-37 provides a list of resources that may be used to implement this strategy and **Table 10-38** details the minimum first strike mobilisation requirements for Santos on activation.

Table 10-42 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-35*: Shoreline clean-up assessment considerations*

Considerations for Shoreline Clean-up Assessment	
Survey design	Shoreline Clean-up Assessment requires a systematic assessment of shorelines, which is typically undertaken in a number of stages (according to the extent of the spill): + Reconnaissance surveys: designed as an initial phase (or further as required, such as inaccessible shorelines) to characterise the distribution, extent, and condition of shoreline habitats + Continual monitoring surveys: monitors hydrocarbon spill extent at the shoreline to assess the potential impact, extent of actual impact, and the effectiveness of clean-up. A shoreline clean-up assessment may include the following tasks: + Assessment of shoreline character, habitats and fauna, including: – shoreline structured biotic habitats – distribution of fauna – shoreline and processes (e.g. wave, tidal flows – shoreline substrate (e.g. mud, sand, pebble, rock)

Considerations for Shoreline Clean-up Assessment	
	– shoreline form (e.g. width, shape and gradient) – access/safety constraints. + Assessment of shoreline oiling (if present): – surface distribution and cover – subsurface distribution – oil type, thickness, concentration and physical character – sampling of oil for laboratory analysis. + Recommendations for response: – applicable strategies based on oil type and habitat – potential access, safety and environmental constraints – likely resourcing (personnel and equipment) requirements. Surveys undertaken on foot, by vehicles or by small vessel will occur at prioritised areas (access permitting) to provide a close-range assessment of shoreline physical characteristics, coastal habitats/fauna, scale and character of oiling and safety/access constraints. Shoreline clean-up assessment team leaders will include personnel from AMOSC Core Group, State and National Response Team and OSRL, or contracted staff who have completed SCAT training. Team members may include personnel who have completed a brief training course and are supervised on the job by team leaders, particularly for deployment to locations that are not contacted in the first few weeks of the spill. The deployment of survey teams will be directed by DoT as the HMA and Control Agency for coastal/shoreline pollution in WA. The deployments will be informed by the observed and predicted contact of oil and from existing baseline information on shoreline character. Shoreline surveys will be undertaken within segments that are recorded and/or mapped that share common traits based on coast geomorphology, habitat type, fauna presence, level of oiling or access. Information on shoreline character and habitat/fauna distribution for each segment should be recorded through the use of: + still or video imagery collected with simultaneous GPS acquisition + field notes together with simultaneous GPS acquisition + mud maps outlining key natural features, oil distribution, imagery locations of quantitative data (transects, oil samples) + transects (cross-shore, longshore) and vertical sediment profiles. + samples of oil and/or oiled sediments. The parameters that should be assessed are: + physical characteristics: rocky, sandy beach, flat, dune, other wetland + major habitat types: mangrove, salt marsh, saltpan flats, fringing reef, rubble shore, seagrass verge + coastal fauna and key habitats (e.g. nests) including quantification/distribution of oiled fauna + state of erosion and deposition: deposition, erosion, stable + human modified coastline (access tracks, facilities, etc) + oil character, if present, including appearance, surface thickness, depth (into sediments), distribution, area and percentage cover.

Considerations for Shoreline Clean-up Assessment	
Analysis and reporting	Shoreline survey reports to be submitted to the Control Agency IMT at completion of assessments. All raw data collected will be included as appendices to the report and provided in a geospatial format for subsequent use in GIS mapping software.

Table 10-36: Shoreline clean-up assessment – implementation guidance

	Action	Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to WA DoT have been made.	Refer to **Section 7** for reporting requirements.	IMT Environment Unit Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for assistance in identification of priority protection areas and Operational NEBA.	Existing shoreline sensitivity mapping information for potential oil contacted locations is available on the Santos ER intranet site.	IMT Environment Unit Leader IMT Planning Section Chief	❑
	Actions below are indicative only and are at the final determination of the Control Agency			
	Mobilise the AMOSC core group responders as required for industry support to DoT.	Refer to **Table 10-37**. Unmanned Aerial Vehicles (UAVs) may be necessary for some sensitive environments and where personnel safety is at risk	IMT Incident Commander IMT Operations Section Chief IMT Logistics Section Chief	❑
	Conduct assessment of shoreline character, habitats and fauna.	Refer to **Table 10-35**. Refer to the WA DoT Shoreline Assessment Form for spills contacting WA shorelines.	AMOSC Core group and Control Agency	❑
	Conduct assessment of shoreline oiling (if present).	Refer to **Table 10-35**.	AMOSC Core group and Control Agency	❑
	Develop recommendations for clean-up activities and clean-up end-points and communicate recommendations and SCAT forms back to IMT at the end of each operating period.	Refer to **Table 10-35**.	AMOSC Core group and Control Agency	❑

Table 10-37: Shoreline clean-up assessment – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos and industry AMOSC core group staff and responders (team leaders)	Santos Core Group Industry Core Group, AMOSC staff	12 (Santos core group) 60+ (industry core group ops)	Perth, Dampier, Varanus Island and other NWS locations	<24 hours from time of shoreline contact prediction
Shoreline assessment team members	Santos contracted Work Force Hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)
Drones and pilots ** 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, 1-2 days if within Australia

Table 10-38: Shoreline clean-up assessment – first strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction and begins sourcing personnel for shoreline clean-up assessment team.	<4 hours
AMOSC core group and drone pilots (shoreline clean-up assessment personnel) mobilised to deployment location.	<24 hours
Minimum Resource Requirements	
+ Minimum two AMOSC core group personnel to undertake initial vessel or ground surveys + Two AMOSC drone pilots trained in SCAT to undertake initial reconnaissance surveys + Two AMOSC drones.	

10.8.2 Resourcing requirements

Shoreline clean-up assessment teams will comprise 2-3 members per team and are assumed to be able to cover approximately 10 km per team per day. Teams may be able to exceed this distance, especially if remote sensing techniques (UAVs) are employed to cover shorelines that have access limitations, which includes many receptor locations in the EMBA.

Santos has used both stochastic and deterministic modelling data for shoreline contact and satellite imagery to plan for the worst-case shoreline and habitat assessment personnel requirements. **Table 10-39** presents all receptors contacted at >100 g/m² using the stochastic modelling results for the surface LOWC (the worst case) along with the SCAT planning considerations and estimated number of SCAT teams required.

It should be noted that not all of the receptors listed in **Table 10-39** will be contacted by one single spill. These results are presenting the range of possible worst-case timeframes to contact, and length contacted based on all runs that make up the stochastic model. Santos will use initial operational monitoring data (e.g. trajectory modelling and aerial surveillance) to determine where resources should be allocated. This may include directing resources to conduct SCAT at locations not identified as protection priority areas, to determine if protection and clean-up activities may be required at these receptors.

Initially, shoreline clean-up assessment may be conducted via reconnaissance (aerial surveillance) surveys and later confirmed via ground and/or vessel surveys. For example, **Table 10-39** shows Montebello Islands may be contacted within 0.3 days, therefore reconnaissance surveys may be employed to provide initial assessments for these remote shorelines.

In addition to stochastic data, deterministic data has been used to further inform SCAT resourcing planning. For Yoorn-1, deterministic run #111 (surface LOWC) was selected to guide resourcing estimates for SCAT, which was the simulation resulting in the highest accumulated shoreline mass of 2,713 tonnes on all shorelines (GHD, 2020a). For Jelen-1 and Parnassus-1 (GHD, 2020b), deterministic run #134 (surface LOWC) was selected to guide resourcing estimates for SCAT, which was the simulation resulting in the highest accumulated shoreline mass of 377 tonnes on all shorelines (GHD, 2020b). These runs have been selected to compare the shoreline clean-up assessment needs against the stochastic shoreline clean-up assessment needs (**Table 10-39**).

For worst-case personnel requirements for Yoorn-1 (based on deterministic realisation #111), Ningaloo Coast North presents the greatest resource requirement of 32-48 personnel (up to 16 teams of 2-3 members each) (**Table 10-40**). For Jelen-1 and Parnassus-1 (based on Dancer-1 deterministic realisation #134), both Ningaloo Coast North and Barrow Island (including Boodie Island) present the greatest resource requirement of 10-15 personnel (up to 5 teams of 2-3 members each) (**Table 10-41**).

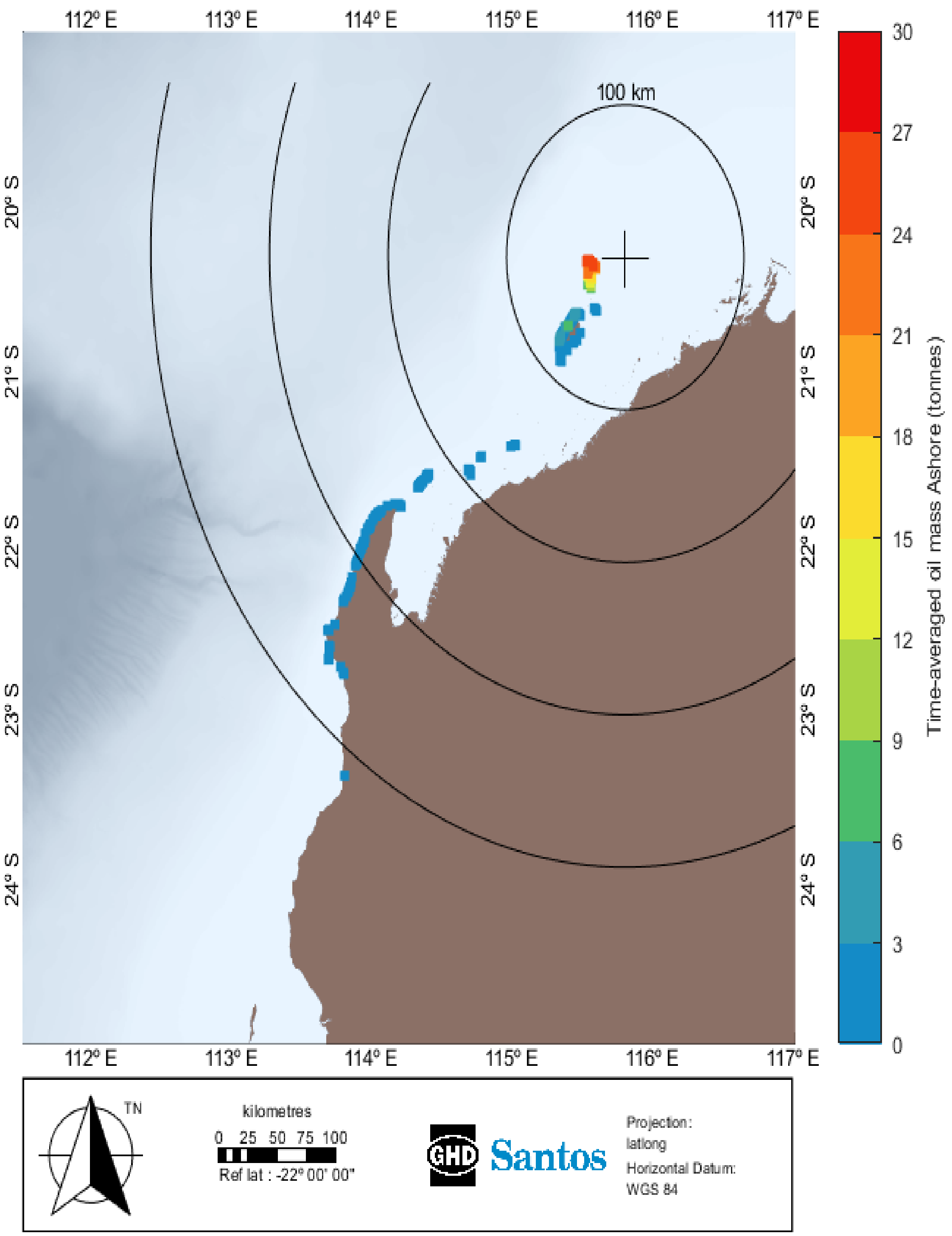
SCAT team leaders will be sourced from multiple sources within the industry, including Santos, AMOSC, OSRL and industry Core Group and will have existing training in SCAT. Team members can include personnel who have completed basic training prior to mobilisation.

Table 10-39: Resource requirements for shoreline clean-up assessment for all locations contacted >100 g/m² based on stochastic results

Location	Minimum time (days) to contact with receptor >100 g/m² from stochastic results	Maximum length (km) of shoreline oiling > 100 g/m²	Planning Considerations	No. of Assessment teams required
Yoorn-1 surface LOWC scenario (GHD, 2020a)				
Clerke Reef MP	56.4	8.5	Remote offshore Islands with limited access (beach access).	1
imperieuse Reef MP	43.5	4.2		1
Dampier Archipelago	9.0	17.0	Nature reserve Islands with limited access (beach access).	2-3
Northern Islands Coast	70.8	4.2	Mainland location, moderately good access	1
Montebello Islands	0.3	38.2	Offshore Islands with varied access. Facilities exist at Thevenard and Barrow Islands.	3-4
Lowendal Islands	2.2	4.2		1
Barrow Island	3.1	59.5		5-6
Thevenard Islands	7.4	8.5		1
Southern Islands Coast	5.9	12.7	Mainland location, difficult access to some shorelines and islands	1-2
Muiron Islands	7.0	12.7	Offshore Island with limited access (beach access)	1-2
Ningaloo Coast North	7.3	80.7		8

Location	Minimum time (days) to contact with receptor >100 g/m^2 from stochastic results	Maximum length (km) of shoreline oiling > 100 g/m^2	Planning Considerations	No. of Assessment teams required
Ningaloo Coast South	41	4.2	Mainland locations, moderately good access	1
Outer Shark Bay Coast	51.5	4.2		1
Jelen-1 and Parnassus-1 surface LOWC scenario (GHD, 2020b)				
Dampier Archipelago	32.3	3.5	Nature reserve Islands with limited access (beach access).	1
Montebello Islands	2.2	28.4	Offshore Islands with varied access. Facilities exist at Thevenard and Barrow Islands.	2-3
Lowendal Islands	12.9	3.5		1
Barrow Island	9.8	14.2		1-2
Thevenard Islands	38.9	3.5		1
Southern Islands Coast	7.4	10.6	Mainland location, difficult access to some shorelines and islands	1
Muiron Islands	8.5	10.6	Offshore Island with limited access (beach access)	1

Note: SCAT numbers not to be added up as spill will not contact all receptors modelled (as these are stochastic results). Number of personnel required will be based on direction of spill and timeframes to contact.



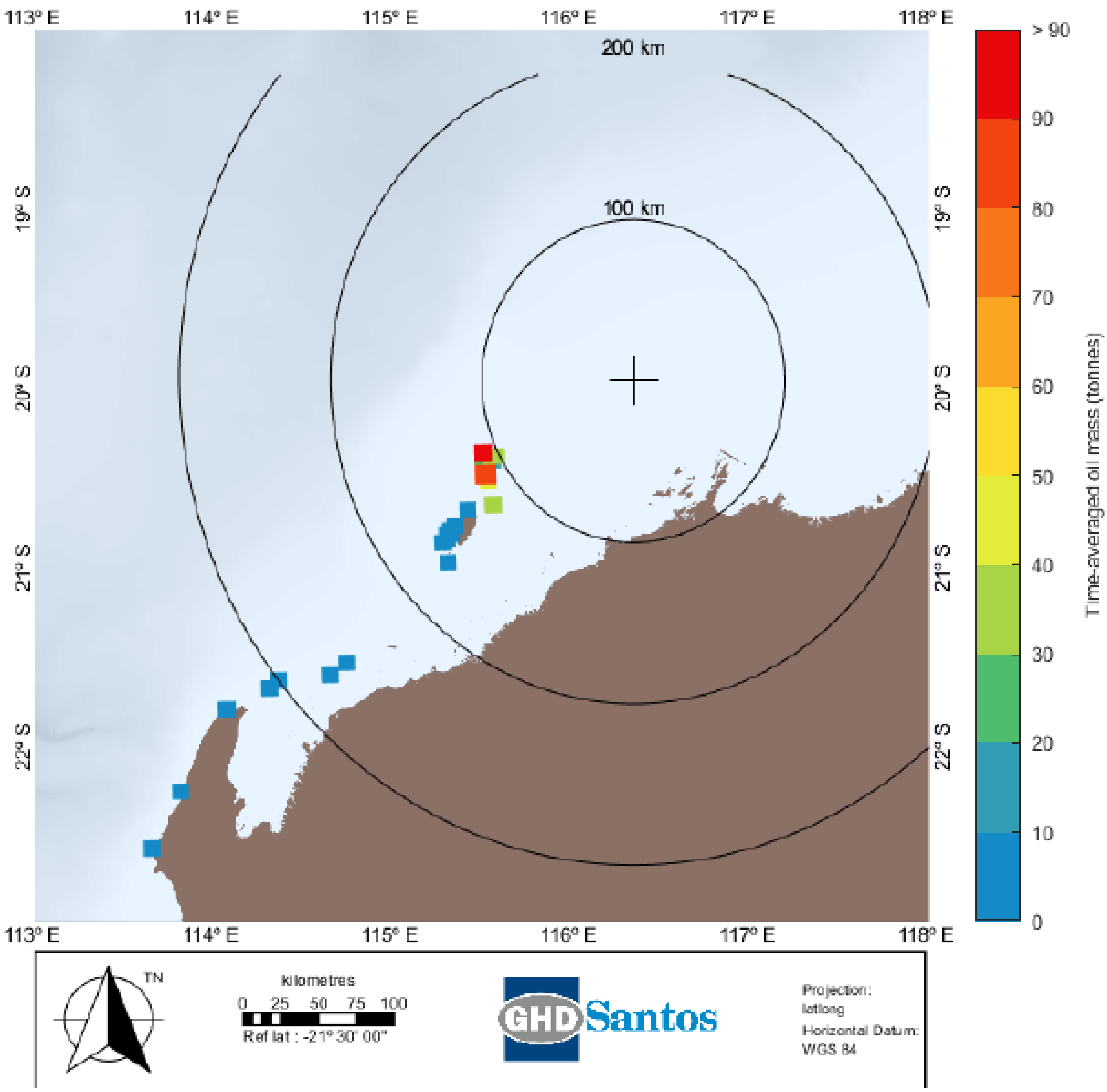
Source: (GHD, 2020a)

Figure 10-1: Yoorn-1 surface LOWC scenario realisation #111 – shoreline loading >10 g/m^2

Table 10-40: Yoorn-1 resource requirements (all locations grouped by PPA) for shoreline clean-up assessment based on deterministic run #111 (Figure 10-1)

PPAs contacted	Estimated No. of teams required
Montebello Islands	2
Lowendal Islands	1
Barrow Island (inc. Boodie Island)	4-5
Thevenard Islands	1
Southern Islands Coast (Serrurier Island and Bessieres Island)	1-2
Muiron Islands	2
Ningaloo Coast North	14-16
Ningaloo Coast South	1
Total estimated SCAT teams required	**26-30**

Source: (GHD, 2020a)



Source: (GHD, 2020b)

Figure 10-2: Jelen-1 and Parnassus-1 (Dancer-1 modelling) surface LOWC scenario realisation #134 – shoreline loading >10 g/m²

Table 10-41: Jelen-1 and Parnassus-1 (Dancer-1 modelling) resource requirements (all locations grouped by PPA) for shoreline clean-up assessment based on deterministic run #134 (Figure 10-2)

PPAs contacted	Estimated No. of teams required
Montebello Islands	2
Lowendal Islands	1
Barrow Island (inc. Boodie Island)	4-5
Southern Islands Coast (Serrurier Island and Bessieres Island)	1-2
Muiron Islands	2
Ningaloo Coast North	3-5
Total estimated SCAT teams required	**13-17**

Source: (GHD, 2020b)

10.9 Environmental performance

Table 10-42: 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**
	Response preparedness		
Monitor and Evaluate – vessel and aerial surveillance	Maintenance of Master Services Agreements (MSAs) with multiple vessel providers	Santos maintains MSAs with multiple vessel providers as specified in **Table 10-3.**	MSAs with multiple vessel providers
	MSA with aircraft supplier	MSA in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos trained Aerial Observers	Santos maintains a pool of trained aerial observers	Exercise Records Training Records
	AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Access to certified UAV providers	Maintenance of contract for access to UAV providers	Maintenance of contract with service provider
	Aircraft charter companies for fauna observations	Maintain a list of aircraft charter companies that	List of providers

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		could potentially provide fauna observation services	
Monitor and Evaluate – vessel and aerial surveillance	**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' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	Vessel contractor procedures align with Santos's Protected Marine Fauna Interaction and Sighting Procedure
		Aircraft comply with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance	Minimum first strike resource requirements mobilised in accordance with **Table 10-8.**	Incident log
		Following initiation two passes per day of spill area	Incident log; Incident Action Plan

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		by observation aircraft provided	
		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 2 tracker buoys on the MODU and access to 10 tracker buoys in Varanus Island/Dampier throughout the activity	Computer tracking software Tracker buoy tests
Monitor and Evaluate – tracking buoys	**Response Implementation**		
	Tracking buoy mobilisation	Minimum requirements mobilised in accordance with **Table 10-11.**	Incident log
Monitor and Evaluate – oil spill modelling	**Response Preparedness**		
	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract
		Access to additional spill modelling capability to ensure redundancy.	Membership in place with OSRL
Monitor and Evaluate – oil spill modelling	**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

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 – 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
Monitor and Evaluate – satellite imagery	**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 as per **Table 10-23.**	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Entrained oil monitoring equipment and services	Maintenance of arrangements to enable access to fluorometry services throughout activity	Arrangement with provider of fluorometry equipment
	Water quality monitoring vessels	Maintenance of vessel specification for Water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil sampling kits pre-positioned at Exmouth, Dampier and Varanus Island	Evidence of deployment to site
Monitor and Evaluate – oil and oil in water monitoring	**Response Implementation**		
	Initial Oil Characterisation	Minimum requirements mobilised in accordance with **Table 10-24.**	Incident Log
		Oil samples sent to laboratory for initial fingerprinting	Incident Log

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**
		Oil samples to be sent immediately for laboratory ecotoxicity testing of oil	Incident Log
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results (minimum five species' tests) within 24 hours of receiving all results	Ecotoxicity report from environmental contractor
	Operational oil and oil in water monitoring	IMT activates monitoring service provider within four 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
		Daily report including fluorometry results provided to IMT	Incident Log
Monitor and Evaluate – shoreline clean-up assessments	**Response Preparedness**		
	SCAT trained personnel are available	Access to SCAT trained personnel capability as outlined in **Table 10-37** and **Table 10-38**. Maintain capability throughout activity through AMOSC Core Group, DoT State Response Team, AMSA National Response Team and OSRL.	AMOSC Participating Member Contract, MoU for access to National Plan resources through AMSA, OSRL Associate Contract
	Response Implementation		
	SCAT	SCAT trained personnel are mobilised as per the numbers and deployment schedules provided in **Table 10-38**	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**
		SCAT will be implemented under the direction of the Control Agency	Incident Log
		SCAT team leader positions will be filled with personnel trained in shoreline clean-up assessment techniques	Training records
		Santos will make available AMOSC Core Group Responders for SCAT positions to the Control Agency (i.e. DoT)	Incident Log
		If required ongoing shoreline assessment teams will be available to meet the requirements specified in **Table 10-40** and **Table 10-41**	Incident Log
		SCAT reports provided to the IMT daily detailing the assessed areas to maximise effective utilisation of resources	Incident Log
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT)	Vessel specification documentation contained in IAP
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/ nearshore habitat/ bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/nearshore habitat/bathymetry assessment is conducted prior to nearshore activities	IAP records assessment records

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**
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat	Unless directed otherwise by the designated Control Agency (i.e. DoT), demarcation zones are mapped out in sensitive habitat areas	IAP demonstrates requirement is met
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT), action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met

11 Mechanical dispersion

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

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

Environmental Performance Outcome	To create mixing for oil and water to enhance natural dispersion	
Initiation criteria	Operational monitoring identifies thin oil patches at sea surface that are not naturally dissipating in sea surface and is posing risks to wildlife and shorelines by remaining on the surface	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	+ There is no longer a noticeable reduction of surface oil resulting from the activity, or + NEBA is no longer being achieved; or + Unacceptable safety risks associated with gas and VOCs at the sea surface, or + Agreement is reached with Jurisdictional Authorities to terminate the response	

11.1 Overview

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

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

11.2 Implementation guidance

Table 11-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

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

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.	IMT Operations Section Chief IMT Environment Unit Leader IMT Planning Section Chief	❑
	Safety Officer to develop a safety plan for the activity with respect to potentially dangerous gasses and VOCs (including applicable controls).		IMT Operations Section Chief IMT Safety Officer	❑
	Notify vessel-based responders to trial mechanical dispersion.		IMT Operations Section Chief	❑
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Section Chief for inclusion in Operational NEBA.		IMT Vessel Master/s IMT Santos/ AMOSC Core Group Responders	❑

Table 11-3: Mechanical dispersion resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Vessels undertaking other activities	Santos contracted vessel providers	Availability dependent upon Santos and Vessel Contractor activities.	Exmouth, Dampier, Varanus Island, NW locations. Locations verified through AIS Vessel Tracking Software.	Varies subject to location/ availability

11.3 Environmental performance

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

Table 11-4: Environmental performance – mechanical dispersion

Environmental Performance Outcome	To create mixing for oil and water to enhance natural dispersion		
Response Strategy	**Control Measures**	**Performance Standard**	**Measurement Criteria**
Mechanical Dispersion	**Response Preparedness**		
	Mechanical Dispersion Plan Safety Plan Operational NEBA	Mechanical dispersion is to be conducted during daylight only, once the safety plan has been developed and Operational NEBA confirms suitability and environmental benefit	Incident Log IAP

12 Shoreline protection and deflection plan

Table 12-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 12-1: Shoreline protection and deflection – objectives, initiation criteria and termination criteria

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities	
Initiation criteria	+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted, and + Approval has been obtained from the relevant Control Agency to initiate the response strategy	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	+ NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s, and + Agreement is reached with Jurisdictional Authorities to terminate the response strategy	

12.1 Overview

Protection and deflection tactics are utilised to divert hydrocarbons away from sensitive shoreline receptors and are more effective if they are deployed ahead of spill contact. They are typically used to protect smaller, high priority sections of shoreline.

The effectiveness of this response will be dependent on spill characteristics, hydrocarbon type, and the operating environment. Due to the very light nature of the reservoir hydrocarbon and the rapid natural dispersion predicted by the modelling, the opportunity to deploy effective protection and deflection tactics may be limited. However, protection and deflection may be beneficial where sensitive resources are threatened over the life of the LOWC release. Deployment is subject to safety constraints such as the potential grounding of vessels.

Protection and deflection is part of an integrated nearshore/shoreline response to be managed by the relevant Control Agency (refer to **Table 4-2**). Where Santos is not the Control Agency, it will undertake first-strike protection and deflection activities as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline protection. Santos will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 10**). DoT are the relevant Control Agency for spills that contact the shorelines of WA State waters.

DAWE are the designated Jurisdictional Authority for all spills that contact the shorelines of AMPs identified in this OPEP; the Santos IMT (as Control Agency for these islands as they are in Commonwealth waters) will liaise with DAWE to direct resources for the purposes of shoreline clean-up activities.

In the event of a spill with the potential for shoreline contact where Santos is not the Control Agency, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by the relevant Control Agency and therefore may differ from that included below.

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

Shoreline protection and deflection techniques include:

+ nearshore booming, which can involve different booming arrangements including:
  - exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
  - diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
  - deflection booming: booms deflect the spill away from an area requiring protection.
+ berms, dams and dikes – uses sandbags or embankments to exclude oil from sensitive areas
+ shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up)
+ passive recovery – uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline
+ non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, currents/tides and wind conditions and the available resources.

12.2 Implementation guidance

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 12-3** 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 protection and deflection operations, unless directed otherwise by the relevant control agency, are listed in **Table 12-4.** The Incident Commander of the Control Agency's IMT (once they assume control) is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 12-2: Implementation guidance – shoreline protection and deflection

	Action	Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to the relevant Control Agency have been made.	Refer to **Section 7** for reporting requirements.	IMT Environment Unit Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for confirmation of priority protection areas and NEBA.		IMT Environment Unit Leader IMT Planning Section Chief	❑
	Actions below are indicative only and are at the final determination of the relevant Control Agency.			
	Conduct Operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline clean-up assessments (**Section 10.8**).	Pre-existing TRPs exist for the majority of the Priority Protection areas, further described in **Section 6.6.1**. TRPs are available on the Santos ER Intranet page[21].	IMT Environment Unit Leader	❑

[21] Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA.

