Bedout Multi Well Exploration and Appraisal Drilling

Oil Pollution Emergency Plan

December 2025

Santos

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Oil Pollution Emergency Plan

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	Lead Oil Spill Risk & Planning Coordinator	Senior Oil Spill Risk & Planning Advisor Principal Oil Spill and Emergency Response Coordinator	Manager, Environmental Approvals – WA, NA & TL
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Manager – HSE Offshore Division	link only
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Santos Company Site Representative (CSR)	link only
AMOSC	●
DTMI	●
AMSA	●
OSRL	●

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Terms

Term	Definition
AEP	Australian Energy Producers (formerly Australian Petroleum Production and Exploration Association [APPEA]; from 13 September 2023)
AFMA	Australian Fisheries Management Authority
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMP	Australian Marine Park
AMSA	Australian Marine Safety Authority
API	American Petroleum Institute
APPEA	Former Australian Petroleum Production & Exploration Association (to 12 September 2023); now Australian Energy Producers (AEP)
BAOAC	Bonn Agreement Oil Appearance Code
BER	Boom Encounter Rate
BIP	Bridging Implementation Plan
BOP	Blowout Preventer
BP	Boiling Point
CEO	Chief Executive Officer
CHARM	Chemical Hazard Assessment and Risk Management
CM	Crisis Management
CMST	Crisis Management Support Teams
CMT	Crisis Management Team
CSR	Company Site Representative
DBCA	Department of Biodiversity, Conservation and Attractions
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DCMP	Drilling and Completions Management Process
DMPE	Department of Mines, Petroleum and Exploration
DFAT	Department of Foreign Affairs and Trade
DISR	Department of Industry, Science and Resources
DOR	Dispersant Oil Ratio
DPIRD	Department of Primary Industries and Regional Development
DTMI	Department of Transport and Major Infrastructure
DWER	Department of Water and Environmental Regulation
EDS	Emergency Disconnect
EHS	Environment, Health and Safety
EMBA	Environment That May Be Affected
EMSA	European Maritime Safety Authority
EP	Environment Plan
EPS	Environmental Performance Standard
ER	Emergency Response
ERT	Emergency Response Team
ERP	Emergency Response Plan

Term	Definition
ESC	Environmental Scientific Coordinator
EVA	Environmental Value Area
FOB	Forward Operating Base
FPSO	Floating Production Storage and Offloading
FSO	Floating Storage and Offloading
FWADC	Fixed Wing Aerial Dispersant Capability
GAPA	Government and Public Affairs
GDS	Global Dispersant Stockpile (OSRL)
GIS	Geographic Information System
GOWRS	Global Oiled Wildlife Response System
GPS	Global Positioning System
HEV	High Environmental Value
HDPE	High-Density Polyethylene
HMA	Hazard Management Agency
HR	Human Resources
IAP	Incident Action Plan
IBC	Intermediate Bulk Container
IC	Incident Commander
ICC	Incident Coordination Centre (Santos)
IMO	International Maritime Organization
IMP	Incident Management Plan
IMT	Incident Management Team
IOGP	International Association of Oil & Gas Producers
IPIECA	International Petroleum Industry Environmental Conservation Association
ISO	International Organization for Standardization
ITOPF	International Tanker Owners Pollution Federation Limited
KPI	Key Performance Indicators
IWCF	International Well Control Forum
LAT	Lowest Astronomical Tide
LOWC	Loss of Well Control
MARPOL	International Convention for the Prevention of Pollution from Ships
MDO	Marine Diesel Oil
MEE	Maritime Environmental Emergency
MEECC	Maritime Environmental Emergency Coordination Centre
MEER	Maritime Environmental Emergency Response
MNES	Matters Of National Environmental Significance
MODU	Mobile Offshore Drilling Unit
MOP	Marine Oil Pollution
MoU	Memorandum Of Understanding
MP	Marine Park
MPCP	Marine Pollution Contingency Plan
MSA	Master Services Agreement
MTE	Marine Transport Emergency

Term	Definition
NA	Not Applicable
NC	No Contact
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
OA	Operational Area
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OMP	Operational Monitoring Plan
OPEP	Oil Pollution Emergency Plan
OPGGS (E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OSC	On-Scene Commander
OSCA	Oil Spill Control Agents
OSCP	Oil Spill Contingency Plan
OSM	Operational and Scientific Monitoring
OSM-BIP	Operational and Scientific Monitoring Bridging Implementation Plan
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OSTM	Oil Spill Trajectory Modelling
OWA	Oiled Wildlife Advisor
OWR	Oiled Wildlife Response
PINP	Phillip Island National Park
POLREP	Pollution Report
POWBONS	Pollution of Waters by Oil and Noxious Substances
PPA	Priority Protection Area
PPE	Personal Protective Equipment
RAT	Rapid Assessment Team
RCC	Rescue Coordination Centre
ROV	Remotely Operated Vehicle
SAR	Search and Rescue
SCAT	Shoreline Clean-up Assessment Technique
SCP	Source Control Plan
SCR	Safety Case Revision
SCRI	Source Control Response Industry
SFRT	Subsea First Response Toolkit
SHP-MEE	State Hazard Plan for Maritime Environmental Emergencies
SITREP	Situation Report
SLA	Service Level Agreement (OSRL)
SMART	Special Monitoring of Applied Response Technologies
SMEEC	State Maritime Environmental Emergency Coordinator
SMP	Scientific Monitoring Plan
SMPC	State Marine Pollution Coordinator
SMPEP	Ship-board Marine Pollution Emergency Plan

Term	Definition
SOPEP	Ship-board Oil Pollution Emergency Plans
SRT	State Response Team
SSDI	Subsea Dispersant Injection
TRG	The Response Group
TRP	Tactical Response Plan
UAV	Unmanned Aerial Vehicle
VHF	Very High Frequency
VI	Varanus Island
VOC	Volatile Organic Compound
VOO	Vessels Of Opportunity
VTS	Vessel Traffic Services
WA	Western Australia
WAFIC	Western Australian Fishing Industry Council
WAMOPRA	Western Australia Marine Oil Pollution Risk Assessment
WANATL	Western Australia, Northern Australia and Timor Leste
WAOWRP	Western Australian Oiled Wildlife Response Plan
WOMP	Well Operations Management Plan
WSP	Waste Service Provider
WWCI	Wild Well Control Inc.

1. Quick reference information

<table>
<tr><th>Parameter</th><th>Description</th><th>Further information</th></tr>
<tr><td>Petroleum Activity</td><td>The Bedout Multi Well Drilling petroleum activity includes site survey, drilling, well evaluation, well testing and abandonment activities related to the exploration and appraisal drilling of up to 8 wells using either a moored semi-submersible mobile offshore drilling unit (MODU) or a jack-up MODU.</td><td>EP Section 2</td></tr>
<tr><td>Location</td><td>The petroleum activity includes up to 8 wells located approximately 123 km north of Port Headland (at the closest point).
The environment plan (EP) applies to seven ‘operational areas’ within which the wells are proposed to be located. The operational areas are defined in the following table:
<table>
<tr><th rowspan="2">EP operational area name</th><th colspan="2">Coordinates (Datum/Projection: GDA 94 Zone 50)</th></tr>
<tr><th>Latitude (South)</th><th>Longitude (East)</th></tr>
<tr><td>Ara (WA-435-P, WA-436-P)</td><td>18° 06' 48.37" S
18° 06' 50.13" S
18° 09' 57.85" S
18° 09' 59.04" S
18° 16' 9.73" S
18° 21' 1.9" S
18° 21' 4.72" S
18° 18' 17.64" S
18° 16' 48.18" S
18° 14' 53.53" S
18° 14' 52.15" S
18° 08' 50.51" S
18° 06' 48.37" S</td><td>118° 52' 22.75" E
118° 59' 59.16" E
119° 00' 0.79" E
119° 02' 2.23" E
119° 04' 26.12" E
119° 04' 24.71" E
119° 00' 1.11" E
118° 51' 3.88" E
118° 50' 10.82" E
118° 50' 9.08" E
118° 48' 58.02" E
118° 45' 16.49" E
118° 52' 22.75" E</td></tr>
<tr><td>Curie (WA-541-P)</td><td>18° 33' 49.88" S
18° 50' 05.76" S
18° 50' 12.65" S
18° 33' 56.66" S
18° 33' 49.88" S</td><td>118° 12' 46.60" E
118° 12' 53.56" E
117° 52' 23.61" E
117° 52' 18.61" E
118° 12' 46.60" E</td></tr>
<tr><td>Mestrel/ Bancroft (WA-541-P)</td><td>19° 16' 30.95" S
19° 07' 44.66" S
19° 11' 27.76" S
19° 11' 27.76" S
19° 04' 55.31" S
19° 04' 55.32" S</td><td>118° 21' 51.47" E
118° 17' 50.93" E
118° 34' 17.72" E
118° 35' 04.54" E
118° 35' 04.53" E
118° 24' 39.26" E</td></tr>
<tr><td>Wallace (WA-435-P)</td><td>18° 37' 35.01305797" S
18° 33' 08.30147669" S
18° 39' 54.98799336" S
18° 39' 54.99286521" S</td><td>118° 33' 18.50" E
118° 19' 4.57" E
118° 19' 4.33" E
118° 26' 58.41" E
118° 33' 17.90" E
118° 33' 18.50" E</td></tr>
</table></td><td>EP Section 2.1.1</td></tr>
<tr><td>Petroleum title/s (Blocks)</td><td>WA-435-P, WA-436-P and WA-541-P.</td><td>NA</td></tr>
<tr><td>Vessels</td><td>All wells are proposed to be drilled with either a moored semi-submersible MODU and/or jack-up MODU which will be supported by an offshore multi-purpose vessel, offshore supply vessel and/or an anchor handling vessel.</td><td>EP Section 2.1</td></tr>
<tr><td>Water depth</td><td>Water depths across all potential drilling locations range from 80-265 m.</td><td>NA</td></tr>
</table>