Action		Consideration	Responsibility	Complete
	If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area.	Shoreline Protection Plan may include (but not be limited to): + priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations) + locations to deploy protection and deflection equipment + permits required (if applicable) + protection and deflection tactics to be employed for each location + list of resources (personnel and equipment) required + logistical arrangements (e.g. staging areas, accommodation, transport of personnel) + timeframes to undertake deployment + access locations from land or sea + frequency of equipment inspections and maintenance (noting tidal cycles) + waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes + no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first) + shift rotation requirements.	Operations Section Chief Planning Section Chief Environment Unit Leader	❑
	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency.	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines.	Operations Section Chief Logistics Team Leader	❑

	Action	Consideration	Responsibility	Complete
	Deploy shoreline protection response teams to each shoreline location selected and implement response.	If passive recovery and/or non-oiled debris removal has been selected as a tactic, ensure deployment activities prioritise their implementation prior to hydrocarbon contact.	Operations Section Chief On-Scene Commander	❑
Ongoing Actions	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities.		Environment Unit Leader	❑
	Report to the Operations Section Chief on the effectiveness of the tactics employed.		Shoreline Response Programme Manager – AMOSC Core Group responder	❑
	Response teams to conduct daily inspections and maintenance of equipment.	Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of the Control Agency. Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers.	Shoreline Response Programme Manager	❑

12.3 Shoreline Protection and Deflection Resources

Shoreline protection and deflection equipment available for use by Santos is a combination of Santos owned, AMOSC, AMSA, DoT and OSRL equipment as well as other industry resources available through the AMOSPlan mutual aid arrangements (**Table 12-3**).

Shoreline protection and deflection personnel available to Santos is a combination of AMOSC Staff, AMOSC Core Group Responders (comprising AMOSC trained Santos and Industry personnel), OSRL responders, State Response Team members and National Response Team members.

The level of deployment of equipment and personnel for protection and deflection operations will be commensurate to the spatial extent of shoreline contact, further described in **Section 12.4**, the volume and minimum time of oil arriving and the sensitivity and access constraints of the shoreline in question.

Table 12-3: Shoreline protection and deflection – resource capability

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
AMOSC nearshore boom and skimming equipment	AMOSC	Beach Guardian (98 x 25 m lengths) Zoom Boom (199 x 25 m lengths) HDB Boom (two 200 m lengths) Curtain Boom (58 x 30 m lengths) Skimmers: Passive Weir GT 185 Desmi 250 Weir Ro-skim Weir boom	Broome –4; Exmouth – 20; Fremantle – 23; Geelong – 51 Broome –8; Exmouth – 20; Fremantle – 30; Geelong – 141 Broome – 2 Fremantle – 18; Geelong – 40 Exmouth –1; Fremantle –1; Geelong –1 Exmouth –1; Geelong –1 Geelong –1 Geelong – 2	Response via duty officer within 15 minutes of first call; AMOSC personnel available within one hour of initial activation call. Equipment logistics varies according to stockpile location For mobilisation timeframes refer to **Table 10-12**
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Structureflex inflatable Versatech zoom inflatable Slickbar – solid buoyancy Structureflex – solid buoyancy Structureflex – land sea Skimmers: None for inshore HFO or heavy crude	Karratha – 5 Karratha –10; Fremantle – 15 Karratha –5; Fremantle – 13 Karratha – 2 Karratha –3; Fremantle – 10 Karratha – 30; Fremantle – 30, other locations around Australia	Access to National Plan equipment through AMOSC For mobilisation timeframes refer to **Table 10-12**

Equipment Type/ Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos owned nearshore boom/skimming equipment	Santos	Beach Guardian (8 x 25 m lengths) Zoom Boom (16 x 25 m lengths) 2 x Desmi DBD16 brush skimmer	Varanus Island (VI) VI One each: Dampier and VI	Within 12 hours for deployment by vessel from VI
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle – 2 Geelong – 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	12	Perth/NW Australia facilities – 10 Port Bonython (South Australia) – 2	From 24 hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation

12.4 Worst-case resourcing requirements

Protection and deflection resourcing requirements have been determined from deterministic modelling for affected shorelines based on the highest shoreline loading and considering predicted times to contact, and also considering the predicted beaching locations (**Figure 10-1** and **Figure 10-2**) alongside satellite imagery. Deterministic run #111 from Yoorn-1 modelling (surface LOWC) (GHD, 2020a) and deterministic run #134 from Jelen-1 and Parnassus-1 (Dancer-1) modelling were considered, which were the simulations resulting in the highest accumulated shoreline loading. Deterministic run #111 was selected as this run contacted a greater number of shorelines (refer to **Table 10-40** and **Table 10-41**). Minimum arrival times and maximum length of shoreline oiled were informed from the stochastic modelling (refer to **Table 10-39**).

This deterministic run does not include all possible spill scenarios and that a single spill may contact other receptors and at different volumes, as presented in **Section 6.3**. However, the selection of this run will provide the worst-case shoreline loading scenario on which to base protection and deflection response preparedness arrangements.

Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and DoT and have been developed for most mainland and offshore island PPA's (refer to **Section 6.6.1**).

12.4.1 Offshore Islands

The islands in the EMBA are a mixture of large islands, such as Barrow Island, and smaller uninhabited islands, including Muiron Islands. Access to many of these islands will be limited to shallow draft vessels, or larger vessels supported by smaller shallow draft vessels. Helicopters may also be deployed to deliver equipment and personnel and remove collected waste.

Island locations contacted over the course of the 77-day release from Yoorn-1 deterministic run #111 are shown in **Table 12-4**. The arrival of hydrocarbons at these locations occurs within 7 days (based on the stochastic modelling data). **Table 12-4** shows the estimated required protection and deflection resources. There may be limited opportunity to stagger teams across these island locations to set up and monitor protection and deflection boom due to the predicted contact times (i.e. all occurring within the first week). The earliest shoreline arrival time is at Montebello island, with contact predicted in 0.3 days (~7 hours).

Table 12-4: Resource requirements at offshore islands (all locations grouped by PPA) for protection and deflection based on Yoorn-1 modelling deterministic run #111 (Figure 10-1)

PPAs contacted	Time to contact (days)*	Max length of shoreline oiled >100 g/m^2 (km)*	Estimated No. of required protection and deflection teams resources (and remarks)
Montebello Islands	0.3	38.2	4 teams to implement and monitor protection and deflection resources across these locations (although these islands are small, a greater number of teams may be required due to the predicted contact times)
Lowendal Islands	2.2	4.2	
Barrow Island (inc. Boodie Island)	3.1	59.5	
Thevenard Islands	7.4	8.5	1 team to implement and monitor protection and deflection resources across this location

PPAs contacted	Time to contact (days)*	Max length of shoreline oiled >100 g/m² (km)*	Estimated No. of required protection and deflection teams resources (and remarks)
Southern Islands Coast (Serrurier Island and Bessieres Island)	5.9	12.7	2 teams to implement and monitor protection and deflection resources across these locations (although these islands are small, 2 teams may be required in case both islands are contacted simultaneously)
Muiron Islands	7.0	12.7	2 teams to implement and monitor protection and deflection resources across these locations (although these islands are small, 2 teams may be required in case both islands are contacted simultaneously)

* Informed by the corresponding stochastic modelling (GHD, 2020a)

12.4.2 Mainland locations

Mainland locations contacted over the course of the 77-day release from Yoorn-1 deterministic run #111 are shown in **Table 12-5**. The predicted arrival of hydrocarbons at these locations ranges from 7 days to 41 days (based on the stochastic modelling data). **Table 12-5** shows the estimated required protection and deflection resources. 3 teams will be staggered across these locations to implement protection and deflection from day 7 to day 41. It is assumed that given the staggered shoreline contact, teams will be able to move between locations to set up and monitor protection and deflection boom.

Table 12-5: Resource requirements at mainland locations (all locations grouped by PPA) for protection and deflection based on Yoorn-1 modelling deterministic run #111 (Figure 10-1)

PPAs contacted	Time to contact (days)*	Max length of shoreline oiled >100 g/m² (km)*	Estimated No. of required protection and deflection resources
Ningaloo Coast North	7.3	80.7	3 teams to implement and monitor protection and deflection resources across these locations
Ningaloo Coast South	41.0	4.2	

* Informed by the corresponding stochastic modelling (GHD, 2020a)

12.4.3 Resourcing

Capability allows for mobilisation of protection and deflection resources in **Section 12.3** by day 1 if required (**Table 14-6**). The earliest shoreline arrival time is at Montebello Island **(Table 12-4**), with contact predicted in 0.3 days (~7 hours). Due to this very short timeline and the remoteness of this island, protection and deflection resources will not be able to be deployed in time to intercept first contact, however, would be set up for the ongoing response. Lowendal Islands and Barrow Island (including Boodie Island) are contacted in 2.2 and 3.1 days, respectively. Through the mutual aid arrangement, Santos will leverage from existing Chevron capabilities on Barrow Island to assist with protection and deflection deployment.

From the deterministic modelling all other island and mainland receptors have longer contact times (**Table** 12-4 and **Table 12-5**) between 2.2 days and 41 days, allowing sufficient time to organise, mobilise and deploy protection and deflection personnel and equipment prior to hydrocarbon contact, guided by the ongoing operational NEBA. A typical shoreline protection and deflection team would consist of 12 personnel as a minimum, comprised of the following:

- 1 x Protection and Deflection Supervisor/ Incident Commander
- 1 x Shallow draft vessel skipper
- 1 x Shallow draft vessel deck-hand
- 9 x Protection and deflection operatives.

A minimum of 4 teams (a total of 48 personnel) would be required to cover these initial contact locations; this is based on 1 team deployed to Montebello Island, 1 team deployed to Lowendal Islands and 2 teams deployed to Barrow Island. A further 8 teams would be required to cover the receptors contacted through the life of the spill, assuming resources will be able to set up and monitor protection and deflection boom across multiple locations (specified in **Table 12-4** and **Table 12-5**). The total required teams for the worst-case P&D response is 12, noting that there may be further opportunities to stagger teams across receptors as the spill develops.

The resourcing requirements will be determined based on feedback from SCAT activities, on operational NEBA, and in consultation with DoT as the Control Agency. Shoreline effort will likely consist of a combination of protection and deflection and clean-up, with resources often working together and/or in parallel.

Table 12-6: Shoreline protection and deflection – first strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirm if protection of shoreline sensitivity/s is required and begins sourcing resources	<4 hours
Santos Core Group mobilised to deployment port location	<12 hours
Protection booming equipment mobilised to deployment port location	<12 hours
Waste storage equipment mobilised to deployment port location	<12 hours
Boom deployment vessel mobilised to deployment port location	<12 hours
AMOSC Staff and Industry Core Group mobilised to deployment port location	<24 hours
Protection/deflection operation mobilised to protection location	<24 hours (weather/daylight dependent)
Minimum Resource Requirements	
NB: Resource requirements for protection and deflection will be situation/receptor specific. TRPs, if developed for the area/receptor will outline suggested resource requirements. TRPs are held by Santos and DoT. For further description on relevant TRPs refer to **Section 6.6.1**). Indicative first strike resources for a single site protection area are: + One small vessel suitable for boom deployment + Shoreline (e.g. Beach Guardian) and nearshore booms (e.g. Zoom Boom) plus ancillary equipment (e.g. anchors, stakes) sufficient for protection of shoreline resource + One skimmer appropriate for oil type + Waste storage equipment + One Protection and Deflection Team + Personal protective equipment	

12.5 Environmental performance

Table 12-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-7: Environmental performance – shoreline protection and deflection

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response Preparedness**		
	Access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity as per **Table 12-3**.	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
	Small vessel providers for nearshore booming operations	Maintenance of a list of small vessel providers for Dampier, Exmouth and Broome regions	List of small vessel providers
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 12-4** unless directed otherwise by Control Agency	Incident log
	Shoreline Protection and Deflection Plan	Santos IMT to confirm protection priorities in consultation with Control Agency	IAP/Incident Log
		Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing
		IAP Shoreline Protection and Deflection Sub-plan developed to provide oversight and management of shoreline protection and deflection operation	Records indicate IAP Shoreline Protection and Deflection Sub-plan prepared prior to shoreline protection and deflection operations commencing

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		NEBA undertaken each operational period by the relevant Control Agency to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP/Incident Log
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination	Incident Log IAP
	Spill response activities selected on basis of a Net Environmental Benefit Analysis	A NEBA is undertaken for every operational period	Incident Log contains NEBA
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT)	Vessel specification documentation contained in IAP.
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT), a shoreline/nearshore habitat/bathymetry assessment is conducted prior to nearshore activities	IAP records assessment records

13 Shoreline clean-up plan

Table 13-1: Shoreline clean-up – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery	
Initiation criteria	+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be, or have been, contacted + NEBA indicates shoreline clean-up will benefit receptors, and + Approval has been obtained from the Control Agency to initiate response strategy	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	+ As directed by DoT	

13.1 Overview

Shoreline clean-up aims to remove hydrocarbons from shorelines and intertidal habitat to achieve a net environmental benefit. Removal of these hydrocarbons helps reduce remobilisation of hydrocarbons and contamination of wildlife, habitat and other sensitive receptors. Shoreline clean-up is often a lengthy and cyclical process, requiring regular surveys to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be managed by the relevant Control Agency. Where Santos is not the Control Agency (Refer to **Table 4-2**), it will undertake first-strike activations as required. In this circumstance, the relevant Control Agency will direct resources (equipment and personnel) provided by Santos for the purposes of shoreline clean-up. The information obtained from Operational Monitoring (refer **Section 10**), will be used by the IMT in the development of the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA. DAWE are the designated Jurisdictional Authority for all spills that contact any AMPs identified in this OPEP; the Santos IMT (as Control Agency for these islands as they are in Commonwealth waters) will liaise with DAWE to direct resources for the purposes of shoreline clean-up activities.

Spill modelling indicates if a worst-case spill were to occur as a result of YJP drilling and geophysical survey activities, shoreline contact would occur and therefore clean-up of shorelines is likely to be required. The vessel collision scenario is predicted to result in small volumes of MDO on shorelines in comparison to larger volumes of condensate predicted to accumulate on shorelines for the LOWC scenarios (**Table 6-3** and **Table 6-4**).

Both types of hydrocarbon are light and volatile with a low proportion of residue following weathering. These hydrocarbons are difficult to handle for removal given their light nature but are readily washed from sediments by wave and tidal flushing; contaminated sand and debris the likely waste products from a shoreline response. It is important to note that natural dispersion (primarily through evaporation) will continue after shoreline contact, which will likely reduce the volumes of hydrocarbon for clean-up.

Shoreline clean-up techniques include:

+ Shoreline Clean-up Assessment – uses assessment processes (refer to **Section 10.8**) to assess shoreline character, assess shoreline oiling and develop recommendations for response. Typically, this should be the first step in any shoreline clean-up response.
+ Natural Recovery – oiled shorelines are left untreated, and the oil naturally degrades over time.
+ Manual and Mechanical Removal – removes oil and contaminated materials using machinery, hand tools, or a combination of both.
+ Washing, Flooding and Flushing – uses water, steam, or sand to flush oil from impacted shoreline areas.
+ Sediment reworking and Surf washing – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

13.2 Implementation guidance

Table 13-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy. **Table 13-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 13-3** 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 shoreline clean-up operations, unless directed otherwise by the relevant Control Agency, are listed in **Table 13-4**. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-2: Implementation guidance – shoreline clean-up

	Action	Consideration	Responsibility	Complete
Initial Actions	**Actions below are indicative only and are at the final determination of the Control Agency.**			
	Initiate Shoreline Clean-up Assessment (if not already activated).	Refer to **Section 10.8** for additional information Unmanned Aerial Vehicles (UAVs) may be necessary for some sensitive environments and where personnel safety is at risk	IMT Environment Unit Lead	❑
	Using results from Shoreline Clean-up Assessment, conduct Operational NEBA to assess shoreline-clean up suitability and recommended tactics for each shoreline location.	Shoreline Clean-up Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations. The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision-making. Engage a Heritage Adviser if spill response activities overlap with potential areas of cultural significance.	IMT Environment Unit Leader	❑
	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP,	Shoreline Clean-up Plan may include (but not be limited to): + clean-up objectives + clean-up end points (may be derived from Shoreline Clean-up Assessment) + clean-up priorities (may be derived from Shoreline Clean-up Assessment) + assessment and location of staging areas and worksites (including health and safety constraints, zoning)	IMT Environment Unit Leader IMT Planning Section Chief IMT Operations Section Chief	❑

	Action	Consideration	Responsibility	Complete
		+ utility resource assessment and support (to be conducted if activity is of significant size in comparison to the size of the coastal community) + permits required (if applicable) + chain of command for onsite personnel + list of resources (personnel, equipment, personal protective equipment) required for selected clean-up tactics at each site + details of accommodation and transport management + security management + waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes + establish no access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first). Refer to IPIECA-IOGP (2015) for additional guidance on shoreline clean-up planning and implementation.		
	In consultation with the Control Agency procure and mobilise resources to a designated port location for deployment, or directly to location via road transport.		IMT Logistics Section Chief IMT Supply Unit Leader IMT Deputy Logistics Officer (DoT IMT)	❑

	Action	Consideration	Responsibility	Complete
	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency.	Each clean-up team to be led by a Shoreline Response Team Lead, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team (as per the MoU agreement between Santos and AMSA). Clean-up teams and equipment will be deployed and positioned as per those observations by the Shoreline Clean-up Assessment Teams in consultation with the Control Agency. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.	IMT Operations Section Chief IMT Logistics Unit Leader IMT Deputy Logistics Officer (DoT IMT)	❑
Ongoing Actions	Shoreline Response Team Lead shall communicate daily reports to the IMT Operations Section Chief to inform of effectiveness of existing tactics and any proposed tactics and required resources.	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline Clean-up Assessment and clean-up, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end-points have been met.	IMT Shoreline Response IMT Programme Manager IMT Operations Section Chief	❑
	The IMT Operations Section Chief shall work with the Planning Section Chief to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through the Supply and Logistics Team Leaders.		IMT Operations Section Chief IMT Planning Section Chief	❑
	Monitor progress of clean-up efforts and report to the Control Agency.		IMT Operations Section Chief IMT On-Scene Commander IMT Deputy OSC (Control Agency FOB)	❑

Table 13-3: Shoreline clean-up – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Manual clean-up tools (shovels, rakes, wheelbarrows, bags, etc)	AMOSC shoreline kits	Shoreline support kits first strike	Fremantle – 1 Geelong – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; equipment logistics varies according to stockpile location (**Table 10-12**)
	Santos	1x shoreline clean-up Container	Varanus Island	Within 12 hours for deployment from VI
	Hardware suppliers	As available	Exmouth, Karratha, Perth	
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit Shoreline impact lance kit	Fremantle –1; Geelong – 1 Geelong – 1	Response via duty officer within 15 mins of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see **Table 10-12**
Nearshore skimmers/hoses	AMOSC AMSA	Refer to Protection and Deflection (**Table 12-3**)		
Decontamination/staging site equipment	AMOSC	Decontamination station – 3	Fremantle –1; Exmouth –1; Geelong – 1	Response via duty officer within 15 mins of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see **Table 10-12**

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	AMSA	Decontamination station – 4	Karratha –2; Fremantle – 2	Access to National Plan equipment through AMOSC
	Oil spill equipment provider (e.g. Global Spill., PPS)	As available	Perth	Subject to availability
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks – (9,000 L & 3,000 L)) Vikotank (13,000 L) Lamor (11,400 L) IBCs (1 m3)	Broome –1; Geelong –4; Fremantle –2; Exmouth – 2 Broome – 1; Geelong – 1 Fremantle – 4 Geelong - 13	15 mins of first call – AMOSC personnel available within one hour of initial activation call For mobilisation timeframes see **Table 10-12**
	AMSA temporary storage	Fast tanks – (10 m^3) Structureflex – (10 m^3) Vikoma – (10 m^3)	Darwin –2; Karratha –2; Fremantle – 4; Adelaide – 1; Brisbane – 2; Devonport – 2; Melbourne – 1; Sydney – 4; Townsville - 4 Brisbane – 1; Adelaide – 2 Darwin – 1; Adelaide – 1; Brisbane – 1; Devonport – 2; Fremantle – 4; Fremantle – 3; Melbourne – 2; Sydney – 2; Townsville - 4	Access to National Plan equipment through AMOSC
	Via North West Alliance contract	Refer to Waste management **(Table 15-3)**	Karratha, Perth	24+ hours

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle – 2 Geelong – 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site
	AMOSC Core Group (Santos)	12	Perth/NW Australia facilities – 10 Port Bonython (South Australia) – 6	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation
	Santos contracted Work Force Hire company (e.g. Dare)	As per availability (up to 2,000)	Australia-wide	Subject to availability (indicatively 72+ hours)

Table 13-4: Shoreline clean-up – first strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirms applicability of strategy and begins sourcing resources.	<4 hours
Santos Offshore Core Group mobilised to deployment port location.	<24 hours
Clean-up equipment mobilised to deployment port location.	<24 hours
Waste storage equipment mobilised to deployment port location.	<24 hours
Remote island transfer vessel (if required) mobilised to deployment port location.	<24 hours
AMOSC Staff, Industry Core Group and Labour Hire mobilised to site/deployment port location.	<48 hours
Clean-up operation mobilised to clean-up area under advice from Shoreline Assessment Team.	<48 hours (weather/daylight dependent)
Minimum Resource Requirements	
NB: Resource requirements for shoreline clean-up will be situation/receptor specific. TRPs if developed for the area/receptor will outline suggested resource requirements and shoreline assessments (as part of operational monitoring strategy) will be conducted prior to clean-up to confirm techniques. TRPs are held by Santos and DoT. For further description on relevant TRPs refer to **Section 6.6.1**[22]. Indicative minimum requirements for one Santos-activated shoreline clean-up team are: + manual clean-up/shoreline flushing equipment kit + waste storage (bags, temporary storage tanks, skips as appropriate) + decontamination/staging equipment kit + personal protective equipment. One clean-up team comprises: + one Team Leader (AMOSC staff, Industry Core Group or Santos Core Group) + 10-25 shoreline clean-up responders (AMOSC Core Group, Santos contracted labour hire personnel)	

[22] Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, Pilbara Region Oiled Wildlife Response Plan and WAMOPRA.

13.3 Shoreline clean-up resources

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

Shoreline clean-up personnel available to Santos is a combination of AMOSC Staff, AMOSC Core Group Responders (comprising AMOSC trained Santos and Industry personnel), OSRL responders, State Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos' labour hire arrangements.

The level of deployment of equipment and personnel for clean-up will be commensurate to the spatial extent of shoreline contact, the volume of oil arriving and the sensitivity and access constraints of the shoreline in question. Deployment will be under the direction of the relevant Control Agency and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 10.8**) will provide information to guide the clean-up strategy and deployment of resources.

13.4 Worst-case Resourcing requirements

Shoreline clean-up requirements have been determined for affected shorelines based on the single modelled scenario that resulted in the highest volume of shoreline loading across all shorelines. Deterministic run #111 from Yoorn-1 modelling (surface LOWC) (GHD, 2020a) and deterministic run #134 from Yelen-1 and Parnassus-1 (Dancer-1) modelling were considered, which were the simulations resulting in the highest accumulated shoreline loading. Deterministic run #111 was selected as this run had the higher shoreline loading and contacted a greater number of shorelines (refer to **Table 10-40** and **Table 10-41**). Minimum arrival times, maximum length of shoreline oiled and total mass of oil ashore were informed from the stochastic modelling (refer to **Table 10-39**).

Resourcing requirements for shoreline clean-up operations have been determined based on a manual clean-up rate of 1 m^3 of oily waste per person per day. A bulking factor of 10 has been applied to manual clean-up activities; i.e. it is assumed that 10% of manually collected oily waste is oil. At some mainland locations, it may be possible to employ mechanical removal techniques (earth moving equipment), which can remove up to 150 m^3 of oily waste per mechanical aid per day. However, the tables below have not assumed these methods, as the suitability of mechanical removal should be assessed for each clean-up segment during SCAT assessments (e.g. taking into account seasonality of receptors, clean-up end points and site access).

Total (peak) loading data has been used from the corresponding stochastic results has been used to inform calculations for resourcing requirements, as presented in **Table 13-5** and **Table 13-6**. The minimum arrival time to shore has been used to gauge the required start time of shoreline clean-up effort. The resourcing estimate takes into account:

+ the size of a typical shoreline clean-up team (10 persons, consisting of 1 x Shoreline Clean-up Supervisor/ IC and 9 x operatives);
+ the assumption that teams will work throughout the 16 weeks duration of the spill (11 weeks LOWC event, plus 5 weeks of dispersion time, as per modelling configuration (GHD, 2020a; 2020b); and

+ the minimum amount of waste material handled per operative of 1 m^3 per day (IPIECA, 2015a).

Whilst representative of the worst-case deterministic run identified for YJP activities, this does not include all possible spill scenarios and that a single spill may contact other receptors and at different volumes, as presented in **Section 6.3**.

The information presented in **Table 13-5** and **Table 13-6** is to demonstrate that Santos can obtain the resources to scale up to the worst-case shoreline loading volumes. In the event of an incident, Santos would use initial operational monitoring data (e.g. trajectory modelling and aerial surveillance) to determine where the available resources should be allocated for an effective clean-up response.

13.4.1 Operational and environmental considerations affecting resourcing

Much of the coastline in the EMBA is remote and inaccessible via road, making many of shoreline clean-up techniques difficult and their use may result in greater environmental impacts than the oil itself. In addition, the remote nature, presence of dangerous fauna (i.e. saltwater crocodiles and Irukandji jellyfish) present significant safety risks to responders working in these environments.

Large scale operations involving large numbers of personnel may cause adverse environmental impacts at many of these sensitive shoreline locations. The constant removal of oil, even via manual removal can result in a removal of substrate (e.g. sand, pebbles). If intrusive clean-up is conducted frequently, over a long period of time and along contiguous lengths of coastline, this may result in geomorphological changes to the shoreline profile and adverse impacts to shoreline invertebrate communities which provide an array of ecosystem services (Michel, et al., 2017).

Given the safety constraints and ecological sensitivities of these shorelines, shoreline clean-up operations should be conducted by smaller teams (max 10 people/team) for a longer period of time. Intermittent manual treatment (<20 visits/month) and use of passive recovery booms is likely to be more effective than intrusive methods (e.g. intrusive manual removal >20 visits/month). Although this may take longer to undertake the clean-up, it is considered that the benefits outweigh the impacts as smaller teams are more targeted, recovering more oil and less sand and debris, reducing trampling of oil into the shore profile and will minimise ecological impacts on the shorelines and their sensitive species.

The number of shoreline clean-up teams estimated to treat these shorelines is estimated from total ashore modelling data and minimum predicted arrival time (GHD, 2020a, GHD 2020b). The estimate is not based on extensive, intrusive and contiguous removal of oil and waste along all shorelines in the quickest time possible, but rather on use of smaller teams at lower frequency of visits working throughout the duration of the spill (as informed by the minimum arrival time and spill duration). Where shoreline based manual removal is safe and deemed advantageous by shoreline clean-up assessment teams and operational NEBA, this should be conducted via land access (if possible) or via suitable vessels. However, it should be noted that it is generally not feasible to move response equipment into and out of mangroves, tidal flats and delta environments without causing excessive damage. Even foot traffic must be minimised, either by laying down wooden walkways or relying on vessel-based activities as much as possible (API, 2020).

Condensate and MDO are light hydrocarbons, and although the resources have been planned for, not all the oil may need to be removed (or be able to be removed) as they will continue to weather rapidly after beaching and are likely to disperse naturally. For this reason, the number of shoreline clean-up teams required is likely to be conservative.

13.4.1.1 Offshore Islands

The islands in the EMBA are a mixture of large islands, such as Barrow Island, and smaller uninhabited islands, including Muiron Islands. Access to many of these islands will be limited to shallow draft vessels, or larger vessels supported by smaller shallow draft vessels. Helicopters may also be deployed to deliver equipment and personnel and remove collected waste. Only Barrow Island has aircraft access and roads across the island providing land-based access. Manual removal is the preferred method of clean-up for these islands.

Access and all clean-up activities will be conducted via vessels or helicopters in front of the primary dune of the impacted shoreline. Santos will not access any areas behind the primary dune of impacted offshore islands during any stage of the clean-up operation, in order to minimise impacts.

If the impacted shorelines can be accessed with a barge and landing craft, crew on the barge will deliver an appropriate number of clean-up packs (to cater for the number of response personnel defined in the IAP) onto the impacted shoreline above the high tide mark. A helicopter will deliver the appropriate number of clean-up packs if barge access is not possible.

Response personnel may be transported to the impacted shoreline on a barge. If access is not possible by barge, helicopters may be used to transport personnel. Response personnel will not camp on Islands due to potential for additional impacts from this activity, and therefore daily crew transfer operations will be needed.

Initially, response personnel will shovel the oily waste into small manageable bags (approx. 20–30 kg when full) which will be stored in a lined, temporary storage area until they are removed from the island. The temporary storage area will be located at the bottom of the primary dune and above the Highest Astronomical Tide (HAT) mark.

Modelling indicates that oil would start contacting islands (Montebello Islands) in 0.3 days (7 hours) at concentrations 100 g/m^2 or above. All other islands indicate contact within the first week (**Table 13-5**). The peak loading occurs at Montebello Islands, with a total predicted loading of 2,163.6 m^3. A total of 22 shoreline clean-up teams are identified to effect shoreline clean-up at Montebello Islands throughout the life of the spill. This is considered reasonable due to the nature and access constraints of the Montebello Islands coastlines. Efforts at other locations range from 1-5 teams (**Table 13-5**). It is possible that some teams may not operate for the full duration of the spill, due to the limited volumes of oil ashore expected at some locations, however this will depend on the beaching times throughout the spill.

Table 13-5: Resource requirements at offshore islands (all locations grouped by PPA) for shoreline clean-up based on Yoorn-1 modelling deterministic run #111 (Figure 10-1)

PPAs contacted	Time to contact (days)*	Total shoreline loading >100 g/m^2 (m^3)*A	Potential maximum waste generated (m3) – bulking factor of 10	Assumed no. weeks working[B]	Estimated no. of shoreline clean-up teams (max. 10 personnel/team)[C]	Maximum volume collected (m^3/week) by teams[D]
Montebello Islands	0.3	2,163.6	21,636	16	22	1,386
Lowendal Islands	2.2	225.9	2,259	16	3	189
Barrow Island (inc. Boodie Island)	3.1	496.9	4,969	16	5	315
Thevenard Islands	7.4	5.8	58	15	1	63
Southern Islands Coast (Serrurier Island and Bessieres Island)	5.9	52.5	525	15	1	63
Muiron Islands	7.0	86.7	867	15	1	63

* Informed by the stochastic modelling (GHD 2020a)

A: Assumes 1 tonne ~1 m^3.

B: Considering minimum arrival time and shoreline clean-up teams working for the duration of the spill; a total of 16 weeks (11 weeks LOWC release + 5 weeks dispersion time as per oil spill modelling configuration (GHD, 2020a; 2020b).

C: = Potential maximum waste generated/ (weekly team capability [63m^3 per week, based on 9 operatives per team and minimum of 1m^3 per day per operative] x No. weeks working).

D: = Weekly team capability [63m^3 per week, based on 9 operatives per team and minimum of 1m^3 per day per operative] x No. Recommended no. of shoreline clean-up teams.

13.4.1.2 Mainland Locations

The mainland locations along the Ningaloo coast have reasonable access either via 4WD tracks or via shallow draft vessels. The mainland locations listed in **Table 13-6** include long segments (e.g. 100 - 200 km), so shoreline loadings could extend across a large geographic area. Numerous long sandy beaches are also present across this area, providing potential for mechanical removal (upon agreement with SCAT personnel and DoT).

Modelling indicates contact with mainland locations commences on day 7 at Ningaloo Coast North, and on day 41 at Ningaloo Coast South (**Table 13-6**). It is possible that teams may not operate for the full duration of the spill, due to the limited volumes of oil ashore expected at these locations, however this will depend on the beaching times throughout the spill.

Table 13-6: Resource requirements at mainland locations (all locations grouped by PPA) for shoreline clean-up based on Yoorn-1 modelling deterministic run #111 (Figure 10-1)

PPAs contacted	Time to contact (days)*	Total shoreline loading >100 g/m^2 (m^3)*[A]	Potential maximum waste generated (m3) – bulking factor of 10	Assumed no. weeks working[B]	Estimated no. of shoreline clean-up teams (max. 10 personnel/team)[C]	Maximum volume collected (m^3/week) by teams[D]
Ningaloo Coast North	7.3	68.9	689	15	1	63
Ningaloo Coast South	41.0	0.9	9	10	1	63

* Informed by the stochastic modelling (GHD, 2020a)

A: Assumes 1 tonne ~1 m^3.

B: Considering minimum arrival time and shoreline clean-up teams working for the duration of the spill; a total of 16 weeks (11 weeks LOWC release + 5 weeks dispersion time as per oil spill modelling configuration (GHD, 2020a; 2020b).

C: = Potential maximum waste generated / (weekly team capability [63m^3 per week, based on 9 operatives per team and minimum of 1m^3 per day per operative] x No. weeks working).

D: = Weekly team capability [63m^3 per week, based on 9 operatives per team and minimum of 1m^3 per day per operative] x No. Recommended no. of shoreline clean-up teams.

13.4.2 Summary

In summary the resourcing analysis in **sections 13.4** and **13.4.1** above has shown that a peak number of up to 35 teams will be needed, with work commencing within the first or second week of a worst case LOWC spill (**Table 13-5** and **Table 13-6**). This equates to a total of 35 Shoreline Clean-up Team Leaders and 315 shoreline clean-up operatives.

13.5 Shoreline clean-up decision guides

To assist with planning purposes, guidance for the selection of appropriate shoreline response strategies based on shoreline sensitivities is provided within **Appendix K: Shoreline Response Strategy Guidance.**

Operational guidelines for shoreline response activities including worksite preparation, manual and mechanical oil removal and vessel access for remote shorelines are included in **Appendix L: Operational Guidelines for Shoreline Response.**

The WA DoT Oil Spill Contingency Plans (2015) also provides guidance on shoreline clean-up techniques.

13.6 Environmental performance

Table 13-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-7: Environmental performance – shoreline clean-up

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL.	Maintenance of access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity, as per **Table 13-3**.	MoU for access to National Plan resources through AMSA.
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Maintenance of MSAs with multiple vessel providers, including shallow draft vessels	Santos maintains MSAs with multiple vessel providers, including shallow draft vessels.	MSAs with multiple vessel providers.
	Vessels for offshore island response.	Maintenance of vessel specification for resource transfer for offshore island response.	Vessel specification.
	Labour hire contract.	Maintenance of contract with labour hire provider.	Contract.
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations.	Minimum requirements mobilised in accordance with **Table 13-4** unless directed otherwise by the Control Agency (i.e. DoT).	Incident log.
	Shoreline Clean-Up Plan.	Santos IMT to confirm protection priorities in consultation with the Control Agency (i.e. DoT).	IAP. Incident Log.
		If required mobilisation of the required number of shoreline teams throughout the release to meet the response need **Table 13-5** and **Table 13-6**.	Incident log.
		Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit.	Records indicate operational NEBA completed prior to shoreline clean-up activities commencing.

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination.	Incident Log. IAP.
		Consult with Director of National Parks whilst preparing operational NEBA that includes Montebello, Clerke Reef and Imperieuse Reef AMPs	Records demonstrate that Director of National Parks consulted when preparing operational NEBA that includes Montebello, Clerke Reef and Imperieuse Reef AMPs
		IAP Shoreline Clean-up Sub-plan developed to provide oversight and management of shoreline clean-up operation.	Records indicate IAP Shoreline Clean-up Sub-plan prepared prior to shoreline clean-up operations commencing.
		Clean-up strategies will be implemented under the direction of the Control Agency (i.e. DoT).	Incident Log.
		Santos will make available AMOSC Core Group Responders for shoreline clean-up team positions to the Control Agency.	Incident Log.
		Santos will make available to the Control Agency equipment from AMOSC and OSRL stockpiles.	Incident Log.
		NEBA undertaken every operational period by the relevant Control Agency to determine if response strategy is having a net environmental benefit. NEBA included in development of following period Incident Action Plan.	IAP/Incident Log.
	Prioritise use of existing roads and tracts.	Unless directed otherwise by the designated Control Agency (i.e. DoT), access plans for shoreline	IAP demonstrates requirement is met.

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		operations will prioritise use of existing roads and tracks.	
	Soil profile assessment prior to earthworks.	Unless directed otherwise by the designated Control Agency (i.e. DoT), a soil profile assessment is conducted prior to earthworks.	Documented in IAP and Incident Log.
	Pre-cleaning and inspection of equipment (quarantine).	Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands.	Documented in IAP and Incident Log.
	Use of Heritage Adviser if spill response activities overlap with potential areas of cultural significance.	Unless directed otherwise by the designated Control Agency (i.e. DoT), a Heritage Adviser is consulted if shoreline operations overlap with areas of cultural significance.	Documented in IAP and Incident Log.
	Select temporary base camps in consultation with DoT and DBCA.	Any establishment of forward staging areas at shoreline areas done under direction or in consultation with the Control Agency.	Documented in IAP and Incident Log.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions.	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met.
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat.	Unless directed otherwise by the Control Agency (i.e. DoT), demarcation zones are mapped out in sensitive habitat areas.	IAP demonstrates requirement is met.
	Operational restriction of vehicle and personnel movement to limit erosion and compaction.	Unless directed otherwise by the Control Agency (i.e. DoT), action plans for shoreline operations include operational restrictions on vehicle and personnel movement.	IAP demonstrates requirement is met.
	Stakeholder consultation.	Consultation is undertaken with relevant stakeholders prior to deployment of resources to	Consultation records

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		townships and marine/coastal areas.	

14 Oiled wildlife

Note: WA DoT is the Control Agency, and the WA Department of Biodiversity, Conservation and Attractions (DBCA) is the Jurisdictional Authority for oiled wildlife response within WA State waters, respectively. Santos and AMSA are the Control Agencies for oiled wildlife response within Commonwealth waters from facility and vessel spills respectively.

Table 14-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 14-1: Oiled wildlife response – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement tactics in accordance with relevant Santos / State Oiled Wildlife Response Plans (OWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife
Initiation criteria	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill
Termination criteria	+ Oiling of wildlife have not been observed over a 48-hour period, and + Oiled wildlife have been successfully rehabilitated, and + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response

14.1 Overview

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

Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat, impacts to food sources, and impacts to reproduction. An assessment of such impacts is covered under scientific monitoring (refer to **Section 16**).

Table 14-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State waters for OWR. For a petroleum activity spill in Commonwealth waters, Santos act as the Control Agency and will be responsible for the wildlife response.

If a spill occurs in WA State waters or enters State waters, DBCA is the Jurisdictional Authority for wildlife, and for level 2/3 spills, will also lead the oiled wildlife response under the control of the Department of Transport (DoT). For level 1 spills, Santos will be the Control Agency, including for wildlife response. It is however also an expectation that for level 2/3 petroleum activity spills, Santos will conduct the initial first-strike response actions for wildlife and continue to manage those operations until DBCA is activated as the lead agency for wildlife response.

The key plan for OWR in WA is the Western Australian Oiled Wildlife Response Plan (WAOWRP). The WAOWRP establishes the framework for preparing and responding to potential or actual wildlife impacts during a spill and sets out the management arrangements for implementing an OWR in conjunction with the

State Hazard: SHP-MEE. It is the responsibility of DBCA to administer the WAOWRP under the direction of the DoT (**Table 14-2**). The Kimberley Region OWRP, which sits under the WAOWRP provides operational guidance to respond to injured and oiled wildlife in the Kimberley region and covers the areas potentially contacted by a spill from YJP drilling and survey-1 activities.

Table 14-2: Jurisdictional and Control Agencies for Oiled Wildlife Response

Jurisdictional boundary	Spill source	Jurisdictional authority for OWR	Control agency		Relevant Documentation
			Level 1	Level 2/3	
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel	Department of Agriculture, Water and the Environment (DAWE)	AMSA		
	Petroleum activities		Titleholder		
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	Department of Biodiversity, Conservation and Attractions (DBCA)	WA DoT[23]		Western Australian Oiled Wildlife Plan (WAOWRP)
	Petroleum activities	WA DoT	Titleholder	WA DoT	
	Petroleum activities		Titleholder		

14.2 Wildlife response levels

The credible spill scenarios for YJP drilling and survey activities show shoreline contact (refer to **Section 6.3**) with certain locations likely to have significant seasonal wildlife aggregations. There is therefore potential for large numbers of wildlife to be impacted by a spill requiring a level 6 wildlife response, as defined in the WAOWRP (2014) (**Table 14-3**).

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

Table 14-3: Indicative oiled wildlife response level (adapted from Western Australian Oiled Wildlife Response Plan, 2014)

OWR Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
Level 1	6	< 3 days	1–2/day < 5 total	None	None	None	None	None
Level 2	26	> 4–14 days	1–5/day < 20 total	None	< 20 hatchlings No juv./ adults	None	None	None
Level 3	59	> 4–14 days	5–10/day	1–5/day < 10 total	< 5 juv./ adults < 50 hatchlings	None	< 5	None
Level 4	77	> 4–14 days	5–10/day < 200 total	5–10/day	< 20 juv./ adults < 500 hatchlings	< 5, or known habitats affected	5–50	Habitat affected only
Level 5	116	> 4–14 days	10–100/ day > 200 total	10–50/day	> 20 juv./ adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv./ adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

Table 14-4: Oiled wildlife response level and personnel numbers (adapted from WAOWRP, 2014)

Skill Level	OWR Response Level and Personnel Numbers					
	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
OWR 4	1	1	3	2	2	2
OWR 3	2	0	4	4	4	4
OWR 2	4	9	15	17	18	18
OWR 1	0	14	33	47	84	90
Technicians (i.e., vets)	0	1	2	4	4	4
Other specified skills	0	0	2	3	4	4
Total	7	25	59	77	116	122

14.3 Implementation guidance

Table 14-5 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing an oiled wildlife first-strike plan. This will enable an initial assessment of the OWR response level, initiation of a Wildlife Response Branch where Santos is the control agency and as outlined in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014). The Santos Oiled Wildlife Framework Plan (SO-91-BI-20014) will be referred to for guidance for coordinating an OWR in association with WAOWRP. Mobilisation times for the minimum resources that are required to commence initial oiled wildlife operations are listed in **Table 14-6**.

Wildlife surveillance/reconnaissance is a critical component of an oiled wildlife first-strike response. Refer to the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014), Section 7.3, for a list of the wildlife reconnaissance aims and objectives, tactics, species and life-cycle stages to consider when developing a wildlife reconnaissance plan. Wildlife reconnaissance should be undertaken in close consultation with personnel undertaking relevant monitor and evaluate activities.

As part of the wildlife first-strike response an early assessment of the level of wildlife impact (**Table 14-3**) must be made (noting this may change over time) for the timely mobilisation of adequate resources (**Table 14-6)**. The information gathered from wildlife reconnaissance and all relevant pre-existing wildlife data/information should be used to inform decisions and aid the development of the Wildlife portion of the IAP (Refer to the Santos Oiled Wildlife Framework Plan [SO-91-BI-20014], Section 7.1).

Table 14-5: Implementation guidance – oiled wildlife first strike response

	Action	Consideration	Responsibility	Complete
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).	IMT Surveillance personnel	❑
	If wildlife are sighted and are at risk of contact (or have been contacted), initiate wildlife response by notifying AMOSC Duty Manager; and if in State waters also notify DCBA State Duty Officer (who will then activate their respective Oiled Wildlife Advisers).	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Adviser. DoT will be the Control Agency for OWR in State waters.	IMT Environment Unit Leader	❑
	Notify Department of Agriculture, Water and the Environment 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).	IMT Environment Unit Leader	❑
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected.		IMT Environment Unit Leader IMT Wildlife Response Branch 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 3), refer to **Table 14-3** + for level 2/3 wildlife incidents where Santos is the control Agency, a Wildlife Response Branch should be established (refer to the Santos Oiled Wildlife Framework Plan [SO-91-BI-20014]) + if OWR activities are likely to result in a net environmental benefit	Oiled wildlife response activities such as hazing and pre-emptive capture can cause additional stress and mortality on individuals than oil pollution alone. The Environment Unit Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether strategies such as hazing/pre-emptive capture will result in a net environmental benefit. This may be done in consultation with the DCBA and AMOSC Oiled Wildlife Advisers and any Subject Matter Experts as relevant (if available, but an Operational NEBA should not be delayed if they are not immediately available).	IMT Environment Unit Leader If Wildlife Response Branch activated: + IMT Wildlife Response Branch Director	❑
	Prepare a Wildlife Plan for inclusion in the IAP	Refer to the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014), Section 7.1	IMT Environment Unit Leader If Wildlife Response Branch activated: + Wildlife Response Branch Director	❑
Mobilisation of wildlife resources				
Determine resources required to undertake wildlife reconnaissance and provide list to Logistics Section.		Confirm best reconnaissance platform (e.g. vessel, aerial, shoreline). Consider ability to share resources (e.g. Monitor and Evaluate activities, Scientific Monitoring).	AMOSC OWA If Wildlife Response Branch activated: + IMT Wildlife Response Branch Director + IMT Wildlife Reconnaissance Officer	❑
Determine resources required to implement the Wildlife Plan			AMOSC OWA	❑

Action	Consideration	Responsibility	Complete
		If Wildlife Branch activated: + IMT Wildlife Response Branch Director or delegate	
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 and DBCA	Consider need for veterinary care.	AMOSC OWA IMT Logistics Section Chief If Wildlife Response Branch activated: + IMT Wildlife Response Branch Director State waters: + DBCA OWA	❑
Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s.		IMT Logistics Section Chief	❑
Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR.		IMT Environment Unit Leader	❑

Table 14-6: 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 forward 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 scenario with low wildlife impact as per the WAOWRP: + Six 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	

14.4 Resourcing requirements

Deterministic run #111 was selected to guide OWR resourcing as this run had the higher shoreline loading and contacted a greater number of shorelines (refer to **Table 13-5** and **Table 13-6**). Shoreline accumulation above 100g/m^2 commenced in 0.3 days (~7 hours) by day 2 at Montebello Islands, followed by Lowendal Islands on day 2 and Barrow Island on day 3. Other Island locations have predicted contact times within 7 days (**Table 13-5**).

Santos is required to provide the first strike OWR actions until DBCA takes over, whereby, Santos then becomes the support organisation. The Santos Oiled Wildlife Framework Plan (SO-91-BI-20014) provides guidance for coordinating an OWR when Santos is the Control Agency/providing the first strike OWR/ or acting as a support organisation when DBCA is the lead organisation.

The first strike response actions for this scenario would focus on Montebello Islands and would initially consist of reconnaissance measures to assess the extent of wildlife impact (wildlife response level) and formulate the Wildlife Plan (in consultation with DBCA) for inclusion in the IAP, and until DBCA can take-over. Santos has staff that have had OWR training and would be capable of formulating the initial Wildlife Plan in consultation with DBCA and the AMOSC OWA. The initial Wildlife Plan may include the following strategies:

+ On-going wildlife targeted reconnaissance and monitoring
+ Preventative actions such as hazing (scaring wildlife away from the oil) in consultation with DBCA, SMEs and with permit approval
+ Wildlife rescue- capture of oiled wildlife
+ Field processing- establishment of field site(s), tagging and initiation of individual wildlife paper-trail, triage, first aid, transport to a primary care facility

- Collection, appropriate storage, and transport of wildlife carcasses
- Health and safety

Further information relating to the development of the Santos Wildlife Plan (for inclusion in the IAP) is included in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014). The Santos Oiled Wildlife Framework Plan (SO-91-BI-20014), which is consistent with the WAOWRP, also includes implementation plans for each OWR strategy.

Santos has access to aircraft that could be used for wildlife reconnaissance within hours of a spill (**Table 14-7**). This would be followed by further access to vessels and Santos personnel trained in OWR that could be mobilised within 24 hours for vessel and wildlife shoreline reconnaissance, as outlined in **Table 14-7**, demonstrating Santos' ability to mount a swift response that could also be sustained as long as required.

Santos has the capability to set up oiled wildlife field facilities within 3-4 days of a spill through access to AMOSC equipment (**Table 14-7**), and equipment purchased at the time of a spill. For locations such as Montebello Islands it maybe more feasible to set up a vessel-based field facility by placing an OWR container/mobile washing facility on the deck of a utility vessel. At the time of a spill, and if required by DBCA, Santos could source experienced wildlife handlers, wildlife veterinarians, and vet nurses to initiate rescue and field processing. Santos could also arrange the transport required to move wildlife from the field to a primary care facility. For further discussion relating to response at offshore islands and mainland locations refer to **Section 13.4.1**.

Santos will not only provide the initial first strike OWR but will act as a support organisation for the on-going OWR once DBCA takes over, mainly through access to the response capability outlined in **Table 14-7** and further resourcing as dictated by DBCA at the time of a spill. Previous oiled wildlife events have demonstrated that the number of wildlife impacted will rise over time and it is unlikely that a large scale-spill event will start as a Level 6 response but instead escalate to one over time. The indicative personnel required for a Level 6 response is 122 personnel (WAOWRP), however depending on the number and species impacted may require many more. For example, at the height of the Rena OWR in 2011, approximately 250 personnel were involved in daily wildlife operations, including field staff, the oiled wildlife facility staff, and the numerous support staff required to assist with the management, logistics, planning and human resourcing (Massey University, 2016).

Santos' current arrangements could support a large scale OWR (requiring > 122 personnel) mainly through support staff, such as, non-technical wildlife support roles (management, logistics, planning, human resourcing, transporter, cleaners, trades persons, security etc.). These roles could be filled by Santos personnel and labour hire agencies that can provide workers that undergo an induction and basic training. In addition, many of the roles required for an OWR require technical expertise and Santos will need to activate OWR arrangements with AMOSC and OSRL to fulfil roles, as well as make contractor arrangements for accessing skilled wildlife personnel at the time of a spill.

Table 14-7: Oiled wildlife response capability

Relevant section in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014)	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
Reconnaissance				
Section 7.3	Identify opportunities to create synergies with surveys required for Monitor and Evaluate and Scientific Monitoring activities	Rotary Wing Aircraft & flight Crew	Karratha Learmonth Onslow	Wheels up within 1 hour for Emergency Response.
		Drones and pilots	Local WA hire companies	1-2 days
		Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.
		Aerial surveillance crew Santos staff AMOSC staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel available	Perth and Varanus Island (VI) (Santos aerial observers) Australia wide	Santos trained personnel - next day mobilisation to airbase <24 hours

Relevant section in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014)	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
Preventative actions- hazing				
Section 4.3.1 Section 7.4.1	Mainly effective for bird species Requires DBCA permit/licence approval	3 x AMOSC Wildlife fauna hazing and exclusion kit 1x AMOSC Breco buoy	2 x Fremantle, 1 x Geelong Fremantle	48 hours
Rescue and field processing				
Section 4.3.1 Section 7.5	Wildlife handling and first aid should only be done by persons with appropriate skills and experience or under the direction of DBCA	4 x AMOSC OWR Box Kits (basic medical supplies, cleaning/rehab, PPE)	1 x Fremantle, 1 x Exmouth, 1 x Broome, 1 x Geelong	48 hours
		50 % of OSRL Search and rescue kits (including field first aid) (approximately 2 available)	1 x Singapore, 1 x Bahrain, 1 x Fort Lauderdale, 2 x Southampton	Location dependent
Transport				
Section 7.5	Transport of oiled animals by aeroplane or helicopter may be restricted due to Civil Aviation Safety Authority (CASA) regulations; such transport will depend on the level of oiling remaining on animals. Therefore, consultation with the air transport provider must take place before transport to ensure the safest and most efficient means	Contracted vessels and vessels of opportunity Santos Contracted Vessel Providers Vessels of opportunity identified through AIS Vessel Tracking.	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 12 hours.

Relevant section in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014)	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
OWR facility				
Section 4.3.1 Section 7.5.2 Section 8	OWR container could be placed on the deck of a suitably sized vessel for field processing in remote locations (benefits associated with temperature regulation and access to water and electricity) An OWR container on a vessel could also be used to aide transport form off-shore islands	OWR container/mobile washing facility 2 x AMOSC 4 x AMSA	AMOSC – 1 x Fremantle, 1 x Geelong AMSA 1 x Dampier, 1 x Darwin, 1 x Devonport, 1 x Townsville	Location dependent
		AMOSC call off contract with DWYERech NZ – a facilities management group	New Zealand	Availability within 24 hrs of call-off
Personnel				
Section 4.3	Untrained personnel would receive an induction, on-the-job training and work under the supervision of an experienced supervisor	Santos provides OWR training to staff, and to-date, approximately 20 personnel have received OWR training.	Perth and Varanus Island	< 24 hours
		Santos maintains labour hire arrangements for access to untrained personnel		
		1x AMOSC Oiled Wildlife Advisor	Victoria, Australia	<48 hours
		18 x AMOSC OWR Industry Team		<48 hours

Relevant section in the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014)	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
		AMOSC MOU with Phillip Island National Park (PINP) (best-endeavours availability)	Victoria, Australia	Best-endeavour availability
Section 4.4	Sea Alarm staff act in a technical advisory role and do not engage in hands-on OWR activities but work impartially with all parties (titleholder, local authorities, mobilised experts and local experts, and response groups), aiming to maximise the effectiveness of the wildlife response.	Access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation	Belgium	Upon notification able to provide remote advice and option to mobilise a Sea Alarm Technical Advisor on-site during an incident

14.5 Environmental performance

Table 14-8 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-8: Environmental performance – oiled wildlife response

Environmental Performance Outcome	Implement tactics in accordance with relevant State Oiled Wildlife Response Plans (OWRP) 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 OSRL throughout activity as per **Table 14-7**.	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Santos Oiled Wildlife Framework Plan (SO-91-BI-20014)	Santos Oiled Wildlife Response Framework provides guidance for coordinating an OWR when Santos is the Control Agency and outlined Santos's response arrangements	Santos Wildlife Framework Plan
	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
	Maintain Santos personnel trained on OWR and positioned at Perth and Varanus Island	Santos personnel trained in OWR positioned at Perth and Varanus Island	Training records
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 14-6** unless directed otherwise by relevant Control Agency	Incident log
	OWR managed in accordance with the Santos Oiled Wildlife Framework Plan (SO-91-BI-20014) in Commonwealth	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to

	waters, WAOWRP in state waters.	(particularly in relation to hazing/pre-emptive capture)	OWR operations commencing
		Wildlife Plan developed and included in the IAP to provide oversight and management of OWR operation	Records indicate IAP Wildlife Plan prepared prior to OWR operations commencing

15 Waste management

Table 15-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 15-1: 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**	**Gas Condensate**
	✓	✓
Termination criteria	+ All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements, and + Agreement is reached with Jurisdictional Authorities to terminate the response	

15.1 Overview

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

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

Where Santos is the Control Agency, or at the request of the designated Control Agency, Santos will engage its contracted Waste Service Provider (WSP) to provide sufficient waste receptacles to store collected waste and manage oily waste collection, transport and disposal associated with spill response activities. The WSP will arrange for all personnel, equipment and vehicles to carry out these activities from nominated collection points to licensed waste management facilities. Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detailed guidance to the WSP in the event of a spill.

Where DoT is the Control Agency, Santos will provide a Facilities Support Officer to the DoT IMT Logistics Unit to support the DoT IMT in coordinating waste management services.

15.2 Implementation guidance

Table 15-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 15-3** provides a list of resources that may be used to implement this strategy The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 15-2: 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 Contacts Directory (SO-00-ZF-00025.020) for contact details.	IMT Logistics Section Chief	❑
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations.	It is better to overestimate volumes and scale back resources then to underestimate waste volumes.	IMT Logistics Section Chief IMT Planning Section Chief	❑
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established.	Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through the WA Department of Water and Environmental Regulation (DWER).	IMT Logistics Section Chief IMT Planning Section Chief IMT Environmental Unit Leader	❑
	For each receival location indicate the anticipated: + material types + material generation rates + material generation quantities + commencement date/time + anticipated clean-up duration + receptacle types required + logistical support requirements + any approvals required from Ports, Local Governments, Landowners, State Government Agencies (refer to Santos Oil Pollution Waste Management Plan (QE-91-IF-10053)).	Consider facilities for waste segregation at source.	IMT Logistics Section Chief IMT Planning Section Chief	❑

Action		Consideration	Responsibility	Complete
	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' Oil Pollution Waste Management Plan (QE-91-IF-10053); DoT Waste Management Guidelines (WA), the respective Port, Port Operator and/or Ship Owner's waste management plan.	IMT Logistics Section Chief (or delegate) IMT Planning Section Chief IMT Deputy Waste Management Coordinator (DoT IMT) IMT WSP Location Responsible Person or Operations Supervisor	❑
	Mobilise waste management resources and services to agreed priority locations.		IMT WSP Location Responsible Person or Operations Supervisor IMT Logistics Section Chief (or delegate)	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP.	If DoT is the Control Agency, the Facilities Support Officer shall be the point of contact between the relevant Control Agency and the WSP.	IMT Deputy Waste Management Coordinator (DoT IMT) IMT Logistics Section Chief	❑
Ongoing Actions	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate)/Deputy Logistics Officer (if DoT 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 Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053)); DoT Waste Management Guidelines (WA), the	IMT WSP Location Responsible Person or Operations Supervisor	❑

Action		Consideration	Responsibility	Complete
		respective Port, Port Operator and/or Ship Owner's waste management plan.		
	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).		IMT WSP Location Responsible Person or Operations Supervisor	❑

15.3 Waste approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through the DWER.

DWER administers the *Environmental Protection Act 1986* (WA) and is the relevant regulatory Authority for waste management approvals in WA. If required, DoT may establish an Operational Area Support Group, as defined in the State Hazard: SHP-MEE, to request support from relevant WA Government Agencies, including DWER, during a State waters spill response. 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' activities.

15.4 Waste service provider capability

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

Key responsibilities of the WSP include:

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

15.5 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.

Table 15-3 shows the Waste Service Provider capability for waste removal and storage. The Waste Service Provider weekly removal capacity is ~8,600 m^3 totalling ~137,600 m^3 over the 16 weeks of the spill duration.

Table 13-5 and **Table 13-6** (in **Section 13.4** - Shoreline Clean-up) used the worst-case deterministic shoreline loading run (realisation #111 from the Yoorn-1 modelling) and estimated the potential maximum waste generated (using a bulking factor of 10). The maximum accumulation across all potential locations, including bulking factor over 16 weeks is 31,012 m^3. This is exceeded by the waste service provider total removal capacity of 138,528 m^3 specified in **Table 15-3.** The storage capacity of the waste storage provider exceeds the removal capacity.

The shoreline clean-up resourcing requirement is based on a principle of using smaller more targeted teams working for longer periods of time given the safety constraints and ecological sensitivities of the more remote island shorelines. This means that the waste removal capacity per week is limited by the number of teams working and an estimate of the waste that those teams can manage. The total maximum volume of waste collected per week from the shoreline clean-up teams (as per **Table 13-5** and **Table 13-6**) is 2,205 m^3. This figure is well within the weekly removal capacity of Santos Waste Service Provider (**Table 15-3**).