Parameter	Description			Further information
Worst-case spill scenarios	**Scenario**	**Hydrocarbon**	**Worst-case volume**	Section 6.1
	Loss of well control (LOWC) causing a subsea crude release in the **Curie operational area**. *The Curie OA scenario is considered representative for the Wallace OA scenario, given the Wallace OA scenario (surface release) has a similar release location to the Curie OA scenario and is a significantly smaller release volume than the Ara and Mestrel/Bancroft surface LOWC scenarios.*	Caley crude	413,367 m^3	
	LOWC causing a surface crude release in the **Ara operational area**.	Caley crude	1,017,519 m^3	
	LOWC causing a surface crude release in the **Mestrel/Bancroft operational area**.	Caley crude	1,367,291 m^3	
	Surface spill of MDO from vessel collision *Note: there are 3 MDO spill scenarios all at different locations. However, the hydrocarbon type and volume are the same across all of them.*	Marine diesel oil (MDO)	325 m^3	
Hydrocarbon properties	**Caley Crude** Density at 15 °C = 773 kg/m^3 Dynamic viscosity at 20 °C = 1.45 cP API Gravity = 51.4° Wax content = 9.2% Pour point = −15°C Asphaltene = <0.5% Oil property classification = light persistent oil, Group II. *Note that Caley crude also has properties that align it with a Group I oil (as per the ITOPF 2023 classifications).*			Appendix P
	MDO Density at 15 °C = 890kg/m^3 Dynamic viscosity at 25 °C = 14 cP API Gravity = 27.5° Wax content = 1% Pour point = −9°C Oil property classification = light persistent oil, Group II.			
Weathering potential	**Caley Crude:** Caley crude is a very light crude with a low viscosity value of 1.45 cP (at 20 ºC). Due to its low viscosity, if spilt on the sea surface, the crude would rapidly spread and thin out. When exposed to the atmosphere at local temperatures, approximately 48% of the product is expected to evaporate within the first 12 hours (BP < 180°C) and a further 19% should evaporate within the first 24 hours (180°C < BP < 265°C). Further, the heavier components of the Caley crude, specifically the low volatile and persistent portions, will have a strong tendency to become entrained into the water column in the presence of moderate winds (above 10 knots) and in turn breaking waves, however, it can re-surface under calm conditions (less than 10 knots) (RPS, 2025).			Appendix P

Parameter	Description	Further information
	MDO: 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 36% will generally evaporate over the first 24 hours and an additional 54% should evaporate over several days. Approximately 10% is unlikely to evaporate and will decay over time (RPS, 2025).	
Protection priorities	Imperieuse Reef MP and Clerke Reef MP	Section 6.5

2. First-strike response actions

The initial spill response actions to oil spill incidents related to the MODU are under the direction of the Emergency Commander - this role will be fulfilled by the Offshore Installation Manager (OIM).

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

Following initial actions undertaken by the Emergency Commander / Vessel Master to ensure the safety of personnel, and to control the source of the spill, the Emergency Commander / Vessel Master 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?

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) is engaged for support and implementation of response strategies. Level 1 spills are managed through on-site response and the IMT is available to assist with regulatory requirements/notifications and support if required. Therefore, the immediate response actions listed in Table 2-1 are relevant for any spill.

Once sufficient information is known about the spill, the Incident Commander at the IMT will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander.

The Bedout Multi Well Drilling Oil Spill First Strike Response Plan and the Bedout Multi Well Drilling Emergency Response Plan (both available in Santos' Emergency Response [ER] SharePoint) should be referred to alongside the first-strike activations in Table 2-1.

Table 2-1: First-strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site emergency response procedures or vessel-specific procedures, as applicable	Emergency Commander/Vessel Master
Immediate	Control the source using site resources, where possible	Control the source using available on-site resources (vessel/MODU) Refer to source control plan – Section 9	Emergency 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	Emergency Commander/Vessel Master
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	Emergency Commander/Vessel Master
60 minutes of incident being identified	Gain situational awareness and begin on-site spill surveillance	Level 1 spills may only require the use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance). Refer to Monitor and Evaluate Plan – Section 10	Emergency Commander/Vessel Master Incident Commander
Refer to timeframes in Section 7	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures – Section 7	Initial notifications by Planning Section Chief – Section 7
Level 2/3 spills (in addition to actions above)			
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Offshore Duty Manager/ Incident Commander
<2 hours	Gain situational awareness and begin tracking of the spill	Deploy tracking buoy(s) from activity vessel	Emergency Commander / Vessel Master
IMT actions (0 to 48 hours)			
Within 90 minutes from IMT call-out	Set up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive Incident Action Planning process Refer to Section 8 Review First-strike Activations (this table)	Incident Commander Planning Section Chief
Refer to timeframes in Section 7	Make regulatory notifications as required. Notify and mobilise/put on standby external oil spill response organisations and support organisations, as required.	Refer to Section 7	Initial notifications by Planning Section Chief Oil Spill Response Organisations (Australian Marine Oil Spill Centre [AMOSC])

When (indicative)	Activations		Who
	Objective	Action	
			and Oil Spill Response Ltd. [OSRL]) activation by designated call-out authorities (Incident Commanders/Duty Managers)
Refer to timeframes in 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 (OSTM) (Section 10.4) Satellite imagery (Section 10.5)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader Environment Unit Leader
Activate on Day 1 as applicable to the incident	Source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario-dependent**	Activate the source control plan. Refer to Section 9	Operations Section Chief (Source Control Branch Director as appropriate to scenario) Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Section 11 and Section 13	Reduce exposure of shorelines and wildlife to floating oil through mechanical / chemical dispersion	Activate the Mechanical and/or Chemical Dispersion Plan Refer to Section 11 and Section 13	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Activate on Day 1 as applicable to the incident Refer to Section 17	Assess and monitor effectiveness of response strategies and potential impacts from spill and response	Activate the North West Shelf Operational and Scientific Monitoring – Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0002) Refer to Section 17	Environment Unit Leader Logistics Section Chief/ Supply Unit Leader Operations Section Chief
Activate on Day 1 as applicable to the incident Refer Section 12	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Activate the Containment and Recovery Plan Refer to Section 12	Operations Section Chief Logistics Section Chief / Supply Unit Leader
Day 1	Identify environmental sensitivities at risk and conduct operational Net Environmental Benefit Analysis (NEBA)	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (Section 6.6)	Environment Unit Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base (FOB) as per Forward Operations Plan (Appendix O)	Operations Section Chief Logistics Section Chief/ Supply Unit Leader
Day 1	Ensure the health and safety of spill responders	Identify relevant hazards controls and develop hazard register Begin preparation Site Health and Safety Management requirements Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Safety Officer

<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>If/ when initiated
Refer Section 14</td><td>Protect identified shoreline protection priorities</td><td>Activate the Shoreline Protection and Deflection Plan
Refer to Section 14</td><td>Operations Section Chief
Logistics Section Chief/
Supply Unit Leader
Environment Unit Leader</td></tr>
<tr><td>If/ when initiated
Refer Section 16</td><td>Prevent or reduce impacts to wildlife</td><td>Activate the Oiled Wildlife Response Plan
Refer to Section 16</td><td>Environment Unit Leader
Operations Section Chief
Logistics Section Chief/ Supply Unit Leader</td></tr>
<tr><td>If/ when initiated
Refer Section 15</td><td>Clean-up oiled shorelines</td><td>Activate Shoreline Clean-Up Plan
Refer to Section 15</td><td>Operations Section Chief
Logistics Section Chief/ Supply Unit Leader</td></tr>
<tr><td>If/when initiated
Refer Section 18</td><td>Safely transfer, transport and dispose of waste collected from response activities.</td><td>Activate the Waste Management Plan.
Refer to Section 18</td><td>Operations Section Chief
Logistics Section Chief/ Supply Unit Leader</td></tr>
<tr><td colspan="4">IMT Actions (48+ hours)</td></tr>
<tr><td>Ongoing</td><td colspan="2">For ongoing incident management (indicatively 48 + hours) a formal incident action planning process is to be adopted to continue with spill response strategies identified above. An Incident Action Plan (IAP) is to be developed for each successive operational period.
Santos will maintain control for those activities for which it is the (designated Control Agency/ Lead IMT).
Depending on the specifics of the spill, the Australian Maritime Safety Authority (AMSA) and/or Western Australia (WA) Department of Transport and Major Infrastructure (DTMI) may be relevant Control Agencies (see Section 4.1).
Where another Control Agency has taken control of aspects of the response, Santos will provide support to that Control Agency. Santos’ support to WA DTMI (for a WA State waters response) is detailed in Section 4.6</td><td>Control Agency IMT
Santos to provide the following roles to DTMI Maritime Environmental Emergency Coordination Centre (MEECC) / IMT for WA State waters response (refer to Table 5-5):
Crisis Management Team (CMT) Liaison Officer
Deputy Incident Controller
Deputy Intelligence Officer
Deputy Planning Officer
Environment Support Officer
Deputy Public Information Officer
Deputy Logistics Officer
Deputy Waste Management Coordinator
Deputy Finance Officer
Deputy Operations Officer
Deputy Division Commander - FOB.</td></tr>
</table>

3. Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Bedout Multi Well Exploration and Appraisal Drilling Environment Plan (EP) (7720-650-EMP-0005) required by Regulation 35(4) and Regulation 22(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (OPGGS(E)R) 2023.

3.1 Description of activity

Santos proposes to conduct site survey, drilling, well evaluation, well testing and abandonment activities relating to exploration and appraisal drilling using a moored semi-submersible MODU or jack-up MODU within four areas defined as 'operational areas' (OA) within the Bedout Multi Well Drilling EP.

Drilling is intended to identify reserves for tie-back to the Dorado development, and/or new reserves for development. Drilling activities will be supported by site surveys which are intended to collect information to allow the safe placement of the MODU/s. The activity ends once all wells have been plugged and abandoned in accordance with the requirements of the NOPSEMA-accepted WOMP, and the MODU and all support vessels have departed the operational areas. At the end of the activity, subsea wellheads will be removed and all anchors (MODU, pre-lay or stand-up by vessel mooring) will be recovered.

The MODU/s will be supported by an offshore multi-purpose vessel, offshore supply vessel and/or an anchor handling vessel. ROVs may also be required to support the activity.

Helicopters will be used primarily for crew change and medevac, and occasional equipment and material transfers. Three to five helicopter flights are expected per week during the activity.

Refer to Section 2 of the Bedout Multi Well Drilling EP for a comprehensive description of the activity.

3.2 Purpose

The purpose of this OPEP is to describe Santos' response to a hydrocarbon spill during the Bedout multi well drilling activities.

This OPEP has been developed to meet all relevant requirements of the Commonwealth OPGGS(E)R 2023. It is consistent with the National and State (WA) systems for oil pollution preparedness and response, being the National Plan for Maritime Environmental Emergencies (AMSA 2020) managed by AMSA; and the WA State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE) (WA DoT 2024a).

This OPEP is to be read in conjunction with the Bedout Multi Well Drilling EP (7720-650-EMP-0005) when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the EP and will remain valid for the duration of the life of the EP (5 years), as per the revision requirements.

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

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos' IMT, so that it will direct its response effort with the aim of preventing long-term significant environmental impacts by safely limiting the adverse environmental effects from an unplanned release of hydrocarbons to the marine environment to a level that is ALARP. This will be achieved through the implementation of the various strategies and spill response mechanisms presented throughout this OPEP. Through their implementation, Santos will:

- initiate spill response immediately following a spill
- establish source control as soon as reasonably practicable to minimise the amount of oil being spilt into the environment

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

3.4 Area of operation

The petroleum activity will occur across four areas defined in the EP as 'operational areas'. These operational areas are located in Commonwealth permit areas WA-435-P, WA-436-P and WA-541-P. The MODU will be supported by a number of support vessels including offshore multi-purpose, offshore supply and/or anchor handling vessels. As part of this activity Santos is planning to drill up to 8 wells.

The activity is located in water depths ranging from 80-265 m approximately 123 km north of Port Headland (at the closest point). Figure 3-1 illustrates the location of the petroleum activity.

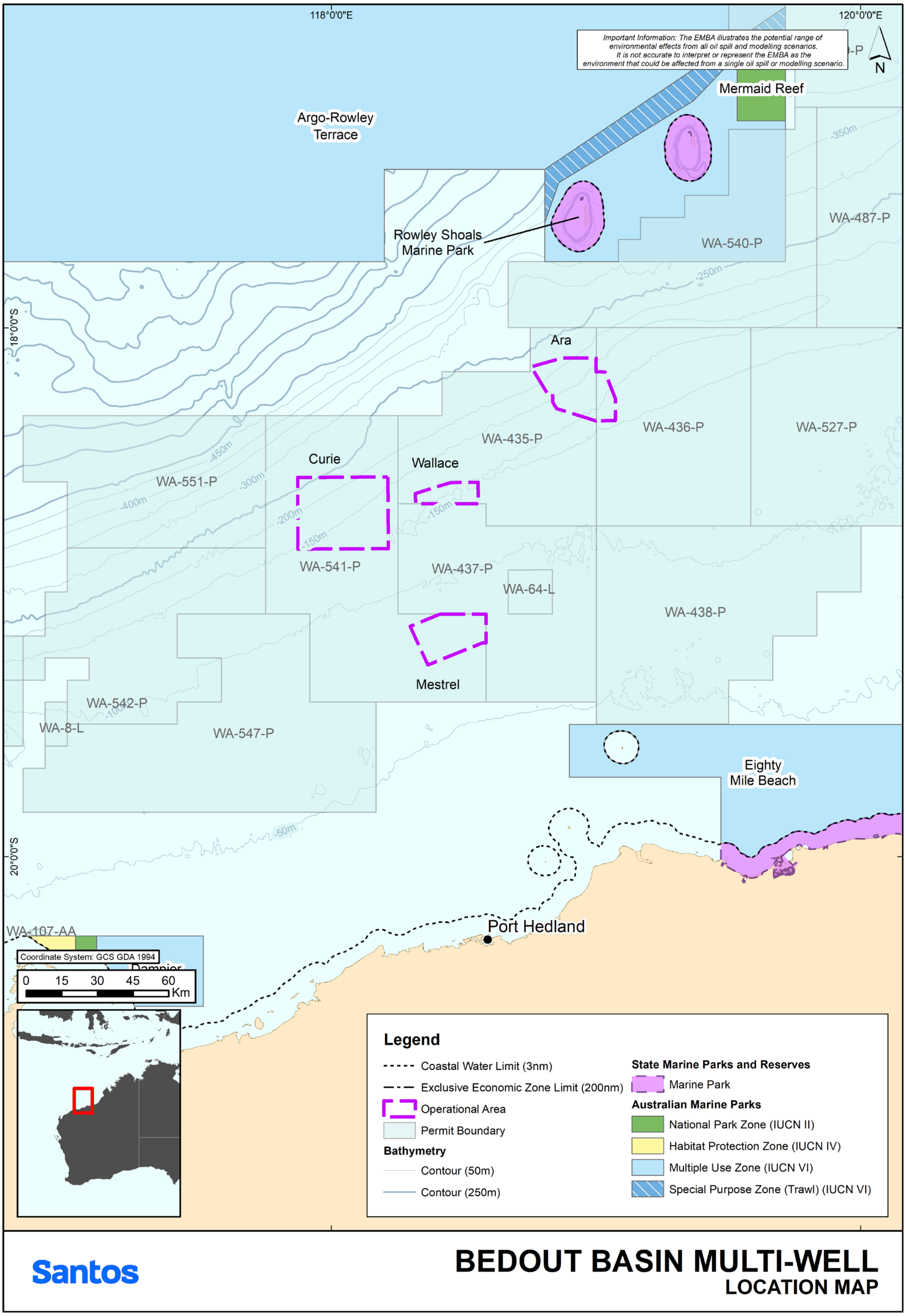

Figure 3-1: Bedout Multi Well Drilling Locations

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:

- Bedout Multi Well Drilling Oil Spill First Strike Response Plan
- Santos Incident Management Plan –Western Australia, Northern Australia and Timor Leste (WANATL) (7700-670-PLA-0016)
- Santos Incident Management Handbook
- Santos Crisis Management Plan (SMS-HSS-OS05-PD03)
- Bedout Multi Well Exploration and Appraisal Drilling EP (7720-650-EMP-0005)
- MODU Operator's Emergency Response Plan
- Santos-MODU Operator Emergency Response Bridging Document
- Incident Response Telephone Directory (7700-670-PLA-0016.20)
- Refuelling and Chemical Management Standard (SO-91-IQ-00098)
- Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001)
- Well-specific or campaign Source Control Plan
- Oil Pollution Waste Management Plan (7715-650-ERP-0001)
- Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)
- Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
- Santos Oiled Wildlife Sample Collection Protocol
- Santos North West Shelf Operational and Scientific Monitoring – Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0002)
- Oil Spill Scientific Monitoring Baseline Data Review (SO-91-RF-20022)
- Santos Offshore Division Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001)
- Santos Offshore Division Oil Spill Response Readiness Guideline (7710-650-GDE-0001)
- Santos Oil and Water Sampling Procedures (7710-650-PRO-0008)
- Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
- Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017)

3.6 Interface with external documents

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

- 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 and National Marine Oil Spill Contingency Plan
  - sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.
- Western Australia State Hazard Plan for Maritime Environmental Emergencies (SHP-MEE)
  - details the management arrangements for preparation and response to a marine pollution incident occurring in State waters.
- WA DTMI Incident Management Plan – Marine Oil Pollution

- provides the WA DTMI, as the hazard management agency (HMA) for marine oil pollution (MOP), with an incident management plan that outlines the procedures and arrangements for responding to MOP incidents occurring within or impacting WA State waters
- DTMI's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (go to: Offshore Petroleum Industry Guidance Note).

- Western Australia Oiled Wildlife Response Plan
  - establishes the framework for responding to potential or actual wildlife impacts in WA waters, within the framework of an overall maritime environmental emergency
  - outlines risk reduction strategies, preparedness for, response to and initiation of recovery arrangements for wildlife impacts during a marine oil pollution incident.
- Western Australia Oiled Wildlife Response Manual
  - a companion document to the Western Australia Oiled Wildlife Response Plan for Maritime Environmental Emergencies, designed to standardise operating procedures, protocols and processes for wildlife response.
- Joint Industry Operational and Scientific Monitoring Framework
  - provides a standardised approach to oil pollution monitoring, including industry guidance, templates, worked examples and standardised Operational and Scientific Monitoring Plans which titleholders can apply to identify and detail monitoring arrangements and capabilities in their EP and OPEP submissions.
- 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 Member 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.
- Pilbara Ports Authority Port of Dampier Handbook (Pilbara Ports Authority, 2024) (https://www.pilbaraports.com.au/about-pilbara-ports/publications/forms-and-publications/forms-and-publications/handbook/2024/february/port-of-dampier-handbook)
  - defines the requirements for marine oil pollution reporting within the Port of Dampier limits.
- Pilbara Port Authority Port of Varanus Island (VI) Handbook (https://www.pilbaraports.com.au/about-ppa/publications/forms-and-publications/forms-publications/form/2021/july/port-of-varanus-island-port-handbook)
  - Defines the requirements for marine oil pollution reporting within the Port of VI limits.
- Pilbara Ports West Marine Pollution Contingency Plan (MPCP) (https://www.pilbaraports.com.au/about-ppa/publications/forms-and-publications/forms-publications/form/2021/july/pilbara-ports-west-marine-pollution-contingency-pl)
  - Provides a source of information for individuals and agencies responsible for developing and managing oil spill response capabilities within Pilbara Ports West port limits.
- Barrow Island Port Information Manual (https://australia.chevron.com/-/media/australia/our-businesses/documents/barrow-island-port--information-manual.pdf):
  - Defines the requirements for marine oil pollution reporting within Barrow Island Port limits.

3.7 Document review

In line with regulatory requirements, this document shall be reviewed, updated and submitted to NOPSEMA every 5 years from date of acceptance.

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

- when major changes have occurred that affect oil spill response coordination or capabilities
- changes to the 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 OPGGSIR 2023.

The custodian of the OPEP is the Santos Lead Oil Spill Risk & Planning Coordinator based in the Santos Perth office.

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 SHP-MEE (WA DoT 2024a). Spill response levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos Incident Management Plan – WANATL (7700-670-PLA-0016) and further detailed in Table 4-1 for hydrocarbon spills.

Table 4-1: Santos oil spill response levels

Level 1	
An incident which will not have an adverse effect on the public or the environment which can be controlled by the use of resources normally available on site.	
• Oil is contained within the incident site. • Spill occurs within immediate site proximity. • Incident can be managed by the On-site Emergency Response Team (ERT) and its resources.	• Source of spill has been contained. • Oil is evaporating quickly and no danger of explosive vapours. • Spill likely to naturally dissipate. • No media interest/not have an adverse effect on the public.
Level 2	
An incident that cannot be controlled by the use of on-site resources alone and requires external support and resources to combat the situation; or An incident that can be controlled on site, but which may have an adverse effect on the public or the environment.	
• Danger of fire or explosion. • Possible continuous release. • Concentrated oil accumulating in close proximity to the site or vessel. • Potential to impact other installations.	• Level 1 resources overwhelmed, requiring additional regional resources. • Potential impact to sensitive areas and/or local communities. • Local/national media attention/may adversely affect the public or the environment.
Level 3	
An incident which has a wide-ranging impact on Santos and may require the mobilisation of external state, national or international resources to bring the situation under control.	
• Loss of well integrity. • Actual or potentially serious threat to life, property, industry. • Major spill beyond site vicinity. • Significant shoreline environmental impact.	• Level 2 resources overwhelmed, requiring international assistance. • Level 3 resources to be mobilised. • Significant impact on local communities. • International media attention.