Solid waste storage is a limiting factor during periods of peak shoreline loading. Santos' Waste Service Provider will activate its sub-contractual arrangements with other waste providers around Australia to move additional waste storage receptacles to key locations to aid shoreline clean-up operations.

The estimated waste resourcing requirements are likely to be highly conservative; condensate and MDO are light hydrocarbons, and although the resources have been planned for, not all the oil may need to be removed (or be able to be removed) as they continue to rapidly weather and disperse naturally following stranding on shorelines.

Table 15-3: North West Alliance (NWA) vehicle and equipment availability

Plant and Equipment	No	Capacity	Functionality	Uses per week	Waste stored/shifted per week
Waste removal					
Oily waste*					
Skip Lift Truck	12	Lift up to 15 Tonnes	Servicing of skip Bins	7	630
Front Lift Trucks	10	28 m^3 Body	Servicing of Front lift Bins	7	784
Side Loading Truck	10	18 m^3 Body	Servicing of MGB's	7	504
Hook Lift Truck	5	70 Tonne rated	Servicing of hook lift Bins	7	980
Flat Bed Truck	16	15 pallet spaces	Servicing of bins	7	840
Waste storage					
Oily waste*					
MGB's	500	240 litres	Mobile bins	2	48
Offshore 8 pack Lifting Cradle (MGB's)	2	16 x 240 litre MGB'S	Able to remove 16 x 240L MGB'S simultaneously	continuous	
Lidded Bins	6	1,100 litres	contain various waste streams	2	13
Front Lift Bins	50	3 m^3	various waste streams	2	300
Front Lift Bins	25	4.5 m^3	various waste streams	2	225
Offshore Rated Front Load Bins	100	3 m^3	various waste streams	2	600

Offshore Rated Bins	45	7 m^3	various waste streams	2	630
Marrell Skip Bins	60	6-9 m^3	various waste streams	2	960
Hook Lift Bins	12	15-30 m^3	various waste streams	25	6,900
Forklift	4	4 tonne Forklift	All areas	continuous	
				Weekly waste storage capacity:	**9,628**
				Weekly waste removal capacity:	**8,658**

15.6 Environmental performance

Table 15-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 15-4: 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 WSP for emergency response services
	Response Implementation		
	Implement Oil Pollution Waste Management Plan (QE-91-IF-10053)	WSP to appoint a Project Manager within 24 hours of activation	Incident Log
		WSP shall track all wastes from point of generation to final destination	Waste tracking records
		Provision of waste bins for oil and oily waste for shoreline clean-up operations to clean-up site or deployment port, if requested, within 24 hours	Incident Log
		WSP shall track all wastes from point of generation to final destination	Waste tracking records
		WSP to provide monthly waste management reports and more regular situation reports during the response until termination criteria are met	Waste reports

16 Scientific monitoring

Table 16-1: Scientific monitoring – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response	
Initiation criteria	Refer to individual Receptor SMPs – **Appendix M: Scientific Monitoring Plans**	
Applicable hydrocarbons	**MDO**	**Gas Condensate**
	✓	✓
Termination criteria	Refer to individual SMPs – **Appendix M: Scientific Monitoring Plans**	

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

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

16.1 Objectives

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

Receptor-specific SMPs have different objectives as outlined in **Appendix M: Scientific Monitoring Plans.**

16.2 Scope

Santos will implement its SMPs, as applicable, for YJP drilling and survey activity oil spills across both State and Commonwealth waters. In the event that control of scientific monitoring in State waters is taken over by DoT under advice from the State Environmental Scientific Coordinator, Santos will follow the direction of DoT and provide all necessary resources (monitoring personnel, equipment and planning) to assist as a Supporting Agency.

16.3 Relationship to operational monitoring

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

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

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

16.4 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 YJP drilling and survey activities (**Table 16-2**). These are detailed further in **Appendix M: Scientific Monitoring Plans**; 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 methodology, termination criteria and analysis/reporting requirements may differ.

Table 16-2: Oil spill scientific monitoring plans relevant to YJP activities

Study	Title
SMP1	Marine Water Quality
SMP2	Marine Sediment Quality
SMP3	Shorelines and Coastal Habitats – Sandy Beaches and Rocky Shores
SMP4	Shorelines and Coastal Habitats – Mangroves
SMP5	Shorelines and Coastal Habitats – Intertidal Mudflats
SMP6	Benthic Habitats
SMP7	Seabirds and Shorebirds
SMP8	Marine Megafauna (incl. whale sharks and mammals)
SMP9	Marine Reptiles
SMP10	Seafood Quality
SMP11	Fish, Fisheries and Aquaculture
SMP12	Whale Sharks

16.5 Baseline monitoring

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

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

Santos periodically reviews the status, availability and suitability of existing baseline data sources related to key environmental sensitivities in its areas of operations. **Appendix O: Scientific Monitoring Capability** provides further information on Santos baseline data reviews and outlines a baseline data assessment conducted on high priority areas for scientific monitoring in the event of a YJP drilling and survey associated oil spill.

16.6 Monitoring service providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos by contracted monitoring service providers (MSPs) and applies to the implementation of SMPs 1 to 12 (**Table 16-2**). 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 the Australian institute of Marine Science (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:

- 24/7 monitoring support accessed through 24 hr call out number
- Provision of a suitably trained Monitoring Coordination Team including a Monitoring Coordinator, Monitoring Operations Officer, Planning and Logistics Officer and Safety Officer
- Provision of Technical Advisers and Field Teams (staff and contractors) for first strike deployments
- Maintenance of standby monitoring equipment
- Monthly personnel capability reports
- Provision and review of Scientific Monitoring Sub-plans
- Provision and review of Standby Service Manual (EA-00-RI-10162) and associated response activation forms
- Participation in audits, workshops, drills and exercise to facilitate readiness.

Appendix O: Scientific Monitoring Capability provides an overview of Santos' processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1-11 are fit for purpose to meet the worst-case first-strike monitoring requirements associated with the YJP drilling and survey activities, as identified in **Section 6.4**.

Activation

The SMP Activation Process is outlined in **Appendix N: SMP Activation Process**. SMPs are activated as per the initiation criteria for each as outlined in **Appendix M: Scientific Monitoring Plans**. The SMP Activation Form is available on the Santos Procedures Index and IMT Environment Unit Leader folder.

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

This process will identify monitoring operational objectives and resourcing/ mobilisation requirements which the Environment Unit Leader will feed back to the IMT for approval. Mobilisation times for the minimum resources that are required to commence initial scientific monitoring operations are listed in **Table 16-3**.

Locations that may be contacted within less than the mobilisation time for scientific monitoring (i.e. <96 hours) have TRPs in place (**Table 6-8** and **Table 6-9**). In addition, shoreline clean-up assessment teams can be mobilised within 24 hours of the spill (**Table 10-38**). Both the TRPs and shoreline clean-up assessment inform scientific monitoring.

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 16-3: 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. First strike personnel requirements for scientific monitoring field teams at Protection Priority areas are presented in **Appendix O: Scientific Monitoring Capability**: + 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 O: Scientific Monitoring Capability**) + Scientific monitoring equipment as detailed in the relevant SMP	

16.7 Environmental performance

Table 16-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 16-4: Environmental performance – scientific monitoring

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement criteria**
Scientific Monitoring	**Response preparedness**		
	Maintenance of Monitoring Service Provider contract for scientific monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Conduct periodical review of existing baseline data sources across the Santos combined EMBA	Regular review of baseline data	Baseline data review report
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil sampling kits located at Exmouth, Dampier and Varanus Island	Evidence of deployment to site
	Response implementation		
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial IAP and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of MSP is to follow the process outlined in the Santos Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement criteria**
		MSP shall commence activation process within 30 mins of initial notification form being received from Santos	Monitoring Service Provider records
		Santos personnel to support MSP through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident Log and Monitoring Service Provider records
	Mobilisation of minimum requirements for initial scientific monitoring operations	Minimum requirements mobilised in accordance with **Table 16-3**	Incident log

17 Response termination

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

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

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:

+ 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
+ assess long-term environmental monitoring requirements.

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Appendix A: Hydrocarbon Characteristics and Behaviour

Marine diesel oil (MDO)

ITOPF (2011) and Australian Maritime Oil Spill Centre-AMOSC (2011) categorises marine diesel oil (MDO) as a light group II hydrocarbon. The physical characteristics of MDO are summarised in **Table A-1**. 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 MDO, refer to 7.5.4 of the YJP EP.

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

+ MDO 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;
+ MDO has a strong tendency to entrain into the upper water column (0 m–10 m) (and consequently reduce evaporative loss) in the presence of moderate winds (> 10 knots) and breaking waves. However, it re-surfaces when the conditions calm;
+ The evaporation rate of MDO will increase in warmer air and sea temperatures such as those present around the OAs; and
+ MDO 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.

Table A-1: Characteristics of MDO

Parameter	MDO (data from SINTEF's Marine Diesel IKU)
Specific Gravity	0.843
API Gravity	36.4
Viscosity (cP)	3.9 @ 20°C
Wax Content (%)	0.05
Pour Point (°C)	-36
Asphaltene (%)	0.05

Source: GHD 2020a & GHD, 2019

Marine Diesel (IKU) has been used as an analogue for MDO in the modelling studies for Yoorn-1 and Dancer-1 (GHD, 2020a; GHD, 2019). Marine Diesel (IKU) has a very low tendency for emulsion formation, with only 1% water content entrained into the surface slick after 120 hours for all wind conditions assessed (GHD, 2020a) (**Figure A-1**).

Under low winds (1 m/s), 60% of the surface slick is predicted to remain after 120 hours (five days). Under moderate winds (5 m/s), 40% of the initial surface slick is predicted to remain after 24 hours decreasing further to approximately 10% after 48 hours and 1% after 72 hours. With high winds (10 m/s), the surface slick is predicted to be almost entirely evaporated and dispersed after 12 hours (GHD, 2020a).

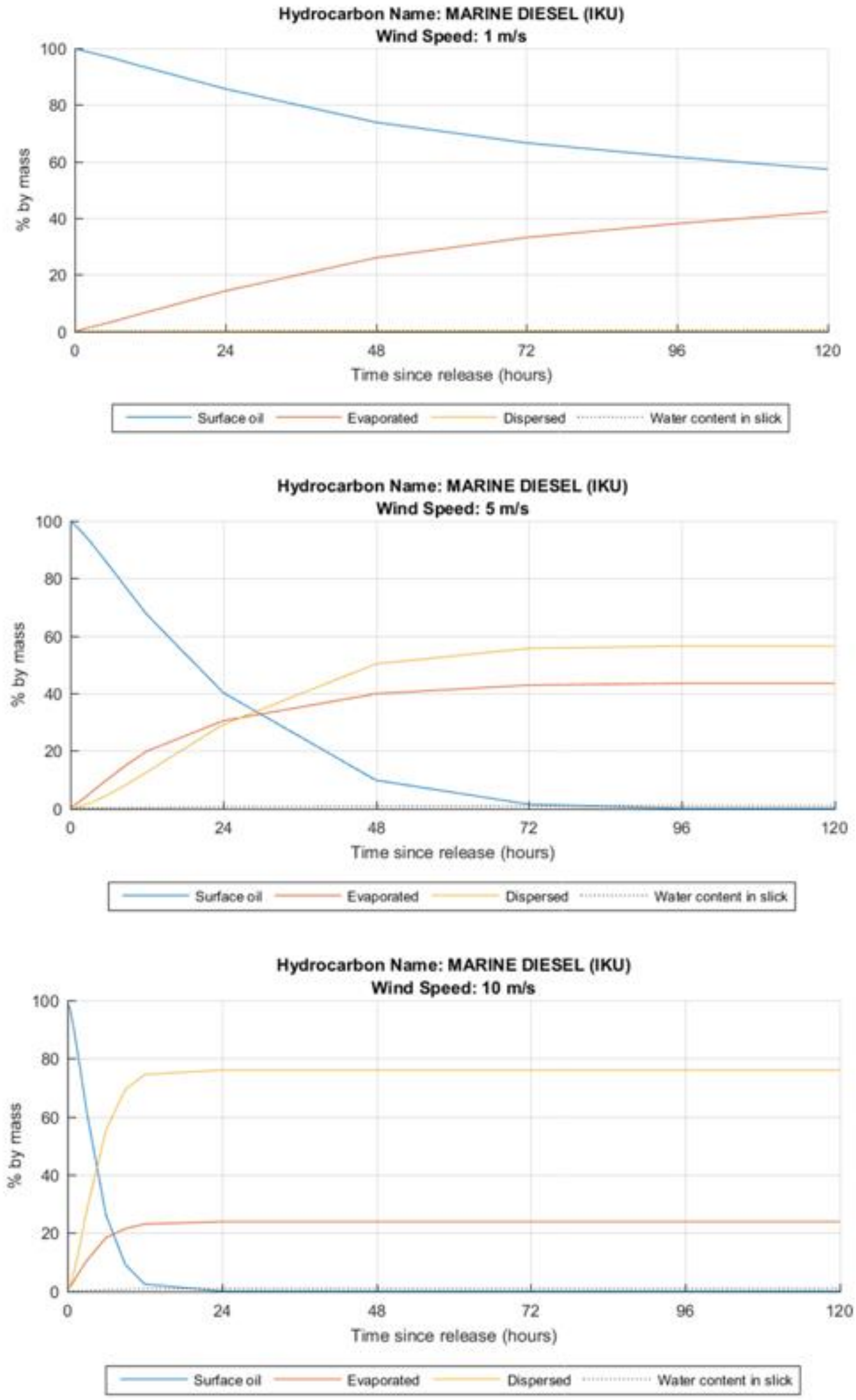


Figure A-1: Simulated Weathering of the Foundation for Specific and Industrial Research at the Norwegian Institute of Technology (SINTEF) Marine Diesel (IKU) Hydrocarbon for Constant Wind Speeds of 1 m/s (top), 5 m/s (middle) and 10 m/s (bottom) (GHD, 2020a)

Gas Condensate

The hydrocarbon type for the LOWC scenarios was identified as Reindeer condensate for Jelen-1 and Parnassus-1; and Linda-1 condensate for Yoorn-1. Rev 2009 13 Grader C (Grader C) was selected from within the SINTEF Oil Library as the modelling analogue for both.

Table A-2 presents the bulk properties of Linda-1 condensate, Reindeer condensate and the SINTEF condensate Grader C, indicating a close match between the three analogues across all comparisons.

Table A-2: Hydrocarbon Characteristics of Linda-1 condensate (Yoorn analogue), Reindeer condensate (J&P analogue) and SINTEF Grader C condensate

Parameter	Linda-1 Condensate	Reindeer Condensate*	SINTEF Rev2009 13 Grader C
Specific Gravity	0.787	0.7862	0.779
API Gravity	48.2	48.5	50.1
Viscosity (cP)	1.33 @ 20°C	0.841	1.1 @ 13°C
Wax Content (%)	0.5	<5	0.6
Pour Point (°C)	-27	<-36	-21
Asphaltene (%)	<0.05	<0.5	0.01

*Source: Intertek (2019)

A preliminary analysis of hydrocarbon weathering was undertaken with the SINTEF Oil Weathering Model (OWM). OWM predicts the mass balance partitioning of hydrocarbons (i.e. evaporation, surface, dispersed subsurface) under steady-state met-ocean conditions. OWM simulations were run for sustained wind speeds of 1 m/s (low winds), 5 m/s (moderate winds) and 10 m/s (high winds). The simulations are based on a test case of 100 m^3 of hydrocarbon released instantaneously onto the sea surface.

The results of the weathering analyses for the modelling analogue Grader C are presented in **Figure A-2**.

Evaporation is the primary weathering mechanism for highly volatile condensates such as Grader C. Under low wind speeds of 1 m/s, approximately 90% of the surface slick is predicted to evaporate after 3 days (72 hours). Under moderate wind speeds of 5 m/s, approximately 82% of the surface slick is predicted to evaporate after 24 hours with the remaining approximately 18% dispersed in the water column and no surface slick under these conditions. High wind speeds of 10 m/s are predicted to rapidly (after only 6 hours) disperse (30%) and evaporate (70%) with no surface slick.

Grader C has a tendency for low levels of emulsification with up to 10% water content in the surface slick over the range of wind conditions. A 10% water content in slick is classed as an unstable emulsion and does not significantly affect its persistence.

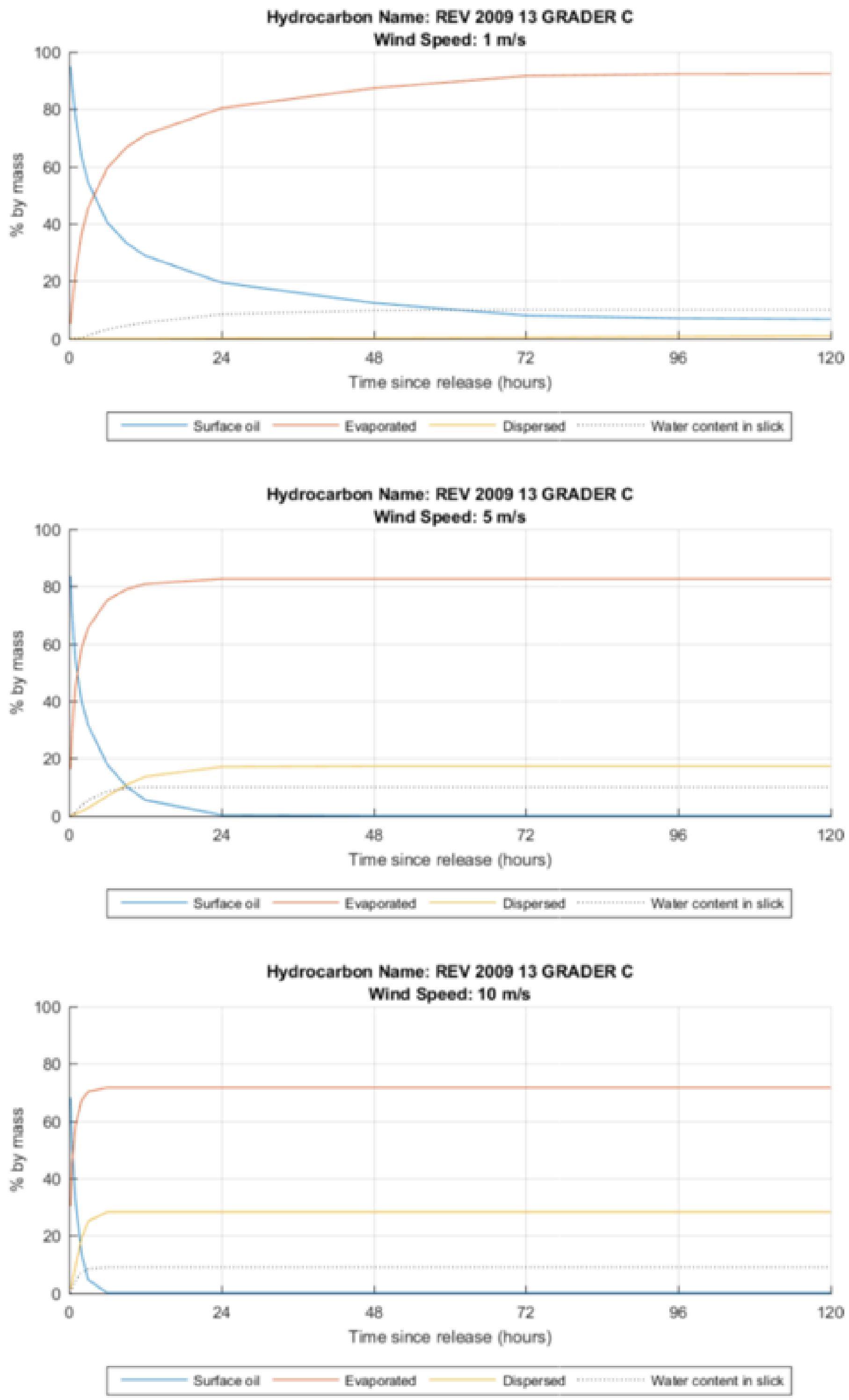


Figure A 2: Simulated weathering of the SINTEF REV 2009 13 GRADER C hydrocarbon for constant wind speeds of 1 m/s (top), 5 m/s (middle and 10 m/s (bottom) (GHD, 2020b)

Appendix B: 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 As Low As Reasonably Practicable (ALARP).

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

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

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 B-1.**

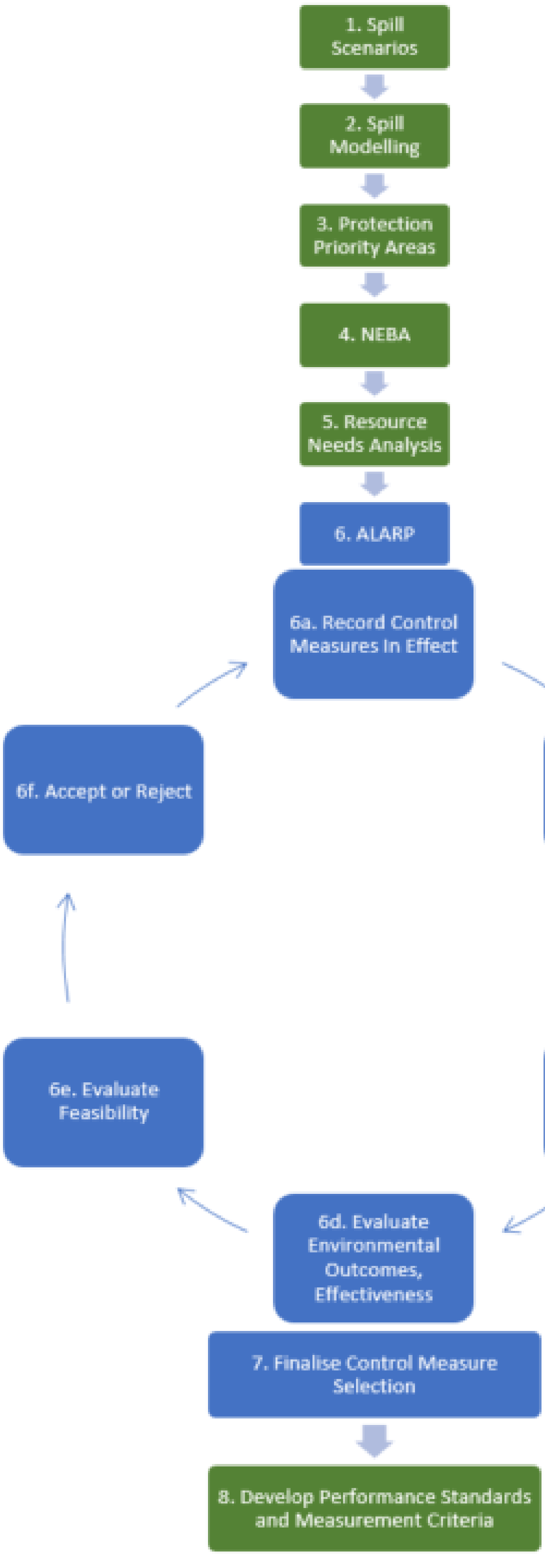


Figure B-1: ALARP Assessment Framework

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

1. Spill Scenarios: this step will involve assessing all possible spill scenarios from the activity and identifying the worst-case credible scenarios as a basis for pollution response planning.

2. Spill Modelling: a quantitative spill modelling assessment is conducted for the worst-case credible scenarios identified in Step 1.
3. Protection Priority Areas: the environment that may be affected (EMBA) is the largest area within which impacts from hydrocarbon spills associated with the activity could extend. The EMBA is predicted using spill modelling results from Step 2. Protection Priority Areas are locations of high ecological value within the EMBA that would be targeted in response. Selection of Protection Priority Areas is detailed in the Oil Spill Risk Assessment and Response Planning Procedure 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 (IMT) to meet the incident requirements up to a worst-case incident.

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

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

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

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

As control measures are evaluated for selection or rejection, they can be compared with industry good 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 B-1**.

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

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721 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

Column	Description
	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. <u>Survivability</u> 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. <u>Dependency</u> 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. <u>Several control measures are reliant on equipment, people and vessels, hence have high dependence.</u> <u>Compatibility</u> 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.

Column	Description
	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

5. ALARP Assessment Summaries

Alternative, Additional and Improved options have been identified and assessed against the base capability described for each of the relevant response strategies (**Section 9** through to **Section 16**). **Table B-2** provides a summary of the ALARP assessment conducted for this activity.

Detailed ALARP assessment worksheets are presented in 6. ALARP Assessment Worksheet.

Table B-2: ALARP Assessment Summary

ALARP assessment summary – source control (refer worksheet for further detail in Section 6)
The Control Measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable in the context of the risk of an uncontrolled well leak from an exploration well. Potential Control Measures were identified and assessed by the Santos Drilling & Completions Department representatives. The drilling of a relief well is considered to be an effective control and relief well planning conducted in the area has demonstrated that relief well drilling within 77 days can be implemented using MODUs, equipment and specialist personnel that Santos has arrangements to gain access to. Twelve potential additional Control Measures were identified and assessed. One additional Control Measure was accepted as reasonably practicable: + Pre-purchase of relief well drilling supplies. Ten Control Measures were rejected as grossly disproportionate. Rejected response strategies were: + Contract source control personnel through an alternative provider in addition to existing arrangements + Wild Well Control personnel on standby in Perth during drilling operations in order to respond immediately to a LOWC + MODU on standby at activity location + Having a dedicated relief well MODU on contract. + Use of two drilling rigs during activity drilling campaign that drill simultaneously so that one rig could act as a relief well drilling rig for the other + Time drilling campaign to align to other Santos drilling activity so that nearby drill rig could be used as a relief well drilling rig + Schedule drilling campaign to avoid cyclone season + Pre-drill riserless intervals for a potential relief well before drilling the main well + Install a mudline closure device + Alternative BOP design (additional BSR installed). Two Control Measures were identified as not feasible for YJP: + Use of semi-submersible drilling rig to drill one or more of the wells + Use of a Capping Stack (subsea) Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 9-6**. The key performance requirements for relief well drilling are the maintenance tracking, access

and relief well planning arrangements (during times of maintaining preparedness) and the timely mobilisation of resources (during a response). These key areas of effectiveness are reflected in the Performance Standards.

ALARP assessment summary – Monitor and evaluate (refer worksheet for further detail in Section 6)

Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture in 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 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. Five were rejected as cost was grossly disproportionate to the reduction in risk, whilst three Control Measures around vessel specifications and accuracy of the vessel tracking system, the provision of strategically located oil sampling kits 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:

+ Determine required vessel specifications and improve accuracy of Vessel Tracking System
+ Purchase of First Strike oil sampling kits to be positioned at Exmouth, Varanus Island and Dampier.
+ Maintain a list of providers that could assist with fauna aerial observation e.g. whale shark spotting planes.

Five Control Measures were rejected as grossly disproportionate. Rejected Control Measures were:

+ Purchase of oil spill modelling system and internal personnel trained to use system
+ Purchase additional satellite tracking buoys
+ Ensure trained aerial observers based at strategic locations such as Port Hedland, Karratha and Broome
+ Trained monitoring specialists on site
+ Ensure trained marine mammal/fauna observers based at strategic locations such as Port Hedland, Karratha and Broome

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in **Table 10-42**. 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 (refer worksheet for further detail in Section 6)

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 – Shoreline protection and deflection (refer worksheet for further detail in Section 6)

Large quantities of various types of nearshore booms and skimmers from Broome, Exmouth, Dampier and Fremantle ensures that equipment is in place to implement this response strategy within 24 hrs in a wide range of metocean conditions. Trained regional Santos personnel can be quickly mobilised to appropriate locations within 24-48 hours, including Santos personnel, AMOSC staff and AMOSC Core Group from Perth. These regional and State resources ensure that equipment and personnel are not a limiting factor in this response strategy. An area of improvement is availability of shallow draft vessel. A review of Control Measures associated with vessels identified that improvement could be made by adding a provision for shallow draft boom tow vessels in existing Master Service Agreements with vessel providers.

Five additional potential Control Measures were identified and assessed.

One Control Measure was accepted as reasonably practicable. The accepted control measure was:

+ Provision for shallow draft boom tow vessels added to Master Service Agreement

Four Control Measures were rejected as grossly disproportionate. Rejected response strategies were:

+ Santos to purchase additional shoreline and nearshore booms and ancillary equipment
+ Access to additional shallow draft boom tow vessels owned by Santos
+ Ensure trained personnel based at strategic locations such as Port Hedland, Broome, Karratha or Exmouth
+ Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations.

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in **Table 12-7**. 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, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence protection and deflection operations and the preparation of an operational NEBA for each operational period that takes into account protection priorities and the ongoing effectiveness of the response strategy. These key areas of effectiveness have been represented in Performance Standards for protection and deflection operations.

ALARP assessment summary – Shoreline clean-up (refer worksheet for further detail in Section 6)

Regional and Fremantle stockpiles and locally available supplies provide a range of shoreline clean-up equipment can be accessed to suit most beach types / required clean-up operations. Trained regional Santos personnel can be quickly mobilised to strategic locations such as Port Hedland, Broome, Karratha or Exmouth, followed by AMOSC staff and AMOSC Core Group from Perth. Equipment and trained personnel are not expected to be limiting factors for this response strategy. The availability of labour hire personnel for initial stages of a response was identified as an area of improvement. Control Measures that were evaluated to improve the availability of labour hire was either not feasible or the cost was grossly disproportionate to the reduction in risk.

The availability of shallow draft vessels was also identified as an area or improvement. A review of control measures associated with vessels identified that improvements could be made by adding a provision for shallow draft vessels in existing Master Service Agreements with vessel providers. Waste management may be a limiting factor for ongoing shoreline clean-up operations and further information is shown in the ALARP assessment for Waste.

Nine additional potential Control Measures were identified and assessed.

One Control Measure was accepted as reasonably practicable. The accepted control measure was:

+ Provision for shallow draft vessels added to Master Service Agreement

Eight Control Measures were rejected as grossly disproportionate. Rejected response strategies were:

+ Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations such as Port Hedland, Broome, Karratha or Exmouth
+ Prepurchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations such as Port Hedland, Broome, Karratha or Exmouth
+ Access to additional shallow draft vessels owned by Santos to transport personnel to key sensitive areas on offshore islands and emergent reefs such as the Montebello Islands, Barrow Island, Lowendal Islands, Imperieuse Reef MP, Clerke Reef MP and Muiron Islands
+ Access to additional team leaders that are locally based at strategic locations (Port Hedland, Broome, Karratha and Exmouth) or can be mobilised within short time frames
+ Faster access to clean-up personnel via Perth based labour hire contractor
+ Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations
+ Faster access to clean-up personnel via Santos employment of local personnel - Port Hedland, Broome, Karratha or Exmouth
+ Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for all PPAs.

Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in **Table 13-7**. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to suitable equipment and personnel through contractual arrangements. During response, a key area of effectiveness is the rapid mobilisation of equipment and personnel and preparation of a Shoreline Clean-up Subplan and NEBA to ensure that impacts from response activities are minimised and operations are conducted in accordance with protection priorities as confirmed by the Control Agency.

ALARP assessment summary – Oiled wildlife (refer worksheet for further detail in Section 6)

Oiled wildlife equipment including first strike kits and containers can be mobilised from various locations around Australia. 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 **Section 14**. 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. Three potential Control Measures were identified and assessed. One Control Measure was accepted as reasonably practicable. The accepted control measure was: + Additional Santos OWR trained personnel positioned at Varanus Island and Perth Two potential Control Measures were identified and assessed. All were rejected as grossly disproportionate. Rejected response strategies 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 Control Measures are shown in Table 14-8. 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 the WA Oiled Wildlife Response Plan are key elements for achieving this strategy and they are represented as a Performance Standards.
ALARP assessment summary – Waste (refer worksheet for further detail in Section 6)
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 **Section 15**. Further detail is captured in the Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053). The waste service provider can mobilise waste receptacles to Port Hedland, Broome and Exmouth from Karratha within 12 hrs. Given the waste service provider arrangements and preplanning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. For these components, potential Control Measures were identified and evaluated but were found to either make no improvement in capability or cost was grossly disproportionate. No other potential control measures were identified. Two potential Control Measures to address this area of improvement was identified. Both potential Control Measures were rejected as grossly disproportionate. Rejected Control Measures were: + Maintain contracts with multiple service providers + Procure temporary waste storage for Santos stockpile. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in **Table 15-4**. 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 (refer worksheet for further detail in Section 6)
Oil spill scientific monitoring will be conducted on behalf of Santos by a contracted monitoring service provider as detailed in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and the relevant

Scientific Monitoring Programs. An area of improvement is the availability of vessels in the initial stages of response. To address this area of improvement, a potential Control Measure around more detailed vessel tracking was assessed and accepted. Additionally, three potential Control Measures were identified and assessed. One Control Measure, 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 relating to 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, both were adopted.

Four additional potential Control Measures were identified and assessed.

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

+ Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans
+ Oil sampling kit for scientific monitoring personnel to be positioned at Varanus Island, Exmouth and Dampier
+ Determine required vessel specifications required for scientific monitoring implementation and improve accuracy of Vessel Tracking System.

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

+ Scientific monitoring personnel and equipment on standby at the OAs.

Performance Standards and Measurement criteria that have been developed for the in effect and accepted Control Measures are shown in **Table 16-4**. 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.

6. ALARP Assessment Worksheet

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment - Source Control							
	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract/ MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.Limit/prevent hydrocarbon contacting sensitive receptors	This primary source control measure provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Cost of contracts/ MOUs	In effect
	Contract source control personnel through an alternative provider in addition to existing arrangements	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	Significant additional cost in maintaining two contracts for the same service	Reject No environmental benefit in having access to personnel surplus to requirements
	Wild Well Control on standby in Perth during drilling operations in order to respond immediately to a LOWC	Additional	People	No environmental benefit as WWC personnel are available to provide support within 72 hours which will coincide with starting to commence sourcing of relief well MODU	No change to effectiveness or reliability as WWC personnel available within a rapid timeframe under existing arrangements.	Significant additional costs in having WWC personnel on standby in Perth. Locating personnel with specialised expertise in Perth may also create issues for other operators, as WWC offer this service to multiple operators. Locating them in remote locations may increase travel times to other global locations if they are required	Reject No environmental benefit in having access to personnel surplus to requirements
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process top follow in the planning and mobilisation for relief well drilling by Santos Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	In effect
	BOP function testing	In effect	People	BOP rams pressure/function tested as per latest edition of API Standard 53 on deployment ensures timely activation of the BOP.	Provides functionality, availabilty, reliability, survivability, compatability and independence	Effort required to conduct BOP function test	In effect
	MODU Capability Register is monitored monthly	In effect	Procedure	By monitoring MODU availability in the region, it will be possible to gain an understanding of which MODU may be rapidly available for relief well operations. This could reduce mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	MODU on standby at activity location	Improved	Equipment	Reduce mobilisation times of MODU to drill relief well thus reducing hydrocarbon released to the environment. Instead of base timeframe for the drilling of a relief well of 77 days, relief well potentially could be drilled in 43 days (77 days less the 34 days required for MODU to be ready to spud/commence relief well operations).	Reduction in spill duration by 34 days, resulting in less hydrocarbon exposure and reduced shoreline loading volumes.	The cost of having a MODU contracted, crewed and holding a valid NOPSEMA Safety Case and WOMP to be on standby would cost between 200-250kUSD per day for a minimum negotiated contract term, plus a cost associated for MODU mob and de-mob. This cost would be paid regardless if there is a loss of containment or not.	Reject Likelihood of LOWC is considered rare and the cost of having a second MODU on standby at location is considered grossly disproportionate to the environmental benefit. It is anticipated a MODU would need to be brought in from overseas to guarantee availability of this rig in the event a relief well was required when the event occurred. It is conceivable that to cover a 50 day well activity (for example) with a relief MODU on standby cost over the same duration would be in the order 15-20MMUSD, depending on where the MODU were mobilised from/to and the market at the time. For YJP, this would require a standby rig for a total of 190 days (50 days each at J&P, and 90 days at Yoorn).
	Having a dedicated relief well MODU on contract.	Improved	Equipment	Provides for rapid mobilisation of relief well rig to location, reducing duration of spill by approximately 20-30 days.	Results in improved availability, reliability and independence. Reduction in spill duration by 20-30 days, results in less hydrocarbon exposure and reduced shoreline loading volumes.	Significant commercial effort required to align two MODUs that are not contracted. Possible that market may not be able to supply this demand.	**Reject** In order to perform this, the MODU will need to be contracted, crewed and hold a valid NOPSEMA Safety Case. This could cost between 150-250k USD per day for a minimum negotiated contract term, plus a cost associated for MODU mob and de-mob. It is anticipated a MODU would need to be brought in from overseas to guarantee availability of this rig in the event a relief well was required when the event occurred. It is conceivable that to cover a 50 day well activity (for example) with a relief MODU on standby cost over the same duration would be in the order 15-20MMUSD, depending on where the MODU were mobilised from/to and the market at the time. For YJP, this would require a standby rig for a total of 190 days (50 days each at J&P, and 90 days at Yoorn). Given there are adequate MODUs covered under the MOU to execute a relief well, this option was rejected as the reduction in risk is grossly disproportionate to the cost and effort required to perform it.

Relief well drilling	Use of two drilling rigs during activity drilling campaign that drill simultaneously so that one rig could act as a relief well drilling rig for the other	Improved	Equipment	Provides for rapid mobilisation of relief well rig to location, reducing duration of spill by approximately 20-30 days.	Results in improved availability, reliability and independence. Reduction in spill duration by 20-30 days, results in less hydrocarbon exposure and reduced shoreline loading volumes.	Considered not feasible to contract and crew and support two rigs to drill two short wells at the same time given that requires: - Double the number of rig crew and service company crew to support the operations for a short time. - Possible inability of the market to supply two MODUs at the same time over a two month window.	**Reject.** Similar reason to the above - would have to move in a rig to make this happen. MOU gives us sufficient access to relief well MODUs.
	Time drilling campaign to align to other Santos drilling activity so that nearby drill rig could be used as a relief well drilling rig	Improved	Equipment	Provides for rapid mobilisation of relief well rig to location, reducing duration of spill by approximately 20-30 days.	Results in improved availability, reliability and independence. Reduction in spill duration by 20-30 days, results in less hydrocarbon exposure and reduced shoreline loading volumes.	This refers to the Dorado activity. Would drilling occur at the same time? Could this rig be nominated as the RW rig for YJP? This would significantly reduce timing (e.g. possibly 20-30 day reduction as not needing to wait for MODU to be sourced and transfer to location.	**Reject** No other concurrent Santos drilling activities expected in the region until mid-2024. Expect adequate rigs via MOU to provide sufficient access for relief well MODU. In order to have 2 rigs on contract, drilling would have to be defered until mid-2024 (for Dorado Development), which means the exploration objectives would not be achieved (i.e to identify backfill for Devil Creek/VI).
	Schedule drilling campaign to avoid cyclone season	Alternative	Procedure	Drilling the well in cyclone season does not increase the likelihood of a loss of containment. This will be verified by NOPSEMA in the accepted WOMP, where the plan to suspend the well during a cyclone will be assessed.	Does not alter the effectiveness of the response strategy.	Having to mob and de-mob a MODU to guarantee the well could be drilled outside of cyclone season would be a >5MM USD cost increase.	Reject There are no additional risks associated with cyclone season on a loss of well control. The barriers installed for cyclone suspension are independent of metocean conditions. Adjusting the timing would preclude the ability to drill for 6 months of the year, materially reducing the MODUs available to do the work. Having to mobe and de-mobe a MODU to guarantee the well could be drilled outside of cyclone season would be a >5MM USD cost increase, which is disproportionate to the benefit gained.
	Direct Surface Intervention Via Well Control Experts	In effect	Procedure	Reduce time taken to control source and reduce environmnetal impacts	1) Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. 2) Mobilisation procedure for personnel as per SCERP 3-4) Contracts and MoUs for well control personnel (WWC)	Ability to implement and effectiveness of this control can only be determined at the time of an incident.	In effect
	Pre purchase of relief well drilling supplies	Improved	Equipment	Relief well drilling supplies such as casings and well head equipment could potentially reduce relief well drilling times	Increase in availability	Cost of purchase, maintenance and storage of supplies	Adopt Offshore D&C commit to having long lead equipment for a relief well at our disposal as part of our WOMP commitments for each well we drill.
	Relief well design assessment to identify and screen relief well spud locations prior to drill campaign	In effect	Procedure	Reduce time taken to plan and execute relief well, and reduce environmental impacts	Improved availability and reliability	Effort required to conduct relief well assessment	In effect
	Pre-drill riserless intervals for a potential relief well before drilling the main well	Additional	Equipment Procedure	Could reduce relief well drill duration by 10 days. However, this activity would result in drill cuttings/discharges being released to the marine environment and noise emissions regardless if a LOWC were to occur or not.	Detailed relief well designs will be re-evaluated and revised for an actual LOWC event. There will be several locations for the relief well identified before an incident, with the optimal location selected after a LOWC incident, based on real-time information (i.e. prevailing weather). A pre-drilled relief well top-section might result in having to use a sub-optimal design and location. It is not industry practice, and such a pre-drilled riseless interval may adversely affect functionality and reliability of this response strategy.	The pre-drilling activity itself would require approximately 10 days and a complete rig move to perform, costing approximately 6-7MM USD per well. Once the main well was completed, the partially completed relief well would need to be abandoned, at a further cost of 6-7MM USD (per well).	Reject This option may result in a sub-optimal relief well location being used. There is minimal environmental benefit gained for the grossly disproportionate costs associated with this option. This option would require an additional drilling location for each of the three wells, which would require an additional two rig movements per well; and double seabed disturbance footprint, additional discharge volumes, and drilling for a longer duration. The pre-drill location may not be in an optimal location in the event of a LOWC (dependent on scenario/conditions on the day). Detailed relief well designs will be re-evaluated and revised for an actual LOWC event. There will be several locations for the relief well identified before an incident, with the optimal location selected after a LOWC incident, based on real-time information (i.e. prevailing weather). A pre-drilled relief well top-section might result in having to use a sub-optimal design and location. It is not industry practice, and such a pre-drilled riseless interval may adversely affect functionality and reliability of this response strategy. Pre-drilling may only save 5-7 days to drill a relief well.
	Use of semi-submersible drilling rig to drill one or more of the wells	NA		NA	A semi-submersible drilling unit is not suitable for the Yoorn-1, Jelen-1 and Parnassus-1 drilling activities given the water depths at the well top-hole locations (which range from ~45 m to 65		This strategy is not applicable for the activity given the water depth is too shallow for semi-submersible drilling.
	Install a mudline closure device	Improved	Equipment	Provides a pre-installed safety barrier at the seabed		Not feasible for jack-up drilling. The wellhead and BOP is at surface.	**Reject.**
	Alternative BOP design (additional BSR installed)	Improved	Equipment	Reduces likelihood of a WCD event	Adds another layer of redundancy in BOP	Could be done. Require modifications to MODU, BOP and BOP control system to implement. Expected cost 3MM USD and time in shipyard or port to install.	**Reject.** Santos commits to using BOP equipment that is fully complaint with API Std 53, which specifies number and type of rams to be installed in the BOP for a given application. This will be a commitment in the SCR and the WOMP. Additional cost doesn't significantly reduce risk and BOP equipment will be fully compliant with industry standards.

	Subsea First Response Toolkit (SFRT) (Provides for subsea dispersant application and light debris clearance)	In effect	Equipment	May support decision making for source control strategy, and potentially for debris clearance; but not SSDI which is not applicable for this hydrocarbon type. Relief well is the primary stratgey for LOWC.	No subsea wellheadd or BOPS are planned to be used	Based on well design, the SFRT is assessed as having no benefit in a LOWC scenario.	In effect. Is available and may be used for for debris clearance aspects of SFRT. SSDI is not relevant for this hydrocarbon type. SFRT is contractually available to Santos and is available should a benefit be identified.
	Capping Stack (subsea) (Place a 'cap' over the blown-out well to stop or redirect the flow of hydrocarbons to allow time to permanently seal the well)	NA		NA	1) Capping stack is only applicable for subsea wells (not Jack-up drilling) due to access issues (rig in the way) and no subsea BOP for connection.		This strategy is not applicable for the activity given Capping Stack is not compatible with Jack-up drilling.
Source Control - Vessel Collision	Vessel Spill Response Plan (SOPEP/SMPEP)	In effect	Procedure	Provides a set process to follow in the planning and mobilisation for spill response actions by the Vessel Contractor thereby reducing the timeframe and increasing the effectiveness of spill response.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Effort required in contractor procudure due diligence.	In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Monitor and Evaluate							
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider. The service provider will be contacted immediately (within 2 hours) upon notification of a level 2 or 3 spill. Upon activation, the service provider will provide trajectory models within: - 2 hours for OILMAP model for offshore and open ocean; - 4 hours for OILMAP operations for near-shore; and - Detailed modelling service is available for the duration of the incident.	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract	In effect
	Access to additional spill modelling capability through OSRL	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	An additional service provider ensures redundancy (independence) if for some reason the other service provider was unable to fulfil the function. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	Cost of membership	In effect
	Purchase of oil spill modelling system and internal personnel trained to use system	Alternative	System, people	This could result in the faster generation of the initial model which may result in an environmental benefit as a consequence of the IMT making operational decisions quicker	Potentially increases availability Decrease in functionality- in house service may not be across technical advances to same extent as contracted service providers	Purchase of system, training of personnel, and on-call roster	Reject The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2 hour turn-around currently guaranteed by the service provider
Tracking buoy	Level 1: Two tracking buoys located on the MODU ready for deployment 24/7. Tracking buoys deployed within 2 hrs.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	In effect
	Level 1. Santos owns and maintains 12x tracking buoys across its NW facilities.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of equipment	In effect
	Level 2: tracking buoys available from AMOSC and through AMOSC Mutual Aid	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Level 3: tracking buoys available from OSRL. Transit times (air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Tracker buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership	In effect
	Purchase additional satellite tracking buoys	Additional	Equipment	There is no expected environmental benefit from having additional tracking buoys, as there are already tracking buoys located on the facility/ vessel ready for deployment 24/7 and any additional needs can be provided by Santos owned stocks. Additional buoys can be accessed from AMSA, AMOSC and OSRL within days with no additional upfront cost.	Increase in availability and reliability	Cost of purchasing additional tracking buoys	Reject Does not provide any additional environmental benefit and the cost associated is therefore not warranted

Aerial surveillance - aircraft and crew	Maintain contract with service provider for dedicated aerial platform operating out of Karratha. (Helicopter services available through WA's primary contracted supplier. Activation of aerial surveillance using helicopter pilots will occur in 3 hours of notification of the spill. Helicopter on site for surveillance within 6 hrs. Surveillance and recording using helicopter pilots is considered adequate for situational awareness.)	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of contract	In effect
No alternate, additional or improved control measures identified							
Aerial surveillance - observers	Level 1: Trained Santos observers will be available from Day 2 of the incident, following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of training and maintaining trained staff	In effect
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of AMOSC membership	In effect
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
	Ensure trained aerial observers based at strategic locations such as Port Hedland, Karratha and Broome	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1 (current arrangements are that the pilot would provide the initial observations and recording on Day 1 with trained aerial observers from Perth and VI mobilised and operational by Day 2).	Improved availability and reliability	Costs associated with staff employment and training	Reject Cost is considered disproportionate to the incremental benefit given surveillance on Day 1 by pilots is considered sufficient
Aerial surveillance - unmanned aerial vehicles	Level 2: Unmanned Aerial Vehicles for aerial surveillance available through AMOSC (UAVs and pilots can be accessed through AMOSC with a mobilisation time of 12+ hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							

Vessel surveillance	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	In effect	Procedure	Provides the procedure for interaction and sighting of protected marine fauna from vessel or aircraft, to ensure compliance with EPBC Regulations.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of maintaining and implementing procedure.	In effect
	Level 1: vessels in use by WA and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. could be used for surveillance purposes in the event of a spill. (Vessel surveillance will be activated within 90 minutes for available on-site vessels. Santos has access to on-hire vessels supporting WA's VI and NV facilities. WA Vessel Monitoring System has access to automatic identification system live-vessel tracking portal to establish vessel availability.)	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of existing contracts with vessel providers	In effect
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by WA Vessel Monitoring System.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of contracts at the time of requirement.	In effect
No alternate, additional or improved control measures identified							
Water Quality Monitoring (operational and scientific)	Maintain of monitoring service provider contract for water quality monitoring services. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hrs.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of contracts	In effect
	Access to additional water quality monitoring services through OSRL	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of OSRL membership	In effect
	Determine required vessel specifications and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Improved availability and reliability	Cost to determine vessel specifications	Accept
	Purchase of First Strike oil sampling kits to be positioned at Exmouth, Varanus Island and Dampier. Development of technical procedure for sample collection by untrained personnel	Additional	Equipment, procedure	Will enable Oil fingerprinting, and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	Cost of purchasing equipment and developing procedure	Accept
	Trained monitoring specialists on site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	Costs associated with staff employment	Reject This is not necessary as a good procedure for sample collection is in place

Satellite Imagery	Maintain membership with AMOSC provider to enable access and analysis of satellite imagery.	In effect	Systems	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Maintain membership with OSRL to enable access to and analysis of satellite imagery	In effect	System	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
Shoreline Assessment	Level 1: WA-based AMOSC staff and core group operations personnel (WA has arrangements through AMOSC to mobilise WA-based AMOSC staff and Core Group personnel to site 24 hours following initiation)	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of AMOSC membership	In effect
	Level 3: Maintain membership with OSRL to access SCAT trained responders (OSRL, 18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides additional functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
No alternate, additional or improved control measures identified							
Wildlife Reconnaissance (aerial/ vessel surveillance. Shoreline and coastal habitat assessment)	Maintain contract with scientific monitoring service provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys.	In effect	People, procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of contract	In effect
	Maintain a list of providers that could assist with fauna aerial observations, eg whale shark spotting planes	Additional	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	Cost of developing and maintaining list	Accept
	Ensure trained marine mammal/fauna observers based at strategic locations such as Port Hedland, Karratha and Broome	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1	Improved availability and reliability	Costs associated with staff employment and training	Reject Maintaining trained fauna observers at location is considered grossly disproportionate as they are required only for the initial stages of the response until observers from scientific monitoring provider can be mobilised.

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

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Shoreline Protection and Deflection							
Protection and deflection- booms and ancillary equipment	Level 2: Shoreline and nearshore booms plus ancillary equipment from Varanus Is. (Santos, 8*Beach Guardian, 16*25m Zoom Boom, 2*skimmer), Exmouth (AMOSC, 20*25m Beach Guardian, 20*25m Zoom Boom, 2 skimmers), Dampier (Santos, 1*skimmer; AMSA, 5* Canadyne Inflatable, 10* Structureflex Inflatable, 5* Versatech Zoom Inflatable, 2 Slickbar Solid Buoyancy, 3*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Fremantle (AMOSC, 23*35m Beach Guardian, 30*25m Zoom Boom, 18* Curtain Boom, 1*skimmer; AMSA, 15*Structureflex Inflatable, 13*Versatech Zoom Inflatable, 10*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Broome (AMOSC, various equipment). Vehicles sourced from local hire companies. Transit times (vessel): Varanus Is. to Exmouth = 18 hrs Transit times (road): Fremantle to Exmouth = ~24 hrs Fremantle to Karratha = ~24 hours Fremantle to Port Hedland = ~24 hours Dampier/ Karratha to Exmouth = 7 hrs Exmouth to North West Cape = 0.5 hr. Protection booming equipment mobilised to FOB location within 12	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs with AMOSC and AMSA	In effect
	Level 3: Shoreline and nearshore booms plus ancillary equipment from Geelong (AMOSC), interstate (AMSA) and Singapore (OSRL). Transit times (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days. These resources in place to commence protection and deflection within 3-10 days.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs Costs associated with staff training	In effect
	Santos to purchase additional shoreline and nearshore booms and ancillary equipment	Additional	Equipment	Enable more protection and deflection operations to occur simultaneously to protect more key areas	Improved availability and reliability	Costs associated with equipment purchase and maintenance	Reject Sufficient quantities of equipment located in the region.
Protection and deflection- vessels	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. Boom deployment vessel / remote island transfer vessel mobilised to FOB location/ port within 12 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of contracts at the time of requirement.	In effect
	Maintain a list of small vessel providers for nearshore booming	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of contracts at the time of requirement.	In effect

	Access to additional shallow draft boom tow vessels owned by Santos	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs of vessel purchase and maintenance	Reject High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
	Provision for shallow draft boom tow vessels added to Master Service Agreement	Improved	Equipment	Reduce time required to source vessels and crew in initial phase of response. Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Time involved in providing vessel specifications and liaising with existing suppliers	Accept
Protection and deflection- personnel	Level 2: Spill responders from Varanus Is., Devil Creek, Perth (Santos, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to Exmouth within 12 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 24 hrs.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - Santos access to helo services ensures that regional personnel can be quickly mobilised to the appropriate location. Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	In effect
	Level 3: Spill responders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances. Through the mutual aid arrangement, Santos will leverage from existing Chevron capabilities on Barrow Island to assist with protection and deflection deployment.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	In effect
	Ensure trained personnel based at strategic locations such as Port Hedland, Broome, Karratha or Exmouth	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs associated with staff employment and training	Reject No Santos personnel currently based at Port Hedland, Broome, Karratha or Exmouth so employment costs would be significant and not justified given that helicopters enable rapid transportation of Santos staff within the region.
Protection and deflection - planning	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations.	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Shoreline Cleanup							
Shoreline Clean-up - equipment	Level 1: Manual clean-up equipment from local hardware outlets. Decontamination/staging equipment from Exmouth (AMOSC, 1*decon station). Mobile plant from local hire companies. PPE from Exmouth (Santos, 1*container). Clean-up equipment mobilised to location within 12 hrs.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of equipment in initial 48 hours of incident	Cost of equipment purchase and hire at the time of incident Cost of membership with AMOSC	In effect
	Level 2: Manual clean-up and flushing equipment from Varanus Is. (Santos, 1*container), Fremantle (AMOSC, 1*shoreline support kit and 1*flushing kit) and state hardware outlets. Decontamination/staging equipment from Karratha (AMSA; 2*decon stations) and Fremantle (AMOSC, 1*decon station; AMSA, 2* decon stations). Mobile plant from state hire companies. PPE from Dampier and Varanus Is (Santos, 2*containers) and Fremantle (AMOSC, 1*container, 2*gas detectors). Transit times (vessel): Varanus Is. to Exmouth = 18 hrs, Transit times (road) Fremantle to Exmouth = ~24 hrs Dampier/ Karratha to Exmouth = 7 hrs Resources in place to commence shoreline clean-up within 1–3 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	Cost of equipment purchase and hire at the time of incident Cost of equipment purchase and maintenance Cost of contract with AMOSC	In effect
	Level 3: Manual clean-up and flushing equipment from Geelong (AMOSC, 1*shoreline support kit, 1* flushing kit, 1*shoreline impact lance kit), Singapore (OSRL) and national hardware outlets. Decontamination/ staging equipment from Geelong (AMOSC, 1*decon station). Mobile plant sourced from national hire companies. PPE from Geelong (AMOSC, 1*container, 7*gas detectors). Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - procurement and mobilisation of equipment	Cost of equipment purchase and hire at the time of incident Cost of equipment purchase and maintenance Cost of memberships with AMOSC and OSRL	In effect
	Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations such as Port Hedlanbd, Broome, Karratha or Exmouth	Additional	Equipment	Environmental benefits and impacts are dependant on hydrocarbon fate and local ecology. Reduced mobilisation times and improved access would assist, should mobile plant be deemed advantageous	Improved availability and reliability	Costs associated with equipment purchase and maintenance	Reject there is a high likelihood that mobile plant equipment is not used due to negative environmental impacts, leaving purchased equipment unutilised and costs disproportionate Locally available hire plant can be used. Additional plant could be purchased and mobilised from Perth if required

	Prepurchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations such as Port Hedlanbd, Broome, Karratha or Exmouth	Additional	Equipment	Improve mobilisation time, potential for more response locations	Improved availability and reliability	Cost in purchase and maintenance of equipment	Reject Equipment for first strike available at Exmouth. Additional equipment can be mobilised to Port Hedland, Broome, Karratha or Exmouth in less than 24 hours.
Shoreline Clean-up - vessels	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. Remote island transfer vessel mobilised to FOB location/ port within 12 hrs.	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region and tracked by Santos Vessel Monitoring System	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Shallow draft vessels sourced without existing contracts from any location	In effect	Equipment	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of contracts at the time of requirement.	In effect
	Access to additional shallow draft vessels owned by Santos to transport personnel to key sensitive areas on offshore islands and emergent reefs such as the Montebello Islands, Barrow Island, Lowendal Islands, Imperieuse Reef MP, Clerke Reef MP and Murion Islands	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas on offshore islands	Improved availability and reliability	Costs of vessel purchase and maintenance	Reject High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
	Provision for shallow draft vessels added to Master Service Agreement	Improved	Equipment	Reduce time required to source vessels and crew in initial phase of response. Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability. Improve capacity for Santos to source shallow draft vessels	Time involved in providing vessel specifications and liaising with existing suppliers	Accept
	Level 2: Clean-up team leaders from Varanus Is., Devil Creek, Perth (Santos, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to Exmouth within 12 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 24 hrs.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	In effect
	Level 3: Clean-up team leaders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel	Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	In effect