4.2 Jurisdictional authorities and control agencies

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

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

Table 4-2 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State waters and for vessel and petroleum activity spills. To aid in the determination of a vessel versus a petroleum activity spill, the following guidance is adopted:

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

Santos

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[1]	AMSA	AMSA		Vessel SOPEP National Plan Bedout Multi Well Drilling OPEP (this document)
	Petroleum activities[2]	NOPSEMA	Titleholder		Bedout Multi Well Drilling OPEP (this document)
Western Australian (WA) state waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	WA Department of Transport and Major Infrastructure (DTMI)	WA DTMI	WA DTMI	Vessel SOPEP SHP-MEE (WA DoT 2024a) WA Incident Management Plan – Marine Oil Pollution (OSCP) (WA DoT 2023) Bedout Multi Well Drilling OPEP (this document)
	Petroleum activities	WA DTMI	Titleholder	WA DTMI	Bedout Multi Well Drilling OPEP (this document) SHP-MEE (WA DoT 2024a)
WA State Waters within Pilbara Port Authority Limits[3]	Vessel	WA DTMI	Port Authority[4]	Port Authority / DTMI[5]	Port of Varanus Island Port Handbook (Pilbara Port Authority 2021a) Pilbara Ports West – Marine Pollution Contingency Plan (Pilbara Port Authority 2021b) Port of Dampier Port Handbook (Pilbara Port Authority 2024) SHP-MEE (WA DoT 2024a)
	Petroleum activities	WA DTMI	Port Authority	DTMI	SHP-MEE (WA DoT 2024a)
International waters	All activities	Relevant foreign authority	Santos will liaise with the Australian Government Department of Foreign Affairs and Trade (DFAT) in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		

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

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

[3] *The Varanus Island port limits are defined in section 4 of the Port of Varanus Island Port Handbook (Pilbara Port Authority 2021a).*

[4] *DTMI and the Port Authority may assign, through IMPs/OSCPs/OPEPs, emergency response functions to a Port Operator or Port Facility Operator for spills originating from their activities, however the role of Control Agency will remain with the nominated agency or organisation as per Table 4-2above (Pilbara Port Authority 2021a).*

[5] *For any incident originating in Port Authority waters, the relevant Port Authority will be the Controlling Agency, unless for Level 2 and 3 incidents it is deemed by the HMA/SMPC in consultation with the Port Authority that it is more suitable for DTMI to be the Controlling Agency (WA DoT, 2024a).*

4.3 Petroleum activity spill in Commonwealth waters

For an offshore petroleum activity spill in Commonwealth waters, the Jurisdictional Authority is the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA). NOPSEMA is responsible for the oversight of response actions to pollution events from offshore Petroleum Activities, in areas of Commonwealth jurisdiction. During a spill incident, NOPSEMA's role will be to implement regulatory processes to monitor and secure compliance with the OPGGS Act 2006 and OPGGSIR 2023, including the issuing of directions as required, and investigate accidents, occurrences and circumstances involving deficiencies in environmental management.

Under the OPGGS Act 2006 and OPGGSIR 2023, the petroleum titleholder (i.e. Santos) is responsible for responding to an oil spill incident as the Control Agency in Commonwealth waters, in accordance with its OPEP.

4.4 Vessel spills

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

WA DTMI manages the SHP – MEE (WA DoT 2023a) and is the Control Agency for all vessel-based spills in WA waters outside of a port proclaimed pursuant to the *Port Authorities Act 1999* (WA). For vessel-based spills within a port proclaimed pursuant to the *Port Authorities Act 1999* (WA), the relevant Port Authority or DTMI may be the Control Agency.

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

Once initial notifications to the Control Agency are made, Santos shall maintain direct contact with the Control Agency and act as a supporting agency throughout the response. This includes providing essential services, personnel, materials or advice in support of the Control Agency. In addition, Santos will be required to implement monitoring activities as outlined in the Monitor and Evaluate Plan (Section 10) and Operational and Scientific Monitoring (Section 17).

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; and DTMI for State waters unless otherwise appointed through agreement between the Hazard Management Agency (HMA) / Jurisdictional Authority of both waters.

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

4.5.2 Cross-jurisdictional vessel spills

If a Level 2/3 vessel spill crosses jurisdictions between Commonwealth and State waters, two Jurisdictional Authorities will exist: AMSA for Commonwealth waters, and DTMI for WA State waters. The Control Agency will remain with the original nominated agency or organisation unless otherwise appointed through agreement between the HMA / Jurisdictional Authority of both waters. Santos will continue to provide all necessary resources (including personnel and equipment) as a supporting agency, as detailed in Section 4.6.

AMSA may request that DTMI manage a vessel incident in Australian Commonwealth waters (WA DoT 2024a).

4.6 Integration with government organisations

4.6.1 Australian Maritime Safety Authority

AMSA is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction. Upon notification to an incident involving a ship, AMSA will assume control of the incident and respond in accordance with the National Plan (AMSA 2020). AMSA is to be notified immediately of all ship-source incidents through the

AMSA Rescue Coordination Centre (RCC) Australia (Santos Incident Response Telephone Directory [7700-670-PLA-0016.20]).

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

For any oil pollution event, Santos will notify AMSA (as per Table 7-1) in the interests of facilitating the most efficient and effective response to the incident.

4.6.2 Western Australia – Department of Transport and Major Infrastructure

If a Marine Oil Pollution Incident enters State waters, the DTMI is the HMA (Chief Executive Officer or proxy). The Director Maritime Environmental Emergency (MEER) & Ports has been nominated by the HMA to perform the role of State Marine Pollution Coordinator (SMPC) (as prescribed in Section 1.3 of the SHP – MEE [WA DoT, 2024a]). Under the SHP-MEE, the Control Agency for Level 1 Petroleum Activity spills in State waters is the Petroleum Titleholder (Santos) with the Control Agency for Level 2/3 spills nominated as DTMI. During a MEE incident within State and Port waters, the role of the SMPC provides strategic management of the incident response on behalf of the HMA.

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

- evaluation of situational awareness information, including all surveillance, monitoring and visualisation data provided by the Titleholder
- evaluation of resources at risk including use of the WA Oil Spill Response Atlas and any other relevant WA/Commonwealth government databases or other information sources
- evaluation of shoreline types, habitat types and seasonality of environmental, socio-economic and cultural values and sensitivities
- consultation with the State Environmental Scientific Coordinator and other relevant State and Federal government departments with environmental responsibilities
- consultation with other relevant oil spill agencies, including the AMSA Environment, Science and Technology network or any other experts as necessary
- Activation of State resources to support culture and heritage management (via request to the SMPC) sourced through State arrangements pertaining to Local Emergency Management Committees, Native Title Management, Heritage Management, and incorporation of local knowledge (WA DoT, 2024a)
- all information is utilised in a NEBA/ Spill Impact Mitigation Assessment (SIMA) type process, to determine protection priorities and response strategies.

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

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

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

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

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

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

To facilitate coordination between DTMI 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 DTMI as Control Agency, initially 11 personnel to fill roles in the DTMI IMT or Forward Operations Bases (FOBs) (refer to Section 5.2) and operational personnel to assist with those response strategies where DTMI is the Lead IMT. Concurrently DTMI will also provide two of their personnel to the Santos IMT as described in Table 5-2. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attend the DTMI Fremantle Incident Control Centre (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 DTMI Fremantle ICC no later than 8am on the day following the request being formally made to Santos by the SMPC. Santos personnel designated to serve in DTMI's FOB will arrive no later than 24 hours after receipt of formal request from the SMPC.

Figure 4-1 shows the organisational structure of Santos incident management personnel within Santos IMT and embedded within DTMI's MEECC/ IMT. Figure 4-2 shows the overall cross-jurisdictional organisational structure referenced from the SHP-MEE.

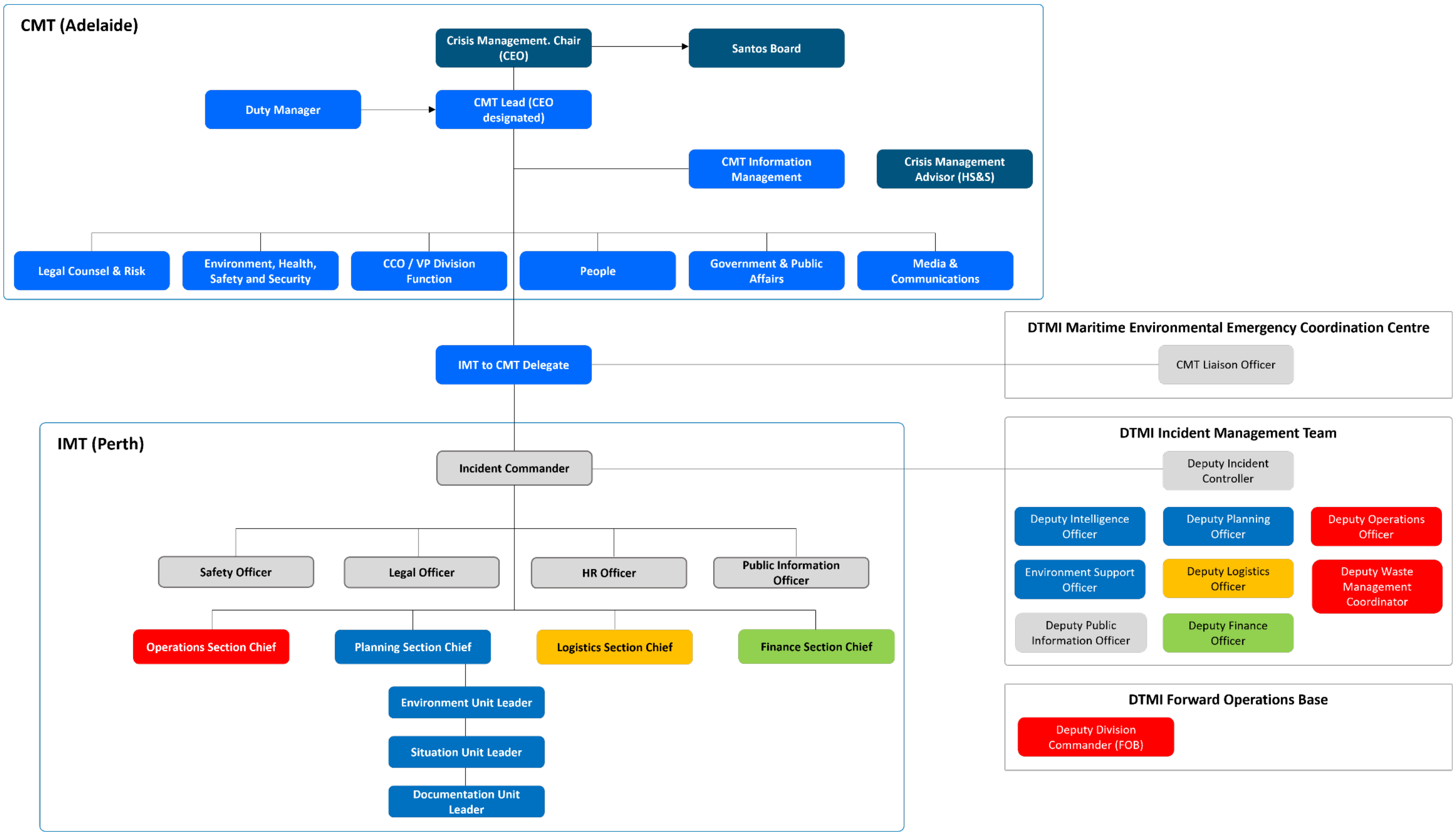

Figure 4-1: Santos cross-jurisdictional incident management structure for a Level 2/3 facility oil pollution incident originating within or entering WA State waters