Shoreline Clean-up - personnel	Access to additional team leaders that are locally based at strategic locations (Port Hedland, broome, Karratha and Exmouth) or can be mobilised within short time frames	Additional	People	Improve mobilisation time, potential for more response locations	Improved availability and reliability	Cost of employment and training of staff Cost of being locally based or on a rapid mobilisation plan	Reject Santos already employs trained oil spill responders in the region that can be mobilised to key areas by helicopter within short time frames.
Shoreline Clean-up - personnel	Clean-up labour personnel predominantly based in Perth.	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Costs of labour hire through existing service provider	
Shoreline Clean-up - personnel	Faster access to clean-up personnel via Perth based labour hire contractor	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Not feasible to mobilise labour hire personnel in less than 72 hours	Reject Not feasible to mobilise labour hire personnel in less than 72 hours
Shoreline Clean-up - personnel	Faster access to clean-up personnel via locally based labour hire companies or emergency response organisations	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	No identified regional labour hire companies	Reject No identified regional labour hire companies
Shoreline Clean-up - personnel	Faster access to clean-up personnel via Santos employment of local personnel - Port Hedland, Broome, Karratha or Exmouth	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Costs associated with personnel employment and training	Reject Cost of permanently employing local personnel is grossly disproportionate to benefits of availability in initial phase of response.
Shoreline Clean-up - planning	Shoreline sensitivity mapping and Tactical Response Plans	In effect	Procedures	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation in initial 48 hours of incident	Cost associated with development and maintenance of mapping and Tactical Response Plans	In effect
Shoreline Clean-up - planning	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for all PPAs	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.
Shoreline Clean-up response	Prioritise use of existing roads and tracks	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities, improve response time and efficiency			In effect
Shoreline Clean-up response	Soil profile assessment prior to earthworks	In effect	Procedures	Improved baseline information for shoreline condition			In effect
Shoreline Clean-up response	Pre-cleaning and inspection of equipment (quarintine)	In effect	Procedures	Reduced potential for contaminating environment during response activities			In effect
Shoreline Clean-up response	Use of Heritage Advisor if spill response activities overlap with potential areas of cultural significance	In effect	Procedures	Improved capacity to respond appropriately to areas of potential cultural significance			In effect

	Select temporary base camps in consultation with DoT and DBCA	In effect	Procedures	Optimise response based on camp location, reduce environmental impact of camps			In effect
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	In effect	Procedures	Improved response efficiency			In effect
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			In effect
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	In effect	Procedures	Reduced environmental impact as a result of shoreline access activities			In effect
	Stakeholder consultation	In effect	Procedures				In effect

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Oiled Wildlife							
Oiled wildlife response - planning	Implementation of the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan	In effect	Procedure	Working within the guidelines of the WAOWRP and Pilbara regional plan will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement- framework for how Santos will integrate with Control Agencies for OWR	Effort and time involved in developing OWR implementation plan within OPEP based on guidance from WAOWRP and Pilbara Regional Plan	In effect
	Santos Oiled Wildlife Response Framework; sets the corporate guidance for OWR preparedness and response and defines how Santos will integrate with Control Agencies to provide a coordinated response.	In effect	Procedure	The framework is complementary to the WAOWRP and Pilbara Regional Plan and facilitates a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR.	Improved functionality and reliability.	Cost of document development and maintenance	In effect
Oiled wildlife response - equipment	Level 2 OWR kits and containers available from AMOSC, AMSA, DBCA or DoT in Exmouth, Darwin, Broome, Karratha, Fremantle, or Kensington. WA equipment (OWR containers) mobilised to Exmouth region within 24 hrs.	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
No alternate, additional or improved control measures identified							
	Level 1/2 Santos personnel trained in OWR. OWR trained personnel mobilised to Exmouth region within 24 hrs.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; ensure personnel are based not just in the Perth Office but also at VI and DC facilities	Cost of training and maintaining training	In effect
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractors, and Industry Mutual Aid. Mobilisation of OWR personnel to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Cost of membership with AMOSC	In effect
	Level 3 OWR personnel available through OSRL. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel accessed through labour-hire arrangements would receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of labour hire at time of incident	In effect

Oiled wildlife response - personnel	Additional Santos OWR trained personnel positioned at VI and Perth	Additional	People	Additional personnel trained in OWR and whom are located at facilities will enhance the first strike capability of Santos and therefore enhance the likelihood of success of the OWR, particularly for those instances where oil is ashore within 48 hours	Improved functionality, availability, reliability and independence.	Cost of training staff	Accept
	Prehire and/or prepositioning of staging areas and responders	Additional	System	This may enhance response times and first strike capability and hence improve the likelihood of success of the OWR. Conversely, prepositioned personnel and staging areas may result in negative impacts to the environment and wildlife.	Improved functionality, availability, reliability and independence.	Additional wildlife resources could total $1500 per operational site per day. This is a guaranteed cost regardless of whether a spill occurs or not.	Reject The cost of setting up staging areas and having responders on standby is considered disproportionate to the environmental benefit gained. Further, prepositioned personnel and staging sites may have negative impacts on the environment and wildlife. The overall OWR capability Santos can access through Santos staff, AMOSC, AMOSC mutual aid, Santos labour force hire arrangements, DBCA and wildlife carer network are considered adequate, with further advice and international resources available through OSRL.
	Direct contracts with service providers	Alternative	System	This option duplicates the capability accessed through AMOSC and OSRL and would complete for the same resources without providing a significant environmental benefit	Does not improve effectiveness	Cost of contract	Reject This option is not adopted as the existing capability meets the need.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcome	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Waste							
Waste Management	Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained and periodically reviewed. Waste service provider waste receptacles mobilised to Exmouth from Karratha within 12 hrs for containment and recovery, protection and deflection and shoreline clean-up response strategies.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Cost of contract	In effect
	Maintain contracts with multiple service providers	Additional	System	Contract with additional waste service provider will not provide an additional environmental benefit as there are two major service providers in the region and reciprocal arrangements facilitate access to equipment of both.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Significant additional cost in maintaining two contracts for the same service	Reject No environmental benefit
	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Costs of contracts, MOU with waste service provider, AMOSC, AMSA and OSRL	In effect
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	Additional cost in purchase and maintenance of tanks	Reject Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA, OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commenced.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
ALARP Assessment Summary - Scientific Monitoring							
Scientific Monitoring - monitoring service provider and equipment	Maintenance of Monitoring Service Provider contract for scientific monitoring services and annual review of standby manual. SMP provider and monitoring equipment mobilised to site within 72 hrs.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract with Scientific Monitoring Service Provider	In effect
	Regular capability reports from Monitoring Service Provider shows personnel availability and annual reviews of standby manual	In effect	System	This ensures the Monitoring Service Provider has the capability to undertake Scientific Monitoring, including, post-spill preimpact surveys within the EMBA of receptors with deficient baseline data	Improves functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	In effect
	Conduct periodical review of existing baseline data sources across the Santos combined EMBA	In effect	System	This ensures that receptors within the EMBA with deficient baseline data are identified	Improves functionality and provides compatibility	Cost of contract with Scientific Monitoring Service Provider	In effect
	Scientific monitoring personnel, plant and equipment on standby at the OAs	Additional	People, equipment	Improve mobilisation time	Improved availability and reliability	Cost would be in excess of $1 mil annually	Reject Cost of control measure is disproportionate to the environmental benefit
	Maintain equipment list and list of suppliers for implementation of Scientific Monitoring Plans	Improved	Procedure	Improve response time	Improved functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	Accept
	Oil sampling kits for scientific monitoring personnel to positioned at Varanus Island, Exmouth and Dampier	Improved	Equipment	Improve response time	Improved availability and reliability	Cost associated with purchase of equipment and maintenance	Accept
Scientific Monitoring - vessels	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos Vessel Monitoring System. Santos to mobilise monitoring vessels to deployment location within 72 hrs.	In effect	Equipment	Improve response time	Provides availability and reliability	Effort associated with maintaining MSA	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of contracts at the time of requirement.	In effect
	Determine required vessel specifications required for Scientific Monitoring implementation and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Increase in availability and reliability	Effort to determine vessel specifications and improve tracking	Accept

Appendix C: Pollution Report

Department of
Transport

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

Marine Pollution Report (POLREP)

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

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

INCIDENT DETAILS

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

Location name/description: ________________________________

Incident Coordinates Latitude of spill________________________ Longitude of spill ________________________

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

Description of Incident: ________________________________

POLLUTION SOURCE

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

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

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

POLLUTANT

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

☐ **Chemical** Name:________________________ MARPOL cat / UN Nos: ________________

☐ **Garbage** Details/description: ________________________

☐ **Packaged** Details/description: ________________________

☐ **Sewage** Details/description: ________________________

☐ **Other** Details/description: ________________________

EXTENT

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

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

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

Weather conditions at site: ________________________

☐ **Photos taken** Details:________________________ held by: ________________

☐ **Video taken** Details:________________________ held by: ________________

☐ **Samples taken** Description:________________________ held by: ________________

☐ **Items retrieved** Description:________________________ held by: ________________

ADDITIONAL INFORMATION

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

Equipment used? ☐ AMSA ☐ State / NT ☐ Industry

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

ORIGINAL REPORT SOURCE

Name:____________________ Position:____________________ Phone: ________________

Combat agency:____________________ Statutory agency: ____________________

SENDER DETAILS

Name:____________________ Agency:____________________ Date:____________

Phone: ____________ Fax: ____________ Email:____________________

PRIVACY STATEMENT

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

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

Appendix D: Situation Report

Department of
Transport

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

Marine Pollution Situation Report (SITREP)

Send completed form to:
Maritime Environmental Emergency Response
Department of Transport
GPO Box C102 PERTH, WA 6839
Email: marine.pollution@transport.wa.gov.au
and rccaus@amsa.gov.au
Fax: 1300 905 866

MARINE POLLUTION SITUATION REPORT (SITREP)

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

This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

Incident Name:______________________________ **Ref. No.** ______________

Priority ☐ Urgent ☐ Immediate ☐ Standard

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

Date:______________________ **Time:**______________

POLREP Reference: ______________________________

Incident location Latitude______________ Longitude______________

Brief description of incident and impact:

Overall weather conditions:

Summary of response actions to date:

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

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

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

POST

RESET

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

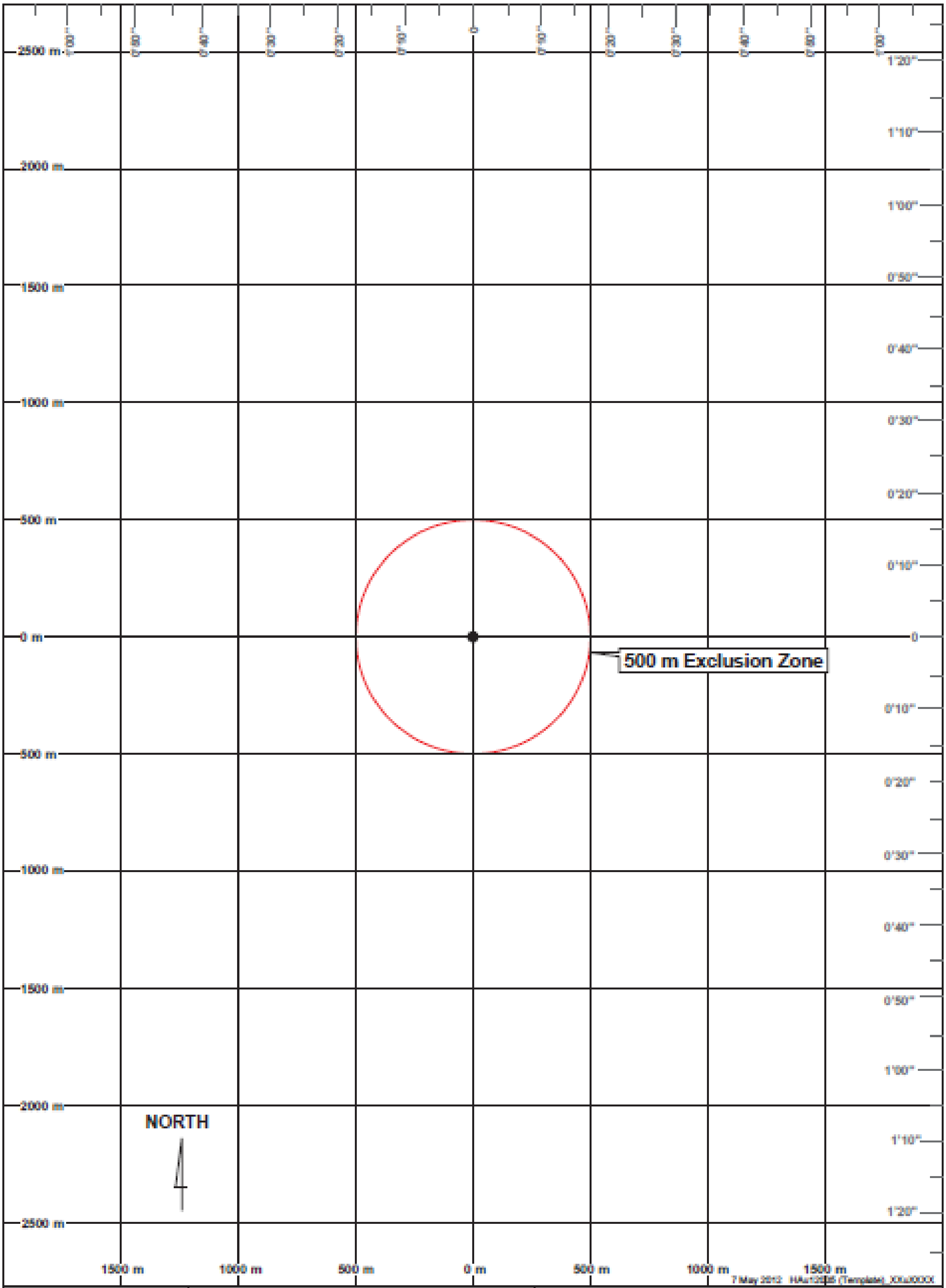
Aerial Surveillance Observer Log – Oil Spill

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)	

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

Appendix G: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



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

Appendix H: Aerial Surveillance Marine Fauna Sighting Record

Santos

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

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

MARINE FAUNA ID GUIDE

◯ Humpback whale

◯ Blue whale

◯ Minke whale

◯ Sperm whale

◯ Killer whale

◯ Bryde's whale

◯ Whale species unknown

◯ Bottlenose dolphin

◯ Spinner dolphin

◯ Dolphin species unknown

◯ Whale shark

◯ Dugong

◯ Hawksbill turtle

◯ Loggerhead turtle

◯ Green turtle

◯ Flatback turtle

◯ Leatherback turtle

◯ Turtle species unknown

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		
<u>Observer Name</u>	<u>Observer signature</u>	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I: Aerial Surveillance Shoreline Observation Log

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Aerial Surveillance Reconnaissance Log – Oil Spill

Survey Details							
Incident:	Date:		Start time:	End Time:	Observer/s:		
Area of Survey							
Start GPS LATITUDE: LONGITUDE:				End GPS LATITUDE: LONGITUDE:			
Aircraft type	Call sign			Average Altitude		Remote sensing used (if any)	
Weather Conditions							
Sun/Cloud/Rain/Windy		Visibility			Tide Height L/M/H		
Time high water		Time low water			Other		

Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present					
	Rocky Cliffs		Boulder and cobble beaches		Sheltered tidal flats
	Exposed artificial structures		Riprap		Mixed sand and gravel beaches
	Inter-tidal platforms		Exposed tidal flats		Fine-Medium sand grained beaches
	Mangroves		Sheltered rocky shores		Other
	Wetlands		Sheltered artificial structures		
Operational Features (tick appropriate box)					
	Direct backshore access		Alongshore access		Suitable backshore staging
Other					

Appendix J: Shoreline Clean-up Equipment

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

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

	Inflatable Tent 9 square metres	1

Equipment list for a decontamination unit for Beach Clean Up Team

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

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

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

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

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

Appendix K: Shoreline Response Strategy Guidance

Shoreline Response Strategy Guidelines

Guidance on response methods for sensitive coastal habitats is provided in **Table K-1**.

Guidance on applicable shoreline clean-up techniques based on shoreline substrate and degree of oiling are presented in **Figure K-1** to **Figure K-4**.

Table K-1: Strategy Guidance for shoreline response at coastal sensitivities

Sensitive Receptors	Strategy Guidance
Mangroves	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of creeks or along the mangrove fringe to prevent/minimise oiling. - Sorbents can be used to wipe heavy oil coating from roots in areas of firm substrate. Close supervision of clean-up is required. - Where thick oil accumulations are not being naturally removed, low-pressure flushing may be attempted at the outer fringe – sorbent pads and sorbent sweeps can be used to recover the sheen. - No attempt should be made to clean interior mangroves, except where access to the oil is possible from terrestrial areas. - Oily debris should be removed; it is extremely important to prevent disturbance of the substrate by foot traffic; thus most activities should be conducted from boats. - Live vegetation should not be cut or otherwise removed.
Mudflats	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, multiple rows of booms, or earthen booms can be deployed at the entrance of channels filling/ draining mudflats. - Efforts to manually clean mudflats may result in further damage due to trampling of the oil into sediments which typically rich in biota and provide a food source for fish and birds. - Therefore, natural remediation may be the preferred approach and if removal is required, the flushing of oil into open water, if feasible, may be preferred to manual collection - The presence of wildlife (e.g. shorebirds) and sensitive flora (e.g. mangroves) which are often associated with mudflats needs to be considered in determining the best approach.

Sensitive Receptors	Strategy Guidance
Sandy beaches	- Clean-up techniques will depend upon the degree of infiltration into sand or and degree of burial which will require surveying/mapping - Clean-up will also depend upon sensitivity of environment (existing ecological features), access to the beach and potential for additional erosion. - Oil and oiled sediments can be physically removed offsite, moved to surf zone for surf washing of sediment or assisted to move to water edge by ploughing of channels or flushing. - Recovery of oil can be by manual means (hand tools) or mechanical means (earth moving, pumping equipment). - The sensitivity of the environment is a key factor, with manual removal creating less waste and disturbance but more consuming in time and resources.
Seabirds, shorebirds and migratory waders	- All efforts should focus on deflecting oil away from this area or dispersing the oil offshore or using booms offshore to divert the oil away from this area. - If oil is expected to move into the coastal colonies and roosting areas, multiple booms can be deployed along the reserve to prevent/minimise oiling.
Turtle nesting beaches during or near nesting season	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, booms can be deployed along the reserve to prevent/minimise oiling.
Fringing coral reef communities (Note: submerged coral reef communities are less susceptible to oiling)	- Little can be done to protect coral reef beds along exposed sections of shoreline. - Floating oil would potentially coat living reef communities, which are usually slightly elevated and are consequently exposed at low tide. - Natural recovery with a close monitoring program is the preferred clean-up technique. Clean-up of the reef itself by natural processes is expected to be rapid. - As much as practicable, oil should be removed from adjacent intertidal areas to prevent chronic exposure of the corals to oil leaching from these sites. - Use of sorbents should be limited to those that can be contained and recovered.
Macroalgal and seagrass beds	- All efforts should focus on deflecting oil away from this area, dispersing the oil offshore, or using booms to divert the oil away from this area. - Extreme care should be taken not to disturb the sediments during clean-up operations in the vicinity of macroalgal and seagrass beds, which could result in total loss of the macroalgal and seagrass beds. - Removal of oiled parts of the macroalgal and seagrass beds should only be considered when it can be demonstrated that special species are at significant risk of injury from contact or grazing on the macroalgal and seagrass beds. - Otherwise, the best strategy for oiled seaweed is to allow natural recovery.
Rocky coast	- Where practicable, booms can be deployed parallel to the rocky coasts to prevent/minimise oiling. - Flushing rocky shoreline is considered the most effective method of cleaning. Care must be taken to assess the fate and transport of the flushed oil and sorbent snares can be used to recover if deemed necessary to reduce impacts to ALARP. - For small areas of contamination, rocky structure can be manually wiped with sorbent pads or scraped to remove oil.

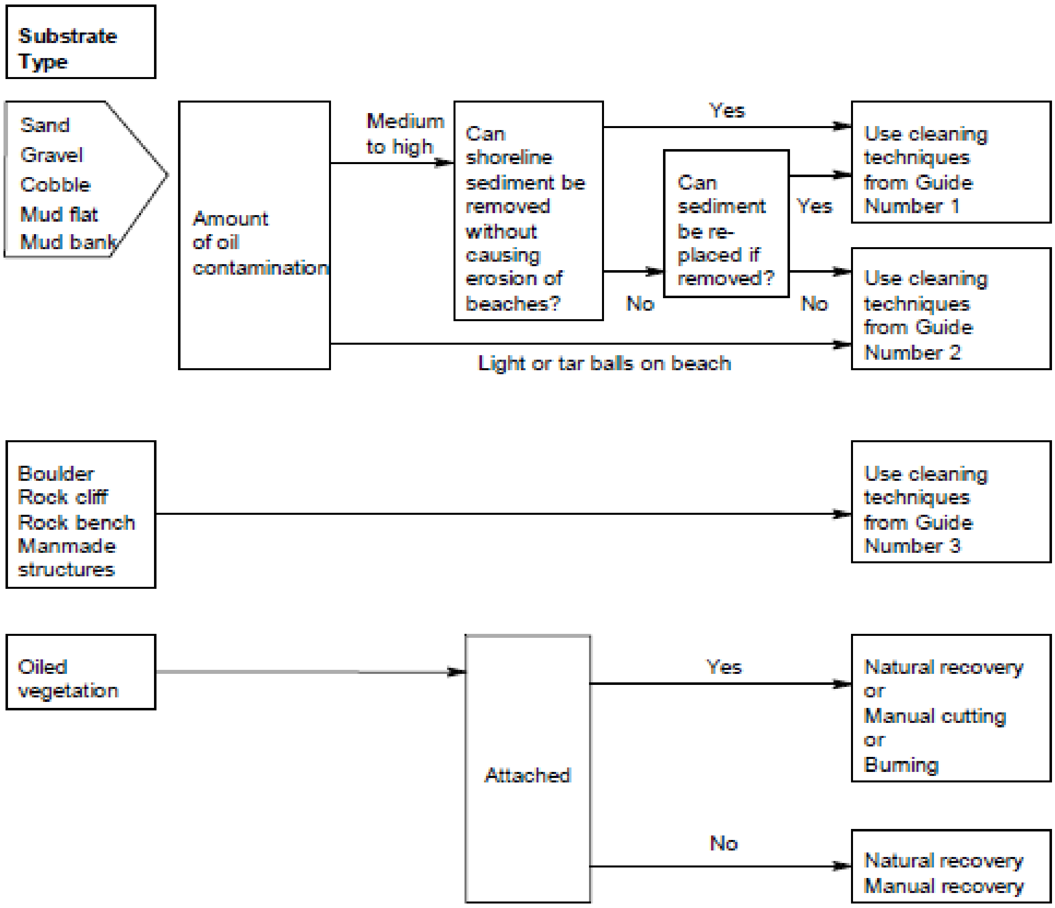

Figure K-1: Shoreline Clean-up Master Decision Guide

Shoreline Cleanup Decision Guide Number 1

TRAFFICABILITY		SUBSTRATE TYPE	DEPTH OF OIL PENETRATION	CLEANUP TECHNIQUES IN ORDER OF PREFERENCE	ACCESS
1. Can rubber-tyred equipment operate on beach?	Yes	Sand, Gravel, Mud	Less than 3cm	Motor Grader and Elevated Scraper Combination. Elevated Scraper. Motor-Grader and Front-End Loader (Rubber-Tyred) Combination.	**3.** Is there access to beach for heavy equipment or can access be constructed?
			Greater than 3cm	Elevated Scraper. Front-End Loader (Rubber-Tyred). Bulldozer and Front-End Loader (Rubber-Tyred) Combination.	
		Cobble	Less than 30cm	Front-End Loader (Rubber-Tyred).	
			Greater than 30cm	Bulldozer and Front-End Loader (Rubber-Tyred) Combination. Front-End Loader (Rubber-Tyred).	
		Mud Bank	Not applicable	Backhoe. Front-End Loader (Rubber-Tyred).	
No ↓					
2. Can tracked equipment operate on beach?	Yes	Sand, Gravel, Mud, Cobble	Less than 30cm	Front-End Loader (Tracked). Bulldozer and Front-End Loader (Tracked) Combination.	
			Greater than 30cm	Bulldozer and Front-End Loader (Tracked) Combination. Front-End Loader (Tracked).	

Yes (from 3.) → Select most preferable technique

No (from 2.) → Use dragline or hydraulic grader or leave to natural recovery.

No (from 3.) → Go to next figure, Decision Guide Number 2, Question 4.

Figure K-2: Shoreline Clean-Up Decision Guide 1

Shoreline Cleanup Decision Guide Number 2

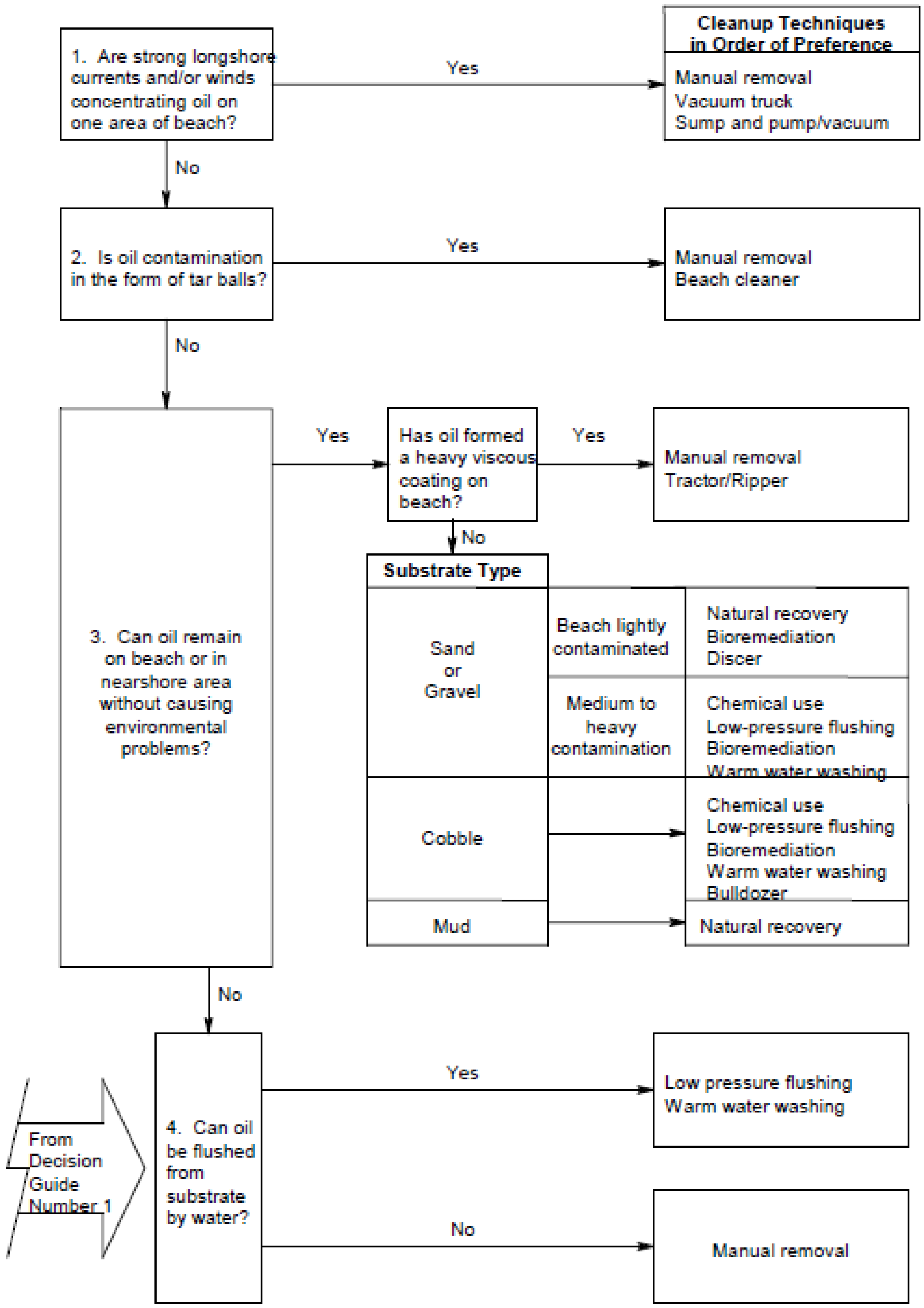

Figure K-3: Shoreline Clean-Up Decision Guide 2

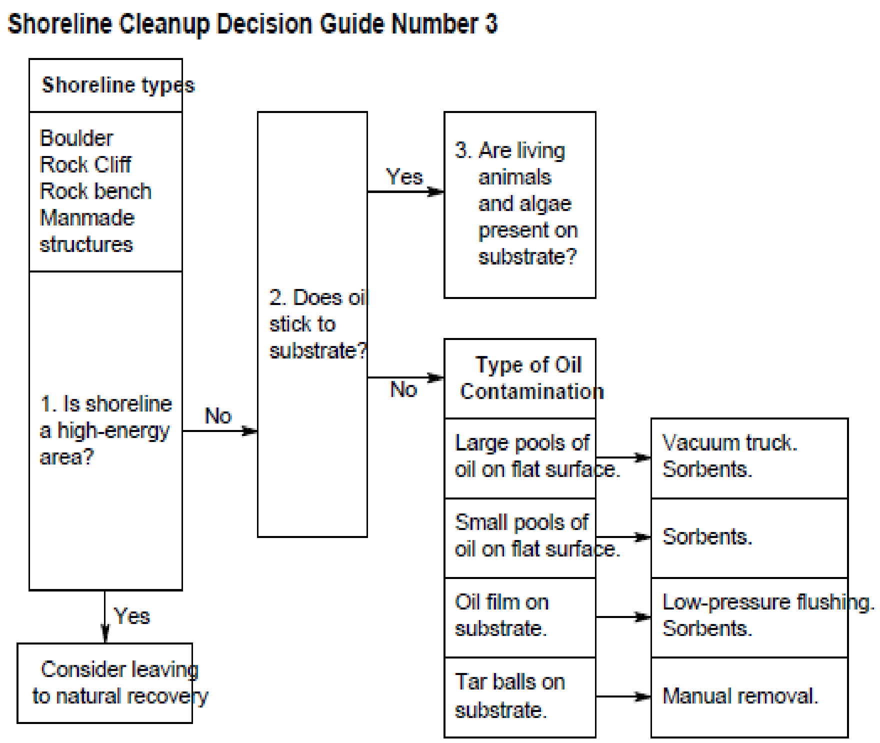

Figure K-4: Shoreline Clean-Up decision Guide 3

Appendix L: Operational Guidelines for Shoreline Response

Operational Guidelines for Shoreline Clean-up activities

1.1.1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
    - Provide an extinguisher for each cabin
    - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
✓ Plastic liners, geotextiles ✓ Barrier tape and stakes ✓ Signposting equipment	✓ Bins, barrels, skips, tanks ✓ Hot and cold beverages Welfare) ✓ Cooking oil, soap (Welfare) ✓ Earthmoving equipment

PRIMARY STORAGE OF WASTE

A primary storage site is:

- ✓ An emergency staging area of the immediate deposit of the waste collected before its transfer to either an intermediate long term storage site or if possible directly to a treatment facility; and
- ✓ A key stage in the waste management process for sorting, labelling and quantifying the types and volumes of waste collected and when possible, reducing volumes to be transported by pre-treatment.

The storage site must be closed as soon as clean-up operations are completed.

The return of the site to its original condition implies:

- ✓ A contamination diagnosis made by an organisation specialised in ground pollution, decontamination operations if needed and the approval of the authorities; and
- ✓ In some cases, botanical evaluations to define a plant cover restoration operation.

✓ Segregate the different types of waste ✓ Protect containers from rain water and to contain odours ✓ Protect containers from prolonged exposure to sunlight if necessary ✓ Ensure security to prevent unauthorised dumping

Primary waste storage sites should meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Good access to roads for heavy lorries; and
- ✓ A flat area with enough space away from environmentally-sensitive areas (vegetation, groundwater) and out of reach of the sea tides and waves.

- ✓ Depending on the volume of waste, site characteristics and availability of containers, prepare:
  - Staging areas
  - Pits if necessary
  - Platform within earth berms
  - Platform for bagged solids and liquids in tank.
- ✓ Protect areas using watertight plastic liners
- ✓ Lay fine gravel or sand at the base of the storage area to protect the membranes
- ✓ Prepare rain water or effluent management
- ✓ Ensure correct labelling of the containers to avoid mixing the different types of waste (liquid, solid, non-biodegradable – oiled plastics, contaminated cleanup equipment, biodegradable – oiled seaweed, faunal)
- ✓ Control access to the cleanup sites and protect access routes using lining and/or geotextiles

BASE CAMP/REST AREA

The rest area (base camp) should at least consist of:

- ✓ Changing rooms;
- ✓ Toilets; and
- ✓ A rest area.

At base camp, operators must be provided with:

- ✓ A first aid kit; and
- ✓ Hot and cold beverages, meals.

Selection of the rest area must meet certain criteria:

- ✓ Close proximity to the clean-up site;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally sensitive areas.

Equipment

- ✓ Shelter/rest area (tent, temporary building;
- ✓ Portable toilets (at least one for men and one for women);
- ✓ Locker rooms;
- ✓ First aid kit;
- ✓ Fire extinguisher; and
- ✓ Communication equipment.

STORAGE AREA FOR EQUIPMENT AND MACHINERY

This area consists of and equipped repair and maintenance site.

In order to avoid incidents and clean-up equipment failures, equipment should only be used by trained personnel and all equipment should regularly be checked for conformity with standard operating procedures and safety.

- ✓ Check and adjust daily levels of gasoline, diesel, oil, water and other fluids
- ✓ Regularly maintain the machines (pumps, pressure washers...)
- ✓ Equipment must be checked, counted by the person in charge of logistics and stored daily at the end of the work day
- ✓ Some pieces of equipment must be washed or at least rinsed daily, with proper recovery of cleaning effluent, other kinds of equipment should be washed weekly or at the end of operations
- ✓ Set up a systematic maintenance-cleaning-repair operation at the end of each week
- ✓ Small tools and equipment and even detachable parts of all equipment remaining outside should be securely stored away (eg stainless steel bucket of small sand screeners)
- ✓ In case of interruption of operations, large pieces of equipment should be moved to a supervised site
- ✓ Regularly check equipment for conformity and safety

The storage area for equipment and machinery must meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally-sensitive areas.

Equipment

- ✓ Cabins;
- ✓ Hut;
- ✓ Maintenance equipment and tools; and
- ✓ Cleaning equipment.

1.1.2 Manual clean-up guidelines

Oil, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.

Conditions of use

- ✓ Pollution : all types ; most often scattered pollution; on large spills, if implementation of other techniques is impossible;
- ✓ Pollutant : all types;
- ✓ Substrate : all types; sufficient load bearing capacity for pedestrians and light equipment; and
- ✓ Site: all types sufficiently accessible and which tolerate intensive traffic.

Equipment

Basic Equipment:

- ✓ Scrapers (paint scrapers, long handle scrapers...), rakes, brushes, forks; and
- ✓ Landing nets, shovels, trowels.

Extra Equipment:

- ✓ Waste containers, big bags, bins, plastic bags; and
- ✓ Front-end loader (for disposal).

PPE: At least protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, expose and responder activity.

- ✓ Divide the response personnel among three functions:
  - o Collection/scraping/gathering
  - o Placing in bags/waste containers
  - o Disposal
- ✓ Rotate the teams among the three functions;
- ✓ The waste can be disposed of manually or with the use of mechanical means if possible;
- ✓ Don't overfill bins, plastic bags; and
- ✓ Don't remove excessive quantities of sediments.

Impact

- ✓ Impact insignificant to heavy, depending on the type of substrate. Risk of destroying the structure of the substrate in marshes. Erosion;
- ✓ Potentially destructive effects on vegetation (dunes, marshland);
- ✓ Deconstruction and destabilisation of the foot of the dune (upper end of beach); erosion, destruction of the dune and the associated vegetation, decrease in biodiversity and fertility by reduction of the low water mark; and
- ✓ Can tend to fragment the oil in certain conditions.

Performance

This is a highly selective technique, but requires a lot of time and personnel. If not done correctly, there is a risk of removal of large quantities of clean sediment.

1.1.3 Mechanical clean-up guidelines

This technique consists of collecting the oil in order to facilitate its removal from the beach. Collection is carried out using a tractor, ATV or earthmoving vehicle or earthmoving equipment.

Conditions of use

- ✓ Pollution : heavy pollution, continuous slick;
- ✓ Pollutant : slightly to very viscous oil;
- ✓ Substrate : vast, flat foreshore with wet fine-grain sand (very damp to saturated) and a good load-bearing capacity, without ripple marks; and
- ✓ Site: accessible and sufficient load bearing capacity for earthmoving equipment, sufficiently large to allow vehicles to manoeuvre.

Equipment

Basic equipment:

- ✓ Backhoe loader;
- ✓ Grader/bulldozer;
- ✓ Tractor or loader with front blade; and
- ✓ Front-end loader or lorry (for removal).

PPE: At least suitable for heavy machinery operation

Impact

- ✓ Normally only removes the oil, but some sediment may also be taken with it (if the operator is poorly supervised or inexperienced), especially if used on light pollution or an unsuitable site;
- ✓ High risk of disturbance due to traffic and mixing of oil with sediment; and
- ✓ May lead to reduction of beach stability and beach erosion/loss of beach area.

Minimum workforce required: 2 people per vehicle (1 drive + 1 assistant)

Waste: oil mixed with a varying quantity of sediment; but can rapidly become unselective if scraping is carried out on moderate pollution (should be avoided)

- ✓ Consists of bringing the oil together in order to facilitate its removal from the beach. Scraping is carried out using a tractor or earthmoving equipment fitted with a front end blade in an oblique position. According to the viscosity of the oil, two options are available:
  - o (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
  - o (case 2) more viscous oil /solids: concentration to form windrows, by successive slightly curing passes parallel to the water line; subsequent removal of windrows
- ✓ Should only be carried out on heavy pollution; do not use on moderate to light pollution
- ✓ Inform and supervise operators; use experienced operators
- ✓ Work methodically
- ✓ Set up traffic lanes on the beach in order to reduce oil and sediment mixing

- ✓ Don’t remove excessive amounts of non-contaminated materials
- ✓ Don’t fill the bucket of loader more than 2/3 capacity
- ✓ Don’t drive on polluted materials

1.1.5 Shoreline vessel access guidelines

There are numerous landing craft vessels available in the North West Shelf area. These vessels are capable of grounding out; therefore the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide. Landing craft vessels are supplied through Quadrant Energy existing vessel suppliers.

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

For shoreline clean-up of remote islands the following guidelines will be considered so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines:

Vessels are to be mobilised to the designated deployment Port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in 4 stages:

(1) Drop off of 6-person clean-up containers (refer below) to shoreline contact locations defined by IMT through observation data;

(2) Deployment of marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary impacts to flora and fauna by the clean-up teams;

(3) Deployment of small clean-up teams with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-high tide mark; and

(4) Deployment of the waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M: Scientific Monitoring Plans

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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)

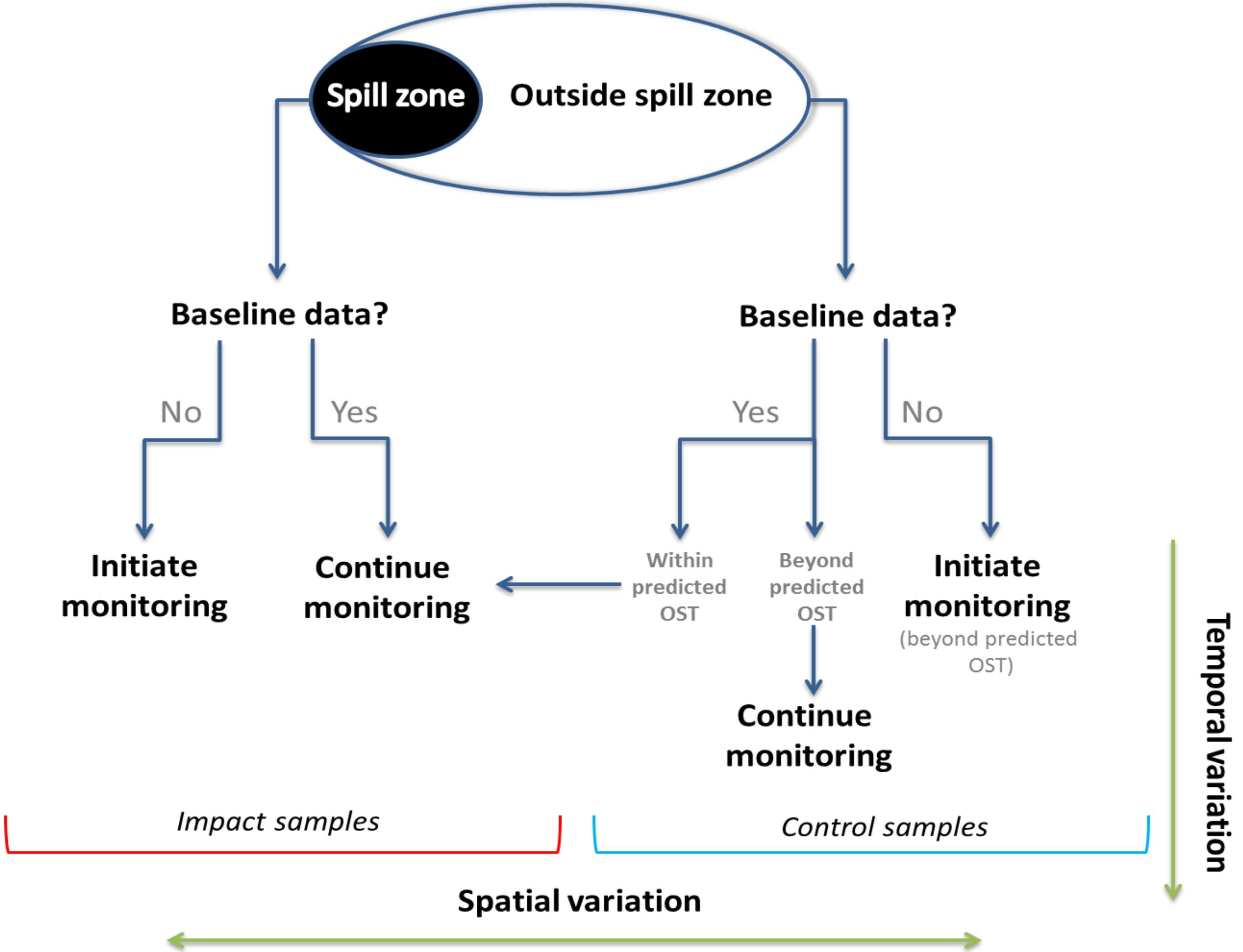

Figure 1: Structured Decision Making Process Based on Gregory et al. (2012) in Reference to Monitoring Programs, the Availability of Baseline Data, and Oil Spill Trajectory. An ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

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 > $1 g/m^2$ 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. Water profiles 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). Water quality 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. <u>Infauna samples</u> 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	<u>Benthic habitat cover and composition</u> Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages. <u>Coral health and reproduction</u> Hydrocarbon concentration in corals, reproductive state and settlement indices are not statistically different from the baseline state (where baseline data exists) or from comparable non-impacted assemblages.
Receptor impact	Impact to benthic habitats from pressures including hydrocarbons is measured through change in: + Species diversity + Assemblage composition + Percent cover. Other pressures to these states are: + Physical disturbance + Discharge of toxicants + Introduction of marine pests + Shading + Climate change.
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**). <u>Benthic Habitat Cover and Composition</u> Field survey methodology will be based upon acquiring repeat digital imagery (video or still images) of benthic habitats along random transects (preferable), using a stratified sampling approach at each site to target different habitat types and depths where clear gradients in these conditions exist. Site selection and image acquisition methodology will aim to align applicable baseline studies where these exist, such that imagery is comparable. The number of sites and frequency of sampling will depend upon the sampling design philosophy.

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 N: SMP Activation Process

astron
astron.com.au

Oil Spill Operational and Scientific Monitoring Activation Form

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

<table>
<tr><th colspan="7">Section 2: Spill Details</th></tr>
<tr><td colspan="2">Date and time of spill</td><td colspan="3">Click here to enter a date.</td><td colspan="2">Enter time, i.e. 1400 WST</td></tr>
<tr><td colspan="2" rowspan="2">Spill source location
(GDA94, MGA Zone 50)</td><td colspan="5">Insert coordinates in GDA94 MGA Zone 50 format (easting and northing).</td></tr>
<tr><td colspan="5">Insert location description</td></tr>
<tr><td colspan="2">Source of spill</td><td colspan="5"></td></tr>
<tr><td colspan="2">Cause of spill (if known)</td><td colspan="5"></td></tr>
<tr><td colspan="2">Status of spill</td><td colspan="5">☐ Secured ☐Uncontrolled ☐Unknown</td></tr>
<tr><td rowspan="3">Release rate</td><td>Instantaneous release</td><td colspan="4"></td><td rowspan="3">State units</td></tr>
<tr><td colspan="5">OR</td></tr>
<tr><td>Continuous release</td><td></td><td>per hour for</td><td></td><td>☐Hours ☐Days</td></tr>
<tr><td rowspan="4">Description of spill</td><td>Estimated quantity</td><td colspan="4"></td><td rowspan="4">State units</td></tr>
<tr><td>Incident tier</td><td colspan="4">☐1 ☐2 ☐3</td></tr>
<tr><td>Direction of travel</td><td colspan="4"></td></tr>
<tr><td>Trajectory</td><td colspan="4"></td></tr>
<tr><td colspan="2">Modelling provider log in details</td><td colspan="5"></td></tr>
</table>

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:	

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 O: 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 1-11. 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 1-11. Between Astron and BMT, capability exists to deliver first strike resourcing against SMPs 1-11 and SMP 12 will be conducted by capability obtained through the Australian Institute of Marine Science (AIMS).

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the 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 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.

Baseline Data Assessment

The Santos approach to undertaking a baseline assessment is to focus on those sensitive receptors for which modelling predicts contact[24] within seven days at a probability > 5%, as indicated in **Table 6-3**, **Table 6-4**, GHD 2019, GHD 2020a and GHD 2020b. It is considered that contact within seven days would require an enhanced

[24] Contact is defined as oil concentrations at sensitive receptors of >1 g/m^2 for surface oil, >10 g/m^2 shoreline oil and > 10 ppb for entrained and dissolved oil.

understanding of available baseline data to ensure a timely response for scientific monitoring and these locations are referred to as Scientific Monitoring Priority Areas.

The Scientific Monitoring Priority Areas identified include Montebello Islands (including Montebello AMP and Barrow-Montebello surrounds), Barrow Island, Lowendal Islands, Southern Islands Coast (Serrurier Island and Bessieres Island), Thevenard Islands, Ningaloo (including Ningaloo coastline and inner/outer Ningaloo waters), Offshore Ningaloo, Muiron Islands, Glomar Shoals, and Rankin Bank. A baseline assessment has been undertaken for the Montebello Islands, Barrow Island, Lowendal Islands, Ningaloo and Muiron Islands. An additional assessment is underway for Offshore Ningaloo to capture any baseline sources that might be in addition to those already assessed for the Ningaloo coast and inner/outer Ningaloo waters. A baseline assessment is also currently underway for Southern Islands Coast (Serrurier Island and Bessieres Island), Thevenard Islands, Glomar Shoals, and Rankin Bank, and will be complete before the Activity commences.

The following data sources were reviewed to identify baseline data related to the Scientific Monitoring Priority Areas identified:

+ all previously identified monitoring programs to confirm whether these programs were ongoing or complete
+ published scientific papers, searched for using relevant key words within Google Scholar, Web of Science and Research Gate
+ publicly available literature
+ monitoring plans from government agencies and industry
+ other internet references relevant to monitoring
+ agency progress reports and annual monitoring reports
+ Index of Marine Surveys for Assessments (IMSA) database
+ North West Atlas web portal
+ Australian Institute of Marine Science (AIMS), Western Australian Marine Science Institution (WAMSI), Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Marine Biodiversity Hub webpages and publication databases.

Following this an assessment of the baseline data was undertaken and included the following steps:

1. A review of the following parameters for each program identified:
    - Integrated Marine and Coastal Regionalisation of Australia
    - Custodian- contact point for data
    - Spatial extent
    - Variables available for monitoring
    - Methods applied to monitoring
    - Year of most recent data capture
    - Total duration of monitoring program
    - Data completeness (number of years monitored as proportion of program duration)
    - How often data is captured
    - Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
    - Is there any clear indication that the monitoring will continue?

2. The quality of the following parameters was then ranked as high, medium, low or unknown:
    I. Year of most recent capture:
        - 2015-2018 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
        - 2009-2014 = medium
        - <2009 = low
    II. Duration:
        - >4 years = high
        - 2-4 years = medium
        - 1 year = low
    III. Data completeness:
        - 100% = high
        - 75-99% = medium
        - <75% = low
    IV. Frequency of capture
        - Annually = high
        - Bi-annually = medium
        - <Bi-annually = low
    V. Appropriateness of parameters
        - High/medium/low

        Appropriateness of parameters was based on reference to the Scientific Monitoring Plan's targeted states for each receptor and considering whether the monitoring parameters were sufficient to compare against these states. Parameters were considered highly appropriate if all targeted states for a receptor could be quantified, of medium appropriateness if only some states could be quantified and low if the monitored parameters had little relevance to the targeted states of an individual receptor.

3. An overall assessment of each study program was then made as follows:
    - All parameters rated high = overall 'good'
    - At least one parameter rated medium = overall 'fair'
    - At least one parameter rated low = overall 'poor'
    - Unknown = overall not enough data to rate

The above assessment process was also performed across monitoring programs which specified at least one of the Scientific Monitoring Priority Areas within their monitoring sites. For Scientific Monitoring Priority Areas, the above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact - Classified as "good" in the above assessment (i.e., data was current, of reasonable duration and frequency, and employed appropriate methodologies) or 2) the existing baseline data is unlikely to be suitable to detect change in state – classified as "fair" or "poor" by the above assessment (i.e., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies). Following this assessment, a Scientific

Monitoring Protection Area by SMP matrix summarising recommendations on baseline data status and recommendations for further action was developed (**Table O-1**) based on three categories:

- Not applicable – SMP is not applicable to the Scientific Monitoring Priority Area as sensitive receptor does not occur.
- Survey - current monitoring/knowledge is considered sufficient (i.e., could be used to detect change in state in the event of a significant impact) and is considered a lower priority for post-spill pre-impact data collection.
- Priority survey – current monitoring is not in place or not practicable; post-spill pre-impact baseline data collection should be prioritised.

For the Scientific Monitoring Priority Areas currently undergoing a baseline assessment (Southern Islands Coast (Serrurier Island and Bessieres Island), Thevenard Islands, Glomar Shoals, and Rankin Bank) a precautionary approach was taken and 'Priority survey' recommended (refer to **Table O-1**).

Ongoing Baseline data review

Santos is committed to undertaking a review of the status, availability, currency and suitability of existing baseline data for all current Scientific Monitoring Priority Areas every 2 years. A review was undertaken in May 2021 to determine whether existing baseline data is sufficient and accessible for sensitive receptors that could be impacted from all current Santos worst-case spills scenarios (Astron, 2021).

The report found that a total of 37 new reports and/or programs were documented since the last assessment. They were predominantly broadscale studies incorporating multidisciplinary scope items with respect to habitats. Whereas for marine megafauna and seabirds/shorebirds, studies tended to focus on single species rather than assemblages of species. In addition, there were recent data captures for ongoing long-term monitoring programs or annual reports from regulatory bodies.

The key results were:

+ Recent sediment and water quality samples were acquired for ongoing monitoring programs associated with existing or proposed infrastructure, specifically on the east coast of Barrow Island and nearshore waters of the Dampier Archipelago and Port Hedland areas.
+ Monitoring data within the region are becoming more abundant and reliable for several receptors including mangroves and finfish. Recent data capture for seabird/shorebird monitoring programs have been undertaken in 2020 at the Montebello Islands, Barrow Island, Lowendal Islands and Eighty Mile Beach
+ While no recent studies of seafood quality applicable to the Scientific Monitoring Priority Areas were located, it is worth noting that ongoing monitoring at Barrow Island and the Burrup Peninsular include assessment of shellfish tissue samples against seafood guidelines and may be a useful surrogate in lieu of specific data.
+ Recent data capture for seabird/shorebird monitoring programs have been undertaken in 2020 at the Montebello Islands, Barrow Island, Lowendal Islands and Eighty Mile Beach. No recent studies or monitoring data collection for Ningaloo/Muiron Islands, Dampier Archipelago and Imperieuse Reef could be found during the literature review.

- No monitoring programs for marine mammals are current for the Scientific Monitoring Priority Areas, with the exception of strandings and entanglement data collected by the Department of Fisheries. Two new studies were conducted on two species of dolphin at Ningaloo, and one study on the migration of the pygmy blue whale that is relevant to Imperieuse Reef.
- There are a large number of reliable long-term marine reptile (turtle) monitoring programs with recent captures in 2020 at Barrow Island, Lowendal Islands, Ningaloo, Dampier Archipelago and Eighty Mile Beach (to be confirmed). In addition, there have been five new studies published for Ningaloo/Muiron Islands, Ningaloo, Pilbara and Bedout Island.

Following this assessment, the following is recommended to change from 'priority survey' to 'survey' (**Table O-1**):

- fish, fisheries and aquaculture at Montebello Islands.

However, the number of high-quality, long-term monitoring programs with recent data is still limited for a number of receptors including water, sediment and seafood quality, intertidal mudflats and sandy beaches/rocky shorelines for most Scientific Monitoring Priority Areas and in several cases may be insufficient to quantify the impacts of an oil spill and recovery rates should one occur.

Table O-1: Summary of recommendations for further action based on review of available baseline data

Receptors	Scientific Monitoring Priority Areas							
	Montebello Islands	Barrow Island	Lowendal Islands	Ningaloo / Muiron Islands	Ningaloo Offshore	Rankin Bank	Glomar Shoals	Southern Islands Coast/ Thevenard Island
Marine Water Quality (SMP1)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Sediment Quality (SMP2)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Sandy Beaches and Rocky Shores (SMP3)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Not Applicable	Not Applicable	Not Applicable	Priority Survey
Mangrove Communities (SMP4)	Survey	Survey	Survey	Survey (not applicable for Muiron Islands)	Not Applicable	Not Applicable	Not Applicable	Priority Survey
Intertidal Mudflats (SMP5)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Not Applicable	Not Applicable	Not Applicable	Priority Survey
Benthic Habitats (SMP6)	Priority Survey	Survey	Priority Survey	Survey	Survey	Priority Survey	Priority Survey	Priority Survey
Seabirds and Shorebirds (SMP7)	Priority Survey	Survey	Survey	Survey	Survey	Priority Survey	Priority Survey	Priority Survey

Receptors	Scientific Monitoring Priority Areas							
	Montebello Islands	Barrow Island	Lowendal Islands	Ningaloo / Muiron Islands	Ningaloo Offshore	Rankin Bank	Glomar Shoals	Southern Islands Coast/ Thevenard Island
Marine Mammals (SMP8)	Survey	Not Applicable	Priority Survey	Survey	Survey	Priority Survey	Priority Survey	Priority Survey
Marine Reptiles (SMP9)	Priority Survey	Survey	Survey	Survey	Survey	Priority Survey	Priority Survey	Priority Survey
Seafood Quality (SMP10)	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Fish, Fisheries & Aquaculture (SMP11)	Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey	Priority Survey
Whale Sharks (SMP12)	Not Applicable	Not Applicable	Not Applicable	Survey (not applicable for Muiron Islands)	Survey	Priority Survey	Priority Survey	Not Applicable

Capability Assessment

Based on the assessment of Scientific Monitoring Priority Areas outlined in **Table O-1** a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days), noting that in the event of very short contact timeframes mobilisation of scientific monitoring teams to priority receptor sites may not be possible within contact timeframes and experimental designs not relying on pre-impact baseline would have to be employed. These experimental approaches are outlined in the Santos Oil Spill Scientific Monitoring Plan (EA-00-RI-10099) and are selected as appropriate to the receptor type.

Given that **Table O-2** lists Scientific Monitoring Priority Areas that could be contacted based on stochastic modelling data (i.e. the outcomes of hundreds of spill modelling simulations rather than a single spill event) for two release locations, it was not considered appropriate or credible that baseline monitoring would occur at all areas over this timeframe. The stochastic and deterministic modelling results (GHD, 2020a; 2020b) show contact within six broad regions (below). Based on the modelling results, the Barrow/ Montebello/ Lowendal Islands region and the waters of Offshore Ningaloo have the highest probability of contact within seven days and have consequently been used for the capability assessment.

1. Barrow/ Montebello/ Lowendal Islands
2. Offshore Ningaloo
3. Ningaloo Coast/ Muiron Islands
4. Southern Islands Coast/ Thevenard Island
5. Rankin Bank
6. Glomar Shoals

Table O-2 outlines the required scientific monitoring capability for rapid response for the Barrow/ Montebello/ Lowendal Islands and Offshore Ningaloo, and Astron’s actual capability. When determining actual team capability, personnel were only allocated to a single SMP team.

The results of the Baseline Data Review document (SO-91-RF-20022) and subsequent baseline and capability assessment of scientific monitoring protection priorities summarised herein (**Table O-2**) has been provided within the Environment Functional Team Folder on the Emergency Response Intranet page so that this information is accessible to guide Santos IMT Environmental roles and monitoring provider roles in the event of activating oil spill scientific monitoring.

Table O-2: Capability assessment for rapid sampling of Montebello/Barrow/Lowendal Islands and Offshore Ningaloo within seven days

Receptors	Required capability for rapid response				Actual Team Capability
	Montebello Islands	Lowendal Islands	Barrow Island	Offshore Ningaloo	
Water Quality (SMP1)	2 teams of 2 personnel			1 teams of 2 personnel	3 teams of 2 personnel at least one member in each team to have experience in water sampling at least one member in each team to have experience in deep sea sediment sampling
Sediment Quality (SMP2)					
Sandy Beaches/Rocky Shorelines (SMP3)	1 teams of 2 personnel	1 teams of 2 personnel	1 teams of 2 personnel	Not applicable	3 teams of 2 personnel at least one team member of team with experience in shoreline macrofauna/infauna assessment
Intertidal Mudflats (SMP5)				Not applicable	
Mangroves (SMP4)	Rapid priority response not required	Rapid priority response not required	Rapid priority response not required	Not applicable	Not required
Benthic Habitats (SMP6)	1 teams of 2 personnel		Rapid priority response not required	1 teams of 2 personnel	2 teams of 2 personnel at least one team member of team with experience in benthic habitat assessment ROV operator or divers
Seabirds/ shorebirds (SMP7)	1 ground-based survey team of 2 personnel[2]	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP8)	Rapid priority response not required	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP8)	4 teams of 2 available at least one member of team be experienced ornithologist

Receptors	Required capability for rapid response				Actual Team Capability
	Montebello Islands	Lowendal Islands	Barrow Island	Offshore Ningaloo	
Marine megafauna (SMP8)	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP9)	1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1]	Not applicable	1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1]	2 teams of 2 available (aerial) all to be experienced wildlife observers 2 teams of 2 available (vessel) all to be experienced wildlife observers
Marine reptiles (SMP9)	1 aerial survey team of 2 personnel[1] 1 vessel-based survey team of 2 personnel[1] 1 ground-based survey team of 2 personnel[2]	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP8)	Rapid priority response not required	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP8)	2 teams of 2 available (aerial)[4] all to be experienced wildlife observers 3 teams of 2 available (vessel)[4] all to be experienced wildlife observers 3 teams of 2 available (ground-based)[5] at least one member with experience in turtle survey techniques
Seafood Quality (SMP10) **Fish, Fisheries & Aquaculture (SMP11)**	2 teams of 3 personnel			1 team of 3 personnel	3 teams of 3 personnel at least one member of team to have experience in fish identification and necropsy at least one member of team to have BRUV experience

Receptors	Required capability for rapid response				Actual Team Capability
	Montebello Islands	Lowendal Islands	Barrow Island	Offshore Ningaloo	
Whale sharks (SMP12)	Not applicable	Not applicable	Not applicable	Rapid priority response not required (incidental sightings will be captured during aerial and vessel surveys for SMP8)	Not required due to ongoing research along the Ningaloo coast

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

[2]Ground based surveys for shorebirds/seabirds and marine reptiles at Montebello Islands could be conducted by the same survey team.