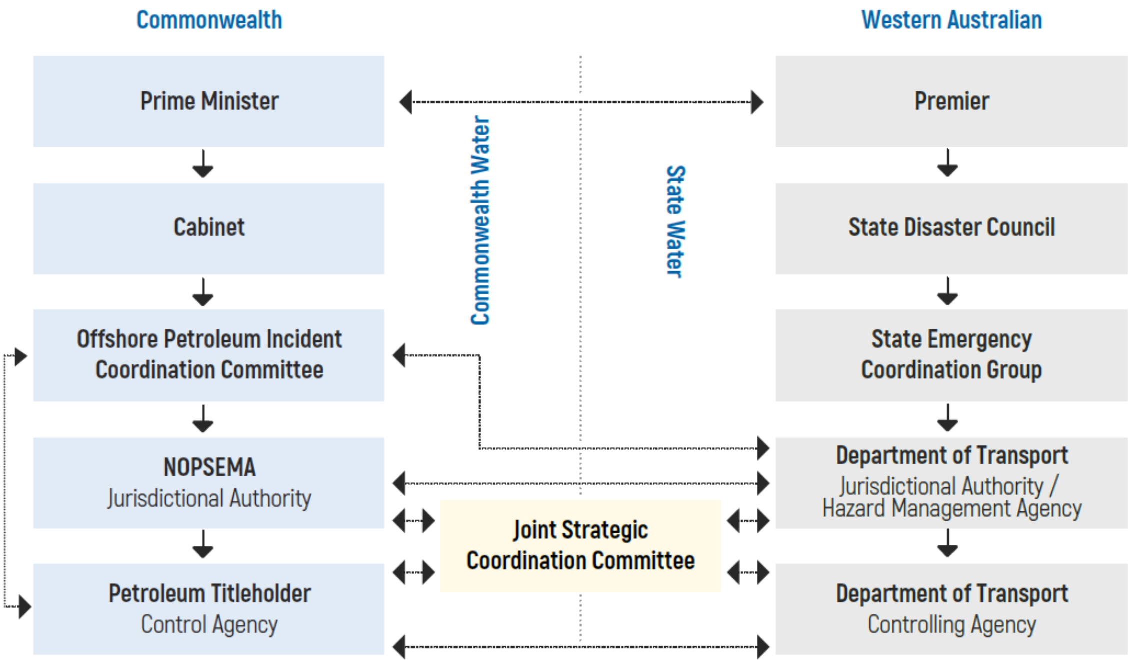

Figure 4-2: Overall control and coordination structure for offshore petroleum cross-jurisdiction incident

4.6.2.1 Consent for use of dispersant in State waters and notification of use in adjacent Commonwealth waters

Approval for the use of dispersant in State waters during an incident shall be pursuant to the [Dispersant Use Consent Framework](). Administered by DTMI, the process will include input from the Environmental Scientific Coordinator (ESC) and require written consent from the HMA/SMPC prior to any dispersant being applied to State waters (WA DoT 2024b).

The use of dispersant in Commonwealth waters does not require the consent of DTMI. However, where the use of dispersant in Commonwealth waters may impact State waters, the DTMI requests to be consulted prior to any dispersant application (WA DoT, 2024b). This will enable potential cross-jurisdictional impacts to be considered appropriately in the operational NEBA with the relevant jurisdictional authority.

NOPSEMA's assessment of the EP and OPEP prior to a petroleum activity commencing provides the mechanism for acceptance of dispersant use and deployment strategies in Commonwealth waters, prior to a MOP incident occurring. Any dispersant use in response to a MOP incident from a Commonwealth offshore petroleum activity must be carried out in accordance with an accepted EP (WA DoT, 2024b).

Limitations on surface dispersant application are described further in Section 13.2.1.

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 (DTMI). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) (DBCA 2022a).

For a Level 2/3 petroleum spill that moves into State waters, DTMI 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 DTMI to facilitate this response.

Any deterrence, displacement or rescue activity involving wildlife in WA (living or dead) constitutes "disturbance" or "taking" of wildlife under the Biodiversity Conservation Act 2016 and will require authorisation through DBCA unless undertaken by licensed personnel. The DBCA Oiled Wildlife Advisor (OWA) will expedite the process of granting interim licences or other authorities to undertake approved activities. No action specifically targeted at wildlife should occur without this authority. Deceased animals disposal will be managed in accordance with the DBCA's WAOWRP which describes the process for disposal of dead animals/carcasses. Initially, the granting of authority to take deceased wildlife is likely to be via a direction from a DBCA wildlife officer while the appropriate licences or licence holder/s that the animals can be held by are identified and organised.

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 DTMI Incident Controller.

This may include advice on priorities for environmental protection, appropriateness of proposed response strategies and the planning and coordination of operational monitoring for response effectiveness evaluation, and planning scientific monitoring for impact and recovery assessment. The ESC can also advise on where AMSA National Plan Dispersant Effectiveness Test Kits can be located, which could be utilised in addition to Santos dispersant testing resources (refer to Section 13).

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 and Resources (DISR) and DFAT will form an inter-agency panel; the Australian Government Control Crisis Centre, who may request AMSA to coordinate the response operations across the trans-national boundary. This Control Crisis Centre will remain responsible for the Australian Government's approach to preparing for, responding to and recovering from a crisis, such as a hydrocarbon spill incident. 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 and Resources

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

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

4.7 Interface with external organisations

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

4.7.1 Australian Marine Oil Spill Centre

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

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

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

4.7.2 Oil Spill Response Limited

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

Under the OSRL Associate membership Service Level Agreement (SLA), Santos has access to response personnel (18 personnel per incident) and 50% of the global response equipment stockpile. In addition to this, Santos is also a member of OSRL's Global Dispersant Stockpile (GDS) and Operational and Scientific Monitoring (OSM) Services Supplementary Agreement.

The GDS Supplementary Agreement provides Santos with access to 5,000 m^3 of dispersant stockpile in addition to the dispersant stockpile available under the Associate membership SLA. The OSM Services Supplementary Agreement provides Santos with access to Operational and Scientific monitoring services. Additional information on OSM services and capability is provided in the Santos North West Shelf OSM-BIP (7715-650-ERP-0002).

Santos also has access to additional dispersant stockpiles held by OSRL through a Global Dispersant Stockpile Supplementary Agreement.

4.7.3 Wild Well Control Inc.

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

4.7.4 The Response Group

The Response Group (TRG) is an international provider of crisis management and emergency response services including oil spill response. TRG are available to Santos 24/7 and can provide personnel for emergency response support.

4.7.5 Pilbara Ports Authority

Pilbara Ports Authority has established an overarching Marine Pollution Contingency Plan (MPCP) for Pilbara Ports (Pilbara Ports Authority 2021a), which covers all Pilbara Ports West waters. The MPCP is a source of information for those individuals and agencies that are responsible for developing and managing oil spill response capabilities within Pilbara Ports West port limits, which includes the Port of Varanus Island and Port of Dampier.

In 2023 WA DTMI developed a guidance note for WA ports on response and collaboration arrangements during maritime environmental emergencies including oil spills that impact port waters. This Guidance Note outlines the roles and responsibilities of the DTMI, and Port Authorities or Port Operators under those arrangements and seeks to promote consistency between Port Authority and Port Operator provisions for the management of Marine Oil Pollution (MOP) or Marine Transport Emergency (MTE) incidents within Port waters, and the overarching arrangements for WA as outlined in the State Hazard Plan – Maritime Environmental Emergencies (SHP-MEE) (WA DoT 2024a), the National Plan for Maritime Environmental Emergencies (National Plan), and the State Emergency Management Framework.

Port of Dampier

Any marine oil pollution incident (irrespective of quantity) within the Port of Dampier port limits should be verbally reported immediately to Dampier vessel traffic services (VTS) via VHF or telephone. A POLREP is also to be submitted to WA DTMI (Pilbara Ports Authority 2024). A call to The Emergency Tower mobile should also be made. Pollution reporting requirements are provided in Table 7-1.

Port of Varanus Island

The Port of Varanus Island (VI) transitioned to Pilbara Ports Authority on 1 July 2021. The VI Port limits are defined in Section 4 of the Port of VI Handbook. Santos is the port operator of the Port of VI and provides the necessary services required to conduct safe operation of the facilities under Santos control. The Port of VI is governed by Pilbara Ports Authority under the WA Port Authorities Act 1999 (Pilbara Ports Authority 2021b).

Any marine oil pollution incident (irrespective of quantity) that has a risk of traversing within the Port limits should be verbally reported within 4 hours to the Harbour Master via VI Port Control. A follow up report must be made within 48 hours through the Pilbara Ports Authority Hazard and Incident Reporting Form (refer to Table 7-1). Pilbara Ports Authority also expects a POLREP to be submitted to WA DTMI (refer to Appendix C) (Pilbara Ports Authority 2021b).

4.7.6 Barrow Island Port Authority

The Barrow Island Port Harbour Master should be notified if there is a risk of a spill from an external source entering the port limits. In the first instance, verbal notification may be given; however, this should be followed up by submitting a to the Harbour Master, and to DTMI, as soon as practicable (Chevron Australia, 2023).

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 (refer to Appendix R).

5. Santos incident management arrangements

5.1 Incident management structure

The Santos IMT (Perth) and Crisis Management Team (CMT) will be activated in the event of a Level 2/3 hydrocarbon spill[6] regardless of the type of spill or jurisdiction. Santos maintains internal resources (trained personnel and equipment) across its activities that provide first strike response capability and to also support an ongoing response. Should an incident occur, the IMT Duty Manager would be notified immediately. This rostered role is on-call, filled by trained Incident Commanders and available 24 hours/day and 7 days/week. The IMT Duty Manager would then activate the IMT via an automated call-out system. Documentation required in a response is accessed via the Santos Emergency Response (ER) intranet site.

As outlined in Section 4, control of the response may be taken over by the relevant Control Agency as the incident progresses. The Santos response structure to a major emergency incident is detailed in the Santos Incident Management Plan – WANATL (7700-670-PLA-0016) and the Santos Incident Management Handbook. The Incident Management Plan – WANATL and Santos Incident Management Handbook describe response planning and incident management that would operate under emergency conditions – describing how the Santos IMT operates and interfaces with the CMT and external parties.

The first priority of an escalating oil spill response to a Level 2/3 spill is forming an IMT and establishing an incident coordination centre (ICC)[7]. The ongoing involvement of the IMT and CMT will depend 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 Bedout Multi Well Drilling incident includes:

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

The Santos incident response organisational structure is defined in the Incident Management Plan – WANATL and Santos Incident Management Handbook (see also Figure 5-1). 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 comprise the following sub-teams, according to the applicable source control strategies:

- Relief Well Team
- Well Intervention Team.

The Santos Source Control Branch (Figure 5-1) reports directly to the Operations Section Chief and is responsible for:

- coordinating engineering safety and operational activities
- managing source control technical personnel from third parties (e.g. Wild Well Control Inc.)
- developing task-specific plans and procedures
- identifying and sourcing required tools and equipment
- approving source control components of IAPs.

[6] *Note that Santos may also choose to activate the IMT regardless of the spill response Levels.*

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

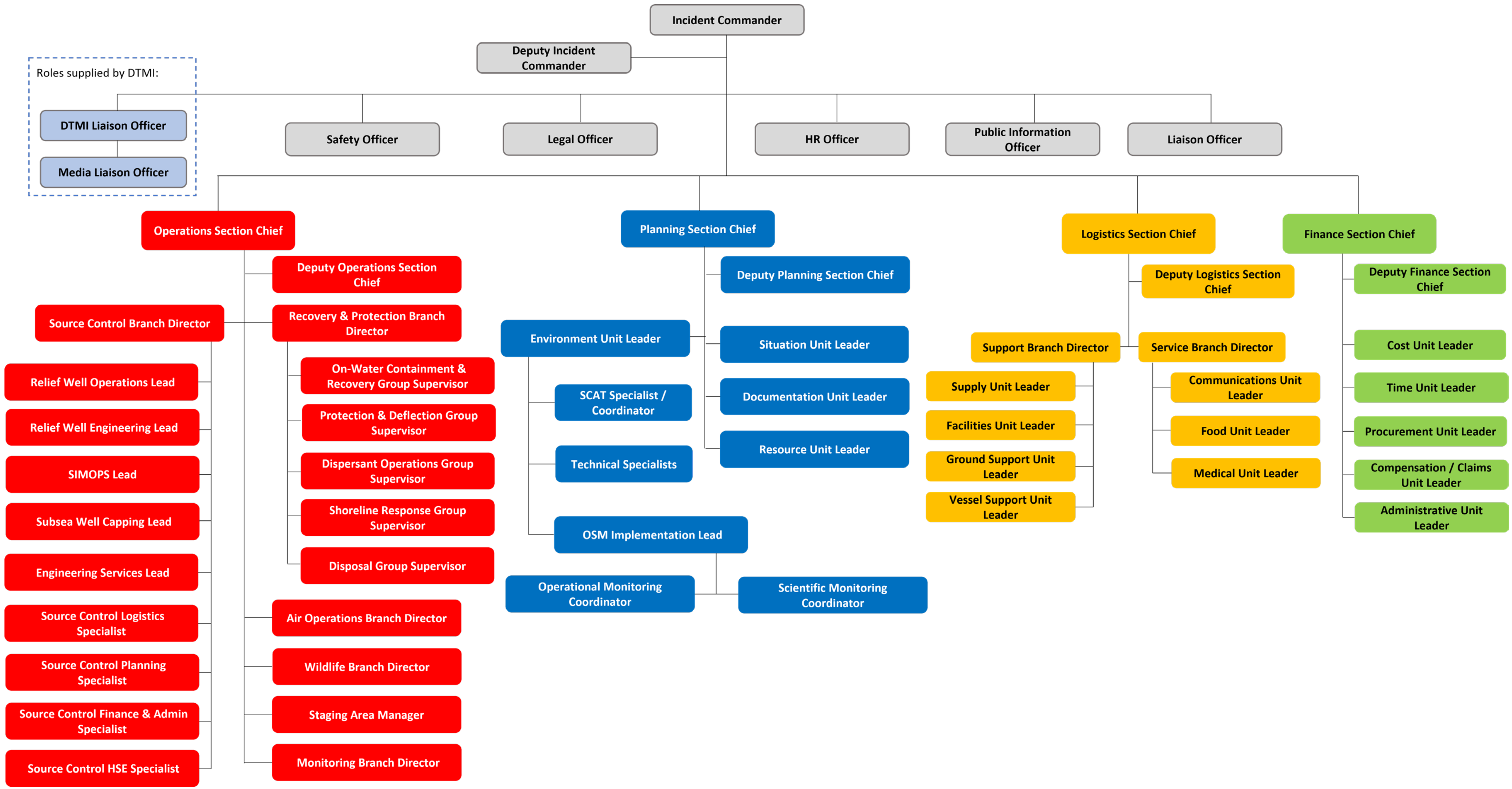

Figure 5-1: Santos incident management team organisational structure

Note: For a Level 2/3 petroleum activity spill whereby DTMI is the 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 DTMI in providing spill response capability. In these cases Santos may be required to supply the DTMI IMT Support roles to the DTMI MEECC / DTMI IMT. This is detailed further in Section 4.6.2 and Figure 4-1.

5.2 Roles and responsibilities

The following tables provide an overview of the responsibilities of the:

- Santos CMT (Table 5-1)
- Santos IMT (Table 5-2)
- Field-based response team members (Table 5-3)
- DTMI roles embedded within Santos CMT / IMT (Table 5-4)
- Santos roles embedded within the WA State MEECC / DTMI IMT and FOBs (Table 5-5).

Not all of the roles listed Table 5-2 are shown in Figure 5-1 as some of the roles in Table 5-2 are support roles or are specific to a particular response strategy. Full responsibilities and checklists/job cards of each role are described in the Incident Management Plan – WANATL (7700-670-PLA-0016), Santos Incident Management Handbook and Santos Crisis Management Plan (SMS-HSS-OS05-PD03) to support the incident action planning process. The IMT and field-based teams are scalable to the nature and scale of the response.

As per Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements, where DTMI is the Control Agency for spill response Santos will provide personnel to work within DTMI's organisational structure. DTMI will also provide a Liaison Officer / Duty Incident Commander to the Santos IMT in a coordinated response.

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

Santos CMT Role	Main Responsibilities
Crisis Management Chair (CEO)	The Crisis Management (CM) Chair (Santos CEO) is responsible for the following: • Leading crisis management direction. • Providing governance and oversight of CMT operations. • Providing enterprise and strategic direction to the CMT for the resolution of the crisis event. • Delegating the CM Lead role and accountability to the appropriate ExCom designee. • Engaging with the CM Lead to endorse the crisis resolution plan. • Liaising with the Santos Board and strategic stakeholders. • Providing the full extent of the company's resources to bring about a resolution and recovery from the crisis impact.
CMT Lead/ Duty Manager	The CMT Lead is responsible for: • Determining the need for establishing a Level 3 response and for activating the CMT. • Determining which / if any Crisis Management Support Teams (CMST) are mobilised. • Leading the crisis resolution process. • Ensuring internal and external notifications to key stakeholders. • Using the crisis resolution process to determine enterprise level impacts (potential or actual) and strategic objectives. • Ensuring a crisis resolution plan is developed and direct the CMT functions to implement strategies, action plans and tasks. • Determining when it is appropriate to conclude the crisis response and stand down all or a portion of the CMT.
CMT Information Management	The CMT Information Managers directly support the CMT by: • Supporting the CMT during crisis management operations. • Setting up the crisis management room, assist with set-up of communications, video conferences and information transfer within the CMT. • Advising 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. • Providing incident action plan information when an IMT is established. • Monitoring and managing the welfare needs of the CMT.
Crisis Management Advisor	The Crisis Management Advisor is responsible for the following: • Providing CMT process guidance and advice to CMT Lead, Function Leaders, and CMST. • Supporting and facilitating the crisis resolution planning process.

Santos CMT Role	Main Responsibilities
	• Acting as the liaison between the CMT and IMT. • Working with CMT Information Managers to manage roster and handovers for extended CMT operations. • Scheduling and facilitating post crisis debriefs and after-action reviews.: The Crisis Management Advisor will support the CMT Lead by: • Facilitating CMT activation requirements with the CMT Lead. • Assisting the CMT Lead in maintaining an ongoing assessment of incident potential and analysis of stakeholder impacts. • Advising the CMT Lead on CMT structure and requirements for CMST engagement. • Coordinating tasks delegated by CMT Lead. • Providing tools to the CMT Lead for review and crisis assessment meetings.
CMT Function Leads	CMT Function Leads include Leaders for the following areas: • Legal Counsel and Risk • Environment Health Safety and Security • Operating Unit VP • People • Government and Public Affairs (GAPA) • Media and Communications The CMT Function Leads are responsible for: • Participating and contributing to the crisis resolution planning process. • Mobilising and coordinating activities of the function CMST. • Advising the CMT Lead on strategic impacts, threats and mitigation created by the crisis event. • Developing and executing strategies to meet objectives endorsed by the CM Chair. • Providing support and resources via the CMST to divisional IMTs. • Ensuring critical actions, decisions or points of strategic criticality are included in the CMT log. • Participating in the crisis management debrief and after-action reviews.

Table 5-2: Roles and responsibilities in the Santos Incident Management Team[8]

Santos Management /IMT Role	Main Responsibilities
IMT to CMT Delegate	• Depending on the level of the incident, the IMT to CMT Delegate (and/or their delegate) will act as the primary liaison to the CMT Duty Manager. • On the activation of the IMT, the IMT to CMT Delegate is advised by the IMT Duty Manager.
Incident Commander (and **Deputy Incident Commander**)	• Overall management of the incident. • Sets response objectives and strategic directions. • Oversees the development and implementation of Incident Action Plans.
Safety Officer	• Develops and recommends measures for assuring personnel safety • Assesses and/or anticipates hazardous and unsafe situations. • May have specialists as necessary.
Legal Officer	• Responsible for identifying potential legal issues stemming from the incident and providing advice and direction on all matters of a legal nature.
Human Resources (HR) Officer	• Advises and assists the Incident Commander, Command Staff and Section Chiefs on any HR related aspects of an incident.
Public Information Officer	• Develops and releases information about the incident to media, incident personnel and to appropriate agencies and organisations.
Liaison Officer	• Acts as the conduit for assisting and cooperating with agency or organization representatives, particularly for incidents that are multi-jurisdictional or have several agencies involved.