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

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

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

Appendix P: Forward Operations Guidance

Forward Operating Base (FOB)

For a significant Level 2/3 response requiring coordination of resources to be deployed to the field, Santos will establish an FOB. For a level 2/3 spill crossing from Commonwealth to State waters (cross-jurisdictional spills) DoT will establish an FOB.

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

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

Additional FOBs may be set up as operational requirements dictate. Based on shoreline areas that might be impacted, potential additional FOB locations include Port Hedland, Broome and Exmouth. **Table P-1** to **Table P-4** list local facilities with operational value for response in Port Hedland, Broome, Exmouth and Dampier respectively.

The IMT will develop a communication strategy to support the FOB/s and forward staging areas.

Table P-1: Port Hedland facilities with operational values for response

Facility	Owner/Operator	Potential Uses
Port of Port Hedland	Pilbara Ports Authority	Staging area for vessel loading for spill response and equipment and waste management Storage of oil spill response equipment Vessel loading for spill response equipment and waste management Office facilities for Marine-based Command Centre
Port Hedland International Airport	Australian Government	Air freight spill response equipment. Storage sheds for oil spill response equipment Office facilities for Aviation-based Command Centre
The Esplanade Hospitality Inn Ibis Styles Cooke Point Holiday Park Kings at the Landing The Lodge Motel South Hedland Motel Others	Various (independent)	Spill responders and IMT accommodation Accommodation and messing for clean-up crew

Facility	Owner/Operator	Potential Uses
Toll Ipec Freight Transport	Toll	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging and repairs Oiled wildlife response centre Laydown/storage area Bunded washing facility
Go Marine Group Offices	Go Marine	FOB OCC Offices

Table P-2: Broome facilities with operational values for response

Facility	Owner/Operator	Potential Uses
Port of Broome	Kimberley Ports Authority	Staging area for vessel loading for spill response and equipment and waste management Storage of oil spill response equipment Vessel loading for spill response equipment and waste management Office facilities for Marine-based Command Centre
Broome International Airport	Australian Government	Air freight spill response equipment Storage sheds for oil spill response equipment Office facilities for Aviation-based Command Centre
Broome Heliport	Australian Government	Air freight spill response equipment Storage sheds for oil spill response equipment Office facilities for Aviation-based Command Centre
Seashells Broome Moonlight Bay Suites Bayside Holiday Apartments Mangrove Hotel Blue Seas Resort Others	Various (independent)	Spill responders and IMT accommodation Accommodation and messing for clean-up personnel

Facility	Owner/Operator	Potential Uses
Toll Mermaid Supply Base 1 Toll Mermaid Supply Base 2	Toll and Mermaid	FOB OCC Office Transfer yard for truck-based equipment deliveries and waste management, Broome Maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging and repairs Oiled wildlife response centre Laydown / storage area Bunded washing facility for oil booms
Civmec Logistics Supply Base	Civmec	Transfer yard for truck-based equipment deliveries and waste management, Boom maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging and repairs Oiled wildlife response centre Laydown / storage area Bunded washing facility for oil booms
Quest Marine Services	QMS	Marine-based response Command Centre and Staging Area
Toll offices	Toll	FOB OCC Offices
Local boat ramp at Broome Town Jetty	Broome Council	Load out for near-shore marine based operations Boat launching

Table P-3: Exmouth facilities with operational values for response

Facility	Owner/Operator	Potential Uses
Harold E. Holt Naval Base	Australian Government Department of Defence	Forward Operations Base Storage of oil spill response equipment Vessel loading for spill response equipment and waste management
Exmouth Marina	Shire of Exmouth	Staging area for vessel loading for spill response equipment and waste management
Learmonth Airport	Australian Government Department of Defence	Air freight spill response equipment.
Exmouth light airstrip	Exmouth council	Air freight spill response equipment. Dispersant operations base
Logistic Services Yard	Exmouth Freight Services	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Response equipment storage
Tantabiddi/Bundegi Boat Ramp areas	Shire of Exmouth	Staging/storage area Load out for near-shore marine based operations Boat launching
Bhagwan/Jetwave/Base Marine Yards Exmouth	Exmouth	Storage/Laydown and Staging Area Materials consolidation Marine equipment storage, staging & repairs

Table P-4: Dampier facilities with operational values for response

Facility	Owner/Operator	Potential Uses
Dampier Cargo Wharf	Pilbara Ports Authority	Staging area for vessel loading for spill response equipment and waste management Storage of oil spill response equipment Vessel loading for spill response equipment and waste management Office facilities for Marine-based Command Centre
Toll Dampier Supply Base	Toll Energy Logistics Pty Ltd	Staging area for vessel loading for spill response equipment and waste management
Karratha Airport	Australian Government Department of Defence	Air freight spill response equipment
Devil Creek accommodation Searipple Village	Santos /Sodexo Searipple Karratha	Spill responders and IMT accommodation Accommodation & messing for clean-up crew
Toll Energy Yard	Toll Energy Logistics Pty Ltd	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging & repairs Oiled wildlife response centre Laydown / storage area Bunded washing facility for oil booms
Local boat ramp at Dampier Yacht Club	Leased to Dampier Yacht Club	Load out for near-shore marine based operations Boat launching

Forward Staging Areas

Staging areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Control Agency for shoreline response activities. Wildlife treatment facilities may also be set-up under the direction of DoT and DBCA to clean and rehabilitate oiled wildlife.

Transport

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

Mobile plant

Mobile plant and equipment for mechanical clean-up can be provided from suppliers in Dampier, Port Hedland, Broome, Exmouth, Karratha or Perth as required.

Decontamination

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

Ablutions

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

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

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

Security

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

Messing

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

Freight movement

The transportation of all equipment and service from all stockpiles and centres can be facilitated through Santos' third-party logistics providers.

Cleaning and repair

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

Suppliers

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

Accommodation

There are four key components to the clean-up operations: marine, aviation, land and emergency response team. Accommodation options for field responders and FOB personnel will be dictated by proximity to their respective activity areas, to ensure maximum utilisation of the shift time available.

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

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

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

Providoring

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

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

Personal protective equipment (PPE)

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

In the event of a spill incident Santos would engage the services of a third party to provide and maintain inventory for the duration of oil spill operations.

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

PPE requirements for spill responders is detailed in the Santos Oil Spill Response HSE Management Manual (SO-91-RF-10016).

Response Personnel Clean-up Crew

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

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

Radio communications

Santos would utilise the services of a specialist communication provider to hire hand-held and vehicle mounted UHF radios to support response and clean-up personnel. Portable deployed repeater stations (battery or mains powered) can be positioned along the shoreline to provide a ‘voting’ system for transmitting and receiving during the clean-up operation. Communication equipment will be supplied through local, national, and international suppliers as the operational situation dictates.

For Exmouth region response operations Santos would request the use of Woodsides radio communication trailers based in Perth. These trailers are licenced for locations in Exmouth and along the Ningaloo coast and permit land, sea and air radio communications.

Appendix Q: IMT Resourcing

Santos manages its IMT capability through a range of arrangements including internal Santos personnel and external support. Santos internal capability includes competent personnel available for incident management from various Santos business units in Australia. Santos also has access to IMT support personnel through a range of external arrangements consisting of:

- AMOSC Member Agreement
- Industry Mutual Aid /Core Group Personnel
- OSRL Member Agreement
- Specialist Service providers including:
  - WWC: for Source Control support
  - RPS: For oil spill modelling/visualization support
  - BMT/Astron: Monitoring Service provider
  - NWA: Waste Management Contractor
  - TOLL: Logistics Services Contractor
  - Aspen: Medical Services Provider
  - Recruitment Servicer provider/ Labour Hire Companies.

Santos's Master Services Contract with AMOSC gives access to 80 to 120 oil spill trained personnel through industry Core Group. The Expanded IMT Resourcing Plan below (Table R-1) assumes about 25% of this capability available for IMT support and the remaining 50 to 90 personnel available for field response team roles. Santos has guaranteed access to 18 Response Specialists from OSRL for any incident under the Associate Membership Agreement. OSRL has about 150 oil spill technical personnel available across their global bases. Santos may request for additional resources from OSRL for major oil spill events and the resources will be available on a best endeavour basis. The Expanded IMT Resourcing Plan below (**Table Q-1**). assumes about 30% of this capability available for IMT support. Santos also has in place arrangements with specialist service providers for roles which apply non-oil-spill expertise in a response context, such as Logistics, Finance, Waste Management, Source Control etc. The IMT capability for these roles is established through the specialist service providers as listed above.

Santos will work closely with relevant government authorities (e.g. DoT, DBCA) for incident management aspects related to shoreline response and oiled wildlife response. The capability available under the SRT/NRT (~ 150 IMT personnel / 40 SRT personnel) is not included in the expanded IMT resourcing plan.

The WCD Response timeline is estimated to be 18 to 20 weeks. This is estimated based on the timeline for relief well drilling (11 weeks) and shoreline clean-up activities to be completed in 16 weeks (for Montebello Islands, Barrow Islands and Lowendal Islands as detailed in **Table 13-5** and **Table 13-6**).

Response termination and demobilization will follow a phased approach and additional 2 to 4 weeks is added to account for the final response termination and demobilization phase once the shoreline clean-up activities for are completed. Peak resourcing requirements for IMT is anticipated between week 3 to week 11 and thereafter to gradually decline until the response is terminated.

Assuming a protracted response requiring two rotational IMT teams with a day and night shift for each team, the total resourcing requirement for the expanded IMT is estimated to be 138 persons. Santos internal resourcing (Including support from other business units in Australia) provides access to 174 personnel for IMT support and an additional 114 personnel is estimated to be available through external arrangements. The predicted allocation of resources to the expanded IMT roles is shown in **Table Q-1**.

Table Q-1: Expanded IMT Resourcing Plan

#	IMT POSITION		Required	Available Resources: Santos	Available Resources: Total Allocated personnel available via Contracting Arrangements	Total Personnel Available through internal/external Arrangements
1	INCIDENT COMMANDER		2	14	NA	14
	DEPUTY IC		2			
2	Safety Officer		2	10	NA	10
3	Public Information Officer		2	6	NA	6
4	DoT LO		2	2	NA	2
	Media LO		2	2	NA	2
5	HR		3	10	NA	10
6	PLANNING SECTION CHIEF		2	8	NA	8
	Deputy Planning Section Chief		2			
	Situation Unit Lead		2	7	2	9
		COP Display Processor/GIS Specialist	2	2		2
	Resources Unit Lead		2	4	2	6
	Documentation Unit Lead		2	3	NA	3
	Environment Unit Lead		2	5	NA	5
	Technical Specialists	Modelling Specialist	2		5	5
		Sampling/Monitoring Specialist	2		3	3
		Waste Management Specialist	2		2	2
		Wildlife Specialist	2	4	4	8
		Response Specialists (as required for branches)	10		10	10
	Shoreline Response Programme Manager		2		4	4
		STR Manager	2	4	6	10
		SCAT Programme Coordinator	2	2	6	8
		SCAT Data Manager	2	2	2	4
		SCAT Field Coordinator	2	2	5	7
7	OPERATION SECTION CHIEF		3	13	NA	13
	Deputy Operations Section Chief		3			
	Source Control Branch Director		2	4		4
		Relief Well Team Lead	2	2		2
		Well Intervention Team Lead	2	2		2
		SFRT Group Lead	2	2		2
	Staging Branch Director		2	2		2
	Monitoring Branch Director		2		3	3
	Wildlife Response Branch Director		2		2	2
	Air Operations Branch Director		2	4	1	5
	Offshore Response Branch Director		2	2	3	5
		Recovery & Protection Group Lead	2		5	5
	Shoreline Clean-Up Branch Director		2		5	5
		Geographical Division Supervisors	14	15	6	21
8	LOGISTICS SECTION CHIEF		3	12	NA	12
	Logistics Specialists (as required for branches)		7		8	8
	Support Branch Director		3	7		7
		Supply Unit Lead Lead	2		2	2
		Facilities Unit Lead	2		2	2
		Ground Support Unit Lead	2		2	2
		Vessel Support Unit Lead	2	1	2	3
	Service Branch Director		3	8		8
		Communications Unit Lead	2		2	2
		Medical Unit Lead	2		6	6
		Food Unit Lead	2		2	2
9	FINANCE SECTION CHIEF		3	13	NA	13
		Procurement Unit Lead	2		4	4
		Claims Unit Lead	2		4	4
		Cost Unit Lead	2		4	4
	NA = Not Applicable					
		Sub-total	*138*	*174*	*114*	288

	Department of Transport Office	Required	Available Resources		Total Personnel Available through internal/external Arrangements
			Santos	Total Allocated personnel available via Contracting Arrangements	
1	CMT Liaison Officer	1	5		5
2	Deputy Incident Controller	1	2		2
3	Deputy PIO	1	2		2
4	Deputy Planning Officer	1		1	1
5	Deputy Intelligence Officer	1		1	1
6	Environmental Support Officer	1	2		2
7	Deputy Logistics Officer	1	2		2
8	Deputy Operations Officer	1	2		2
9	Deputy Finance Officer	1	2		2
10	Deputy Division Commander (FOB)	1		1	1
11	Deputy Waste Management Coordinator	1		1	1
		11	*17*	*4*	21

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Appendix R: Testing Arrangements Plan

Table R-1: Testing Arrangements Plan

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
1.	**Source Control Options**				
	Relief Well Drilling - Access to MODU	MODU Register review	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
	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
	Testing of Santos Source Control Planning and Response Guideline DR-00-OZ-20001	Desktop Exercise	Annually	Testing of key arrangements in the Santos Source Control Planning and Response Guideline DR-00-OZ-20001	Validate key arrangements in Santos Source Control Planning and Response Guideline DR-00-OZ-20001
	Vessel Fuel Tank Rupture - SOPEP	Contract/Plan Review	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.	**Monitor & Evaluate Options**				
	Vessel Surveillance a) Access to vessels	Contract/Plan Review	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
	Aerial Surveillance a) Access to aircraft	Contract/Plan Review	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
	Aerial Surveillance b) Access to trained aerial observers	Contract/Plan Review	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
	Unmanned Aerial Vehicles (UAV) a) Access to UAV providers	Contract/Plan Review	Annually	To confirm access to UAV providers	Review to confirm access to UAV providers through: + AMOSC Member Contract or + OSRL Associate Member Contract
	Fauna observations – Maintain a list of air charter companies that could provide fauna observation services	Review List	Annually	To confirm that a list of air charter companies that could provide fauna observation services is maintained	Review to confirm that a list of air charter companies that could provide fauna observation services is maintained
	Tracking Buoys a) Access to Tracking Buoys	Contract/Plan Review	Prior to activity commencement	To confirm access to tracking buoys	Review to confirm access to 12 Tracking Buoys
	Tracking Buoys b) Response readiness	Communication/Tracking software Test	6-monthly	To confirm response readiness for Tracking buoys	Tracking Buoys pass functional test as per operational instructions
	Oil Spill Modelling a) Access to oil spill modelling service provider	Contract/Plan Review	Prior to activity commencement	To confirm access to emergency response oil spill modelling services	Review to confirm access to emergency oil spill modelling services through maintenance of service provision contract

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
	Satellite Imagery a) Access to Satellite Imagery service provider	Contract/Plan Review	Prior to activity commencement	To confirm access to satellite imagery services	Review to confirm access to satellite imagery services through: + AMOSC Member Contract or + OSRL Associate Member Contract
	Operational Water Quality Monitoring a) Access to monitoring service provider	Contract/Plan Review	Prior to activity commencement	To confirm access to operational water quality monitoring services	Review to confirm access to operational water quality monitoring services through maintenance of service provision contract
	Operational Water Quality Monitoring b) Access to fluorometry equipment	Contract/Plan Review	Prior to activity commencement	To confirm access to fluorometry equipment for water quality monitoring	Review to confirm access to fluorometry equipment through: + Maintenance of service provision contract with monitoring service provider + OSRL Associate Member contract
	Operational Water Quality Monitoring d) Access to Dispersant Efficacy Field Test Kit	Equipment Check	Annually	To confirm access to Dispersant Efficacy Field Test Kit	Review to confirm access to Dispersant Efficacy Field Test Kit
	Operational Water Quality Monitoring e) Access to Oil Sampling Kit	Equipment Check	Annually	To confirm access to Oil Sampling Kit	Review to confirm access to Oil Sampling Kit
	Shoreline Clean-up Assessment	Contract/Plan Review	Prior to activity commencement	To confirm access to trained SCAT personnel	Review to confirm access to trained SCAT personnel through: + AMOSC Member Contract

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
	a) Access to trained Shoreline Clean-up and Assessment Technique (SCAT) personnel				+ OSRL Associate Member Contract
		Desktop Exercise	Annually	To confirm access to a range of Monitor & Evaluate options to ensure situational awareness for IMT	+ Access to vessel and aerial platforms for surveillance confirmed. + Availability of trained aerial observers from day 2 confirmed through internal or external resources + Spill modelling delivered to IMT within 2 hrs of request to service provider + Availability of Tracking Buoy for deployment confirmed by onsite team + Satellite imagery acquisition and timelines confirmed by the service provider upon notification + Access to water quality monitoring services confirmed by service provider upon notification + Availability of Dispersant Efficacy Field Test Kit confirmed by on-site team + Access to SCAT trained personnel confirmed through AMOSC or OSRL contract
4.	**Mechanical Dispersion**				
	a) Access to vessels	Contract/Plan Review	Annually	To confirm access to vessels for mechanical dispersion	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
6.	**Shoreline Deflection & Protection**				
	a) Access to shoreline deflection & protection equipment	Contract/Plan Review	Annually	To confirm access to shoreline deflection and protection equipment	Review to confirm access to shoreline deflection and protection equipment through the following: + Santos' equipment + AMOSC Member Contract

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
					+ OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
	b) Access to trained responders	Contract/Plan Review	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following: + AMOSC Member Contract + OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
	c) Access to shallow draft vessels	Review of list of shallow draft vessel providers	Annually	To confirm access to shallow draft vessels to support shoreline deflection & protection	Review to confirm access to shallow draft vessel providers
	d) Santos' shoreline deflection and protection equipment	Deployment Exercise	Annually	To confirm response readiness for Santos' shoreline deflection and protection equipment	Shoreline deflection and protection booms and recovery devices (disc/brush skimmers) deployed successfully as per operational instructions
		Desktop Exercise	Annually	+ IMT to confirm shoreline protection priorities and develop IAP shoreline deflection and protection sub-plan + To test activation procedure to access shoreline deflection and protection equipment and trained responders from external arrangements and service providers + To confirm access to shoreline deflection and protection equipment and personnel from	+ Shoreline protection priorities established by IMT + IAP shoreline deflection and protection sub-plan developed by IMT + Emails confirming access to shoreline deflection and protection equipment and trained responders through external arrangements and service providers

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
				external arrangements and service providers	
7.	**Shoreline Clean-up**				
	a) Access to shoreline clean-up equipment	Contract/Plan Review	Annually	To confirm access to shoreline clean-up equipment	Review to confirm access to shoreline clean-up equipment through the following: + AMOSC Member Contract + OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
	b) Access to trained responders	Contract/Plan Review	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following: + AMOSC Member Contract + OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
	c) Access to labour hire	Contract/Plan Review	Annually	To confirm access to labour hire	Review to confirm access to labour hire through maintenance of contract with labour hire provider
		Desktop Exercise	Annually, subject to DoT availability	+ To test coordination with DoT to implement shoreline clean-up plan as detailed in Section 13 of the OPEP + To test activation procedure to access shoreline clean-up equipment and personnel from external arrangements and service providers	+ IMT interfaces established between Santos and DoT to jointly manage shoreline clean-up activities for impacted shorelines as identified in the OPEP Section 13 + Shorelines clean up priorities established, and IAP shoreline clean-up sub-plan developed by IMT in consultation with DoT + Shoreline clean-up resourcing plan established and access to equipment and personnel

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
				+ To confirm access to shoreline clean-up equipment and personnel from external arrangements and service providers	confirmed through internal and external arrangements/service providers to meet these requirements.
		DoT Joint Exercise	Every 2 years; The exercise will be coordinated by DoT and will be dependent on DoT's interest and availability. Santos will express interest for a joint exercise with DoT	+ To test collective response arrangements between Santos and DoT for a Level 2/3 oil spill incident impacting State waters	+ IMT interface between Santos and DoT IMT established to jointly manage the shoreline clean-up activities as identified for the exercise scenario + Shoreline response plan jointly developed by Santos and DoT + Equipment and personnel required identified and implemented through collective response arrangements between Santos and DoT.
8.	**Oiled Wildlife Response**				
	a) Access to OWR equipment	Contract/Plan Review	Annually	To confirm access to OWR equipment	Contract review to confirm access to OWR equipment through the following: + AMOSC Member Contract + OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
	b) Access to OWR personnel	Contract/Plan Review	Annually	To confirm access to OWR personnel	Contract review to confirm access to OWR personnel through the following: + AMOSC Member Contract + OSRL Associate Member Contract + Santos personnel

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
		Desktop Exercise	Annually	+ To confirm activation procedure for OWR services with external service providers + To confirm access to OWR equipment from external arrangements + To confirm access to OWR personnel through a combination of internal and external resources	+ Emails from service providers confirming OWR equipment availability. + Access to OWR personnel confirmed through a combination of internal and external resources
9.	**Waste Management**				
	a) Access to personnel, equipment, and vehicles through Waste Service Provider	Contract/Plan Review	Annually	To confirm access to personnel, equipment, and vehicles for oil spill waste management	Contract review to confirm access to personnel, equipment, and vehicles for oil spill waste management
		Desktop Exercise	Annually	To confirm activation procedure for oil spill waste management services	Confirmation email from service provider on personnel, equipment, and vehicles for oil spill waste management within 24hrs of notification
10.	**Scientific Monitoring**				
	a) Access to specialist monitoring equipment	Contract/Plan Review	Annually	To confirm access to specialist monitoring equipment	Contract review to confirm access to specialist monitoring equipment
	b) Access to specialist monitoring personnel	Contract/Plan Review	Annually	To confirm access to specialist monitoring personnel	Contract review to confirm access to specialist monitoring personnel
		Desktop Exercise	Annually	+ To confirm activation procedure for scientific monitoring services + To confirm access to personnel and equipment	Confirmation email from service provider (Astron) on monitoring personnel and equipment available

#	Response Arrangements & Critical Components	Type of Test	Schedule	Objectives	KPIs
11.	**IMT**				
	a) Access to trained IMT personnel	Contract/Plan Review	Annually	To confirm access to trained IMT personnel	Review to confirm access to IMT personnel through the following: + AMOSC Member Contract + OSRL Associate Member Contract + MoU for access to National Plan resources through AMSA
		Availability Test for IMT	Annually	To confirm appropriate Santos's personnel to fill the IMT roles outlined in this OPEP	Each role listed can be filled by appropriately qualified staff and reporting hierarchy understood
		Level 2/3 IMT exercise	Annually	+ To confirm the response capability and capacity for Santos IMT + To confirm external capability and capacity arrangements for IMT	• IAP is completed for the operational period and approved by the Incident Commander • An operational NEBA is undertaken for the operational period of the incident by the IMT • External arrangements tested and successfully integrated with IMT
12.	**Others**				
	Communications Testing a) Communications channels in place and functioning	Desktop	Required for every approved OPEP. When response arrangements have changed. Annually	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP	+ Notification and communication processes tested successfully for: – Service providers – Regulatory agencies + Communications Test Report completed + Corrections updated within the Santos Incident Response Telephone Directory (SO-00-ZF-00025.020)

Appendix S: Cumulative Response Capability Assessment

Table S-1 below shows the total cumulative worst-case response needs for the YJP activities. The table assess the accumulative requirement for personnel based on a LOWC incident for the YJP activity against the Santos resource capability. It must be noted, that during a real event, the resourcing may be different to the below based on operational NEBA. This is for an assessment purpose only, to ensure adequate resources are available for response strategy implementation.

The personnel numbers in **Table S-1** represent the total requirements. Additionally, it is assumed the total number of personnel required would be approximately 50% more to cover shift arrangements to manage responder fatigue. It is estimated that 41 skilled field response personnel will be required to allow for shift change across the response. Additional personnel requirements will be resourced through a combination of the following:

+ Ad-hoc training for specific response strategy needs on a just-in-time basis; and
+ Sourcing of additional personnel from OSROs on a best endeavours basis.

Table S-1: Cumulative Response Capability Assessment

Function	Response Strategy	YJP Response Need Requirement	Capability to meet YJP Required				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual Aid, Contractors and Service Providers
Source control [25]		39[26]	39	-	-	-	Additional personnel available from WWC and Oceaneering [27]
Monitor and Evaluate	Vessel surveillance	2 vessel crew	-	-	-	-	2 vessel crew
	Aerial surveillance[28]	2 aerial observers 1 flight crew	-	1 aerial observer	1 aerial observer	-	1 flight crew
	Tracking buoys	1 vessel crew	-	-	-	-	1 vessel crew
	Oil spill trajectory modelling	*Services provided with no specific personal numbers required.*					
	Satellite imagery	*Services provided with no specific personal numbers required.*					
	Initial oil characterisation	1 vessel crew	-	-	-	-	1 vessel crew (Santos contracted vessel provider)
	Operational water quality monitoring	1 field team 1 vessel crew	-	-	-	-	1 field teams of 3 personnel (1 Team Leader/ 2 Team Members) 1 vessel crew

[25] The Cumulative capability for Source Control is assessed on its own, as the resources do not impact other strategy implementation. 60 Santos source control personnel available.

[26] Inclusive of Source Control IMT personnel counted in Appendix J.

[27] WWC has confirmed availability of 34 source control personnel

[28] Based on 1 aircraft conducting 2 sorties per day.

Function	Response Strategy	YJP Response Need Requirement	Capability to meet YJP Required				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual Aid, Contractors and Service Providers
	Shoreline clean-up assessment technique (SCAT) resources as per **Table 10-40**	30 Teams (1 Team Leader/ 1-2 Team Members)	6 SCAT Team Leaders	12 SCAT Team Leaders	12 SCAT Team Leaders	Available on request	Labour hire: 60 Up to 2,000 Team Members who can complete shoreline assessment training, working under direction of Team Leader (contracted work force hire company)
Mechanical dispersion		*n/a – personnel as per vessel availability*	-	-	-	-	As per in-field vessel availability
Shoreline protection and deflection	P&D resources as per **Table 12-4** and **Table 12-5.**	12 x team leaders 12 x deployment operative teams (108 personnel) 24 x vessel crew	-	-	8 Protection and Deflection Supervisors	4 Protection and Deflection Supervisors	Labour Hire: 108 Vessel personnel as per contract.
Shoreline clean-up resources as per **Table 13-5** and **Table 13-6**.		35 teams: 35 Shoreline Clean-up Supervisors 315 team members	5 Shoreline Clean-up Supervisors	-	30 Shoreline Clean-up Supervisors	-	Labour Hire: 315 team members, working under direction of Shoreline Clean-up Supervisors
Oiled wildlife response		122	Sourced as per the WAOWRP arrangements (Level 6)				
Waste management		*n/a – personnel as per shoreline clean-up resourcing*	-	-	-	-	WSP to provide personnel under existing contract to collect and transport waste
Scientific monitoring		41[29]	-	-	-	-	41 from BMT/Astron
Response need (excluding Source Control)			11	13	51	4	
Response need including +50% for shift change.			17	20	77	6	

[29] As per the resourcing requirements in **Appendix O:** Scientific Monitoring Capability.

Function	Response Strategy	YJP Response Need Requirement	Capability to meet YJP Required				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual Aid, Contractors and Service Providers
Total Available (excluding Source Control)			11	16	96[30]	18	*Santos has either contracts in place, or can appoint ad-hoc contracts, to resource the above numbers required.*
Total Required Source Control			39	-	-	-	Additional personnel available from WWC and Oceaneering
Total Source Control			60				

30 States 84 as per the AMOSC policy, however October 2021 Core Group report total states 96 personnel in total.