[8] *These roles are aligned with the Santos Incident Management Handbook.*

Santos Management /IMT Role	Main Responsibilities
Operations Section Chief*	• Leads the Operations Section within the IMT. • Manages all tactical operations directly applicable to the primary assignments. • Activates and supervises operational elements in accordance with the IAP and directs its execution.
Deputy Operations Section Chief	• Flexible role. May support the Operations Section Chief in a relief capacity, or by supervising field operations in lieu of an On-Scene Commander.
Source Control Branch Director	• The Source Control Branch Director will be responsible for the implementation of the Source Control Plan (as per the Source Control Planning and Response Guideline – DR-00-OZ-20001) and will activate and supervise source control elements in accordance with the Incident Action Plan and direct their execution.
Relief Well Operations Lead	• Responsible for all operational aspects related to the drilling of a relief well and the subsequent dynamic kill operation through to abandonment of both the relief and incident well(s). • Works closely with the Relief Well Engineering Sector and Logistics Section to source the MODU, dynamic kill pumping equipment and operational personnel.
Relief Well Engineering Lead	• Responsible for the planning, permitting and execution of a relief well. • Works closely with the Relief Well Operations Sector and Logistics Section to source relief well tangibles.
SIMOPS Lead	• Co-ordinates all activities within the 1,000 metre (or less) radius of the incident well. • Responsible for the co-ordination of resources and activities to ensure their safe and efficient utilisation in a prioritised way. • The SIMOPS group co-ordinates vessel and aviation activities within the 1,000 metre zone and interfaces closely with other surface responders.
Subsea Well Capping Lead	• Responsible for preparing plans and procedures for BOP intervention, and installing the capping stack. The scope includes mobilising, staging, deploying and installing capping stack followed by shutting in the well, or if not possible to shut in, choking back the flow. • If required, the group is also responsible for delivering a non-vertical access solution. Once installed, and if top kill is the desired approach, the group is responsible for developing the plan and sourcing the equipment needed. • Has a close affiliation with the SIMOPS and engineering sectors.
Engineering Services Lead	• Responsible for performing an array of engineering activities that support adjacent groups response efforts. • Focused on developing models and engineering outputs that would be used by various operations teams throughout the response organisation.
Recovery & Protection Branch Director	• Responsible for overseeing and implementing the protection, containment and clean-up activities established in the IAP. Depending on the size and nature of the incident, will direct various groups led by the following Group Supervisors: – On-Water Containment & Recovery Group Supervisor: Responsible for the deployment of on water containment and recovery operations in the designated locations in compliance with the IAP. – Protection & Deflection Group Supervisor: Responsible for diversion/protection booming in the designated locations in compliance with the IAP. – Dispersant Operations Group Supervisor: Responsible for coordinating all aspects of dispersant operations in compliance with the IAP. For aerial applications, the Group works closely with the Air Operations Branch. – Shoreline Response Group Supervisor: Responsible for leading all shoreline response activities working closely with the shoreline clean-up supervisors at various locations. – Disposal Group Supervisor: Responsible for coordinating the on-site activities of personnel engaged in collecting, storing, transporting and disposing of waste materials, in compliance with the IAP
Air Operations Branch Director	• Responsible for the coordination of the air operations section (ICS 220) of the IAP and for providing logistical support to incident aircraft.
Wildlife Branch Director	• Working with relevant state authorities, responsible for implementing the OWR plan for the incident including the deployment of equipment and personnel required.
Staging Area Manager	• 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.

Santos Management /IMT Role	Main Responsibilities
Monitoring Branch Director	• Working closely with the Environment Unit, responsible for implementing the operational and scientific monitoring plans required based on the nature and scale of the incident.
Planning Section Chief* (and **Deputy Planning Section Chief**)	• Leads the Planning Section within the IMT. • Collects, evaluates, disseminates and uses incident information. • Maintains status of assigned resources.
Environment Unit Leader	• Responsible for environmental matters associated with the response, including strategic assessment, modelling, surveillance and environmental monitoring and permitting.
Situation Unit Leader	• Responsible for collecting, processing, and organizing incident information relating to escalation, mitigation or intelligence activities taking place in an incident. • Responsible for preparing future projections of incident growth, maps, and intelligence information.
Documentation Unit Leader	• Responsible for maintenance of accurate, up-to-date incident files including Incident Action Plans, incident reports, communication logs, situation status reports etc.
Resource Unit Leader	• Responsible for maintaining the status of all assigned tactical resources and personnel at an incident. • Oversees the check-in of all tactical resources and personnel, maintaining a status-keeping system indicating current location and status of all the resources.
SCAT Specialist/ Coordinator	• Primary point of contact within the IMT for all SCAT activities • Acts as project manager for SCAT program and will design and direct the SCAT program for any incidents • Implements and manages 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.
Technical Specialists	• The Environment Unit Lead may be supported by various technical specialists according to the specific details and circumstances of the oil spill incident.
OSM Implementation Lead	• Identifies the relevant OMP and SMP components that may be triggered based on the information collected during the initial response and OMP monitoring. • Ensures that the relevant OMP and SMPs are implemented at the appropriate times. • Confirms monitoring priorities with the Environment Unit Lead and continually re-evaluate. • Integrates any protected matters requirements into final monitoring designs. • Approves monitoring designs and monitoring plans. • Liaises with relevant stakeholders and regulators on monitoring design, monitoring priorities, and results.
Operational Monitoring Coordinator **Scientific Monitoring Coordinator**	• Assists the OSM Implementation Lead in finalising the monitoring design for individual OMPs (Operational Monitoring Coordinator) / SMPs (Scientific Monitoring Coordinator). • Understands the data metrics collected in the event of a spill. • Advises the OSM Implementation Lead on data collection, logistical support required, and monitoring priorities if constraints (e.g. safety, time, logistics) are encountered. • Oversees data analyses and interpretation. • Manages data, including spatial data. • Presents data in an appropriate and informative format to allow for timely decisions.
Logistics Section Chief* (and **Deputy Logistics Section Chief**)	• Responsible for providing facilities, services and materials in support of the incident. • Participates in the development and implementation of the Logistics Section of the IAP.
Support Branch Director	• 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.
Service Branch Director	• Responsible for the management of all service activities for the incident including the operations of the Communications, Medical and Food Units
Finance Section Chief*	• Responsible for all the financial, administrative and cost analysis aspects of the incident and for supervising members of the Finance Section

Santos Management /IMT Role	Main Responsibilities
(and **Deputy Finance Section Chief**)	
Cost Unit Leader	• Responsible for collecting all cost data and providing cost estimated and any cost saving recommendations for the incident
Time Unit Leader	• Responsible for equipment and personnel time recording to include personnel travel, work hours, transfers, promotions. • Liaise with each response organisation management and ensure daily personnel time records are prepared and in compliance with Santos policies.
Procurement Unit Leader	• Responsible for administering all financial matters pertaining to vendor contracts and leases. • Executes all procurements in accordance with the Santos policies and procedures
Compensation / Claims Unit Leader	• Responsible for the management and direction of all administrative matters pertaining to compensation and claims related matters for any incident

**Note: The Section Chiefs may be supported by various other roles that will be mobilised as part of scale-up of IMT resources, depending on the severity of the incident.*

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

Field-based position	Main Responsibilities
Emergency Commander[9]	• Assesses facility-based oil spill situations / incidents and respond accordingly. • Single point of communications between facility/site and IMT. • Directs emergency response activities in accordance with the Santos emergency response principles and philosophy. • Develops an emergency response strategy. • Communicates the Emergency Response actions and delegates actions to the Incident Commander in the IMT. • Manages the spill incident in accordance with the Facility Emergency Response Plan, Third Party Incident Response Plan and/or the activity-specific OPEP (this document). • Coordinates medical evacuations as required. • Liaises with the Perth IMT Operations Section Chief if/when the IMT is established.
Emergency Coordinator	• Establishes and maintains contact with the incident scene. • Ensures information is passed to and from the On-Scene Commander, including relevant emergency information from the Command team time-outs. Such information may include the source of the spill, whether the spill is ongoing or contained, and no. of personnel responding. Also advise On-Scene Commander when next Command Team time-out will be. • Ensures accurate transfer of information from On-Scene Commander to Status Board log person. • Communicates with outside assistance, e.g. vessels, aircraft, etc. • If instructed, coordinates activities such as spill control/response strategies. • If instructed, liaises with onshore technical authorities & onshore IMT. • Informs Emergency Commander of incident and vessel status.
On-Scene Commander (OSC) (ERT Field Team Leader)	• Undertakes command and leads field response as directed by the Emergency Coordinator, where safe to do so. • Establishes, when appropriate, a Forward Control Point. • Maintains spill responder safety in accordance with the Santos response philosophy. • Assures all field and affected area personnel are accounted for. • Considers tactical response in accordance with incident management guides • Deploys and executes spill control/response strategy resources to contain and control the spill incident, as per advice from the Emergency Coordinator / Incident Commander / Staging Area Manager / Deputy Division Commander (DTMI FOB).
Medical Evacuation Team	• Manages all medical and transportation requirements related to injured personnel to an appropriate medical facility.

[9] *This role is fulfilled by the Offshore Installation Manager (OIM) or Vessel Master for vessel-based incidents.*

Field-based position	Main Responsibilities
	Refer to the Medical Evacuation Procedure (SO-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team
Source Control Branch	• Responds 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	• Responds to oiled wildlife incidents to minimise the impacts to wildlife. *Refer to the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) for a description of the wildlife response branch, and the Santos Incident Management Handbook for detailed descriptions of roles and responsibilities within the Wildlife Response Branch.*
Monitoring Branch	• Monitors the effectiveness of response strategies, and impacts and recovery to sensitive receptors from an oil spill and associated response actions. *Refer to the North West Shelf OSM-BIP (7715-650-ERP-0002) for detail on Operational and Scientific Monitoring Team roles and responsibilities.*

Table 5-4: DTMI roles embedded within Santos' CMT / IMT

DTMI roles embedded within Santos' CMT/IMT	Main Responsibilities
DTMI Liaison Officer (before DTMI assuming role of Control Agency) **Deputy Incident Controller – State Waters** (after DTMI assumes role of Control Agency)	• Facilitate effective communications between DTMI's State Marine Pollution Coordinator (SMPC)/ State Maritime Environmental Emergency Coordinator (SMEEC)/ the Incident Controller and Santos' appointed CMT Lead/Incident Commander. • Provide enhanced situational awareness to DTMI of the incident and the potential impact on State waters. • Assist in the provision of support from DTMI to Santos. • Facilitate the provision of technical advice from DTMI to Santos' Incident Commander as required.
Media Liaison Officer	• Provide a direct liaison between the Santos Media team and DTMI IMT Media team. • Facilitate effective communications and coordination between the Santos and DTMI 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 DTMI Information and Warnings team. • Offer advice to the Santos Media Coordinator on matters pertaining to DTMI and wider Government media policies and procedures.

Table 5-5: Santos personnel roles embedded within the WA State Maritime Environmental Emergency Coordination Centre/DTMI Incident Management Team/ Forward Operations Base

Santos roles embedded within the State MEECC/ DTMI IMT/ FOB	Main Responsibilities
CMT Liaison Officer	• Provide a direct liaison between the Santos CMT and the State MEECC. • Facilitate effective communications and coordination between the Santos CMT Lead and the SMEEC. • Offer advice to SMEEC on matters pertaining to Santos crisis management policies and procedures.
Deputy Incident Controller	• Provide a direct liaison between the Santos IMT and the DTMI IMT. • Facilitate effective communications and coordination between the Santos Incident Commander and the DTMI Incident Controller. • Offer advice to the DTMI 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 DTMI IMT.

Santos roles embedded within the State MEECC/ DTMI IMT/ FOB	Main Responsibilities
Deputy Intelligence Officer	• As part of the DTMI 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 DTMI IMT to the Santos IMT. • Facilitate the provision of relevant mapping from the Santos IMT. • Assist in the interpretation of mapping originating from the Santos IMT. • Facilitate the provision of relevant mapping originating from the Santos IMT.
Deputy Planning Officer	• As part of the DTMI 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 DTMI 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 DTMI 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 DTMI IMT to the Santos IMT.
Deputy Public Information Officer[10]	• As part of the Public Information Team, provide a direct liaison between the Santos Media team and DTMI IMT Media team. • Facilitate effective communications and coordination between Santos and DTMI media teams[11]. • 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 DTMI Information & Warnings team. • Offer advice to the DTMI Media Coordinator on matters pertaining to Santos media policies and procedures. • Facilitate effective communications and coordination between Santos and DTMI Community Liaison teams • Assist in the conduct of joint community briefings and events. • Offer advice to the DTMI 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.

[10] *In the event of an incident, Santos can provide the DTMI IMT with a list of agencies, organisations, representative bodies, and other stakeholders that were consulted in the development of the Environment Plan to assist DTMI with the management and provision of public information.*

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

Santos roles embedded within the State MEECC/ DTMI IMT/ FOB	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 DTMI 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 in line with legislative and regulatory requirements. • Collect Waste Collection Request Forms from DTMI 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 DTMI 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 DTMI Operations Section. • Offer advice to the DTMI 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 DTMI response efforts.
Deputy Division Commander (FOB)	• As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between Santos' Forward Operations Base/s (FOB/s) and the DTMI FOB. • Facilitate effective communications and coordination between Santos Operations Section Chief and the DTMI Division Commander. • Offer advice to the DTMI 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. DTMI) and third-party spill response service providers.

5.4 Training and exercises

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

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

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

5.4.1 Incident management team training and exercises

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

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

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

IMT Role	Exercise	Training
Incident Commander	One Level 3 exercise annually or two Level 2 exercises annually[12]	• PMAOMIR418 Co-ordinate Incident Response • AMOSC – IMO3 equiv. Oil Spill Response Command and Control
Operations Section Chief Source Control Branch Director		• PMAOMIR322 Manage Incident Response Information • AMOSC – IMO3 equiv. Oil Spill Response Command and Control
Planning Section Chief Logistics Section Chief Environment Unit Leader		• PMAOMIR322 Manage Incident Response Information • AMOSC – IMO2 equiv. Oil Spill Management
Safety Officer Supply Unit Leader Geographic Information System (GIS) Team Leader Data Manager[13] HR Officer Situation Unit Leader Documentation Unit Leader IMT Log & Situation		• PMAOMIR322 Manage Incident Response Information • AMOSC – Oil Spill Response Familiarisation Training
Relief Well Team Leader Well Intervention Team Leader		• Drilling Well Control accredited training through International Well Control Forum (IWCF) Level 4 (Well Site Supervisor Training)

5.4.2 Oil spill responder training

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

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

[13] *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 equiv. Oil Spill Response Operations and/or IMO2 equiv. Oil Spill Response Management	16
Santos Facility Emergency Response Teams	Present at Varanus Island facilities for first-strike response to incidents.	Internal Santos training and exercises as defined in each facility's Emergency Response Plan Emergency Commander to have AMOSC – Oil Spill Response Familiarisation Training.	One ER team per operational facility per shift
Santos Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken triennially).	7
Santos IMT	Provides a pool of Santos employees trained to perform leadership roles in the Santos IMT.	As per the Santos training matrix	87
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every two years). AMOSC – IMO1 equiv. Oil Spill Response Operations and/or IMO2 equiv. Oil Spill Response Management	As defined in Core Group Member Reports[14] Target to maintain at least 100 members (minimum 84, maximum 140) (Ref.: AMOSC Core Group Program and Policies V2.0) (AMOSC, 2024)
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos-OSRL contract.	As per OSRL training and competency matrix.	18 responders guaranteed Up to 80 dedicated responders available, may be approved under best endeavours
TRG Response Personnel	Emergency response personnel provided by arrangement with Santos	As per TRG training and competency matrix	60
AMOSC Staff	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix.	16[15]
Santos Source Control Personnel	Management and coordination of source control strategies including relief well drilling and subsea intervention	Santos Source Control Personnel IWCF Level 4 certification	60[16]
Oiled Wildlife Response Roles	Refer to Section 16 and Appendix M		

[14] A total of 124 personnel in the Core Group as of November 2025 (AMOSC Member's website), plus 16 AMOSC staff members (AMOSPlan 2021)

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

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

Responder	Role	Training	Available Number
OSM Services Provider	Refer to Section 17 and Section 9.1 of the Santos North West Shelf OSM-BIP (7715-650-ERP-0002).		
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, will be deployed under the direction of the relevant Control Agency in a response. The National Response Team is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA 2021b).
- **WA SHP-MEE: State Response Team (SRT) –** Oil pollution response team available to assist under the jurisdiction of the DTMI in State waters. SRT members remain trained and accredited in line with the SHP-MEE requirements (WA DoT 2023a).

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 monitor and evaluate, shoreline protection, shoreline clean-up and oiled wildlife response.

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

5.5 Response testing arrangements and audits

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

5.5.1 Testing arrangements

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

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

- contract/plan review
- audit
- notification/communication check
- desktop exercise
- deployment exercise
- level 2/3 IMT Exercise.

These above tests, and the testing schedule, are detailed in full within the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001). Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified Key Performance Indicators (KPIs). The objectives and KPIs for testing the response arrangements specified in this OPEP are detailed in Appendix T.

The tests are carried out for all in-force OSCPs / OPEPs. In accordance with regulation 22(14) of the OPGGS(E)R 2023, the spill response arrangements need to be tested:

a) When they are introduced

b) When they are significantly amended

c) Not later than 12 months after the most recent test

d) If a new location for the activity is added to an EP after the response arrangements have been tested, and before the next test is conducted—testing the response arrangements in relation to the new location as soon as practicable after it is added to the EP

e) If a facility becomes operational after the response arrangements have been tested and before the next test is conducted—testing the response arrangements in relation to the facility when it becomes operational.

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

Source control testing arrangements have been formulated with reference to industry guidelines including the Australian Energy Producers (AEP) (formerly Australian Petroleum Production & Exploration Association [APPEA]) Offshore Titleholders Source Control Guideline (June 2021) and the NOPSEMA Information Paper: Source Control Planning and Procedures IP1979 (January 2024).

Source control objectives and KPIs are developed in order to test the response arrangements specified in this OPEP and the Source Control Planning and Response Guideline (DR-00-OZ-20001). In addition to objectives and KPIs, test frequency and type of test are also detailed in the Santos Offshore Oil Spill Response Readiness Guideline (7710-650-GDE-0001).

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

5.5.2 Audits

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

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

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

6. Response strategy selection

6.1 Spill scenarios

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

- The hydrocarbon types that could be spilt during Bedout Multi Well Drilling activities;
- The maximum credible release volumes;
- 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 and State/Commonwealth boundaries etc.

The worst-case credible spill risks selected to inform this OPEP and taken forward for oil spill modelling are presented in Table 6-1. The Bedout Multi Well Drilling EP (EP Section 7) details the derivation of these maximum credible spills.

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

Table 6-1: Maximum credible spill scenarios for Bedout Multi Well Drilling activities

Worst-case credible spill scenario	Approx. depth of spill	Hydrocarbon type	Max. credible volume released (m^3)	Release duration
Loss of well control causing a crude release at surface (drilling riser in place) for a subsea well in the Ara operational area.	Surface	Caley crude	1,017,519 m^3	77 days
Loss of well control causing a crude release from a surface wellhead in the Mestrel / Bancroft operational area.	Surface	Caley crude	1,367,291 m^3	77 days
Loss of well control causing a crude release from a subsea wellhead in the Curie operational area[17].	162 m subsea	Caley crude	413,367 m^3	77 days
Surface spill from vessel collision[18].	Surface	MDO	325 m^3	1 hour

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in Section 7 of the Bedout Multi Well Drilling EP. In addition to the environmental impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These thresholds are provided as a guide for response planning based on case studies that have demonstrated some response strategies require certain oil spill thicknesses and conditions to be effective.

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

[17] The Curie OA scenario is considered representative for the Wallace OA scenario, given the Wallace OA scenario (surface release) has a similar release location to the Curie OA scenario and is a significantly smaller release volume than the Ara and Mestrel/Bancroft surface LOWC scenarios.

[18] There are 3 credible scenarios for an MDO release from a vessel collision, all at different locations within the operational areas. However, each of these scenarios have the same spill characteristics.

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

AMSA indicate typical windows of opportunity for mechanical recovery and dispersant application, where minimum slick thicknesses of 100 g/m^2 and 50 g/m^2 are cited, respectively (AMSA 2023a).

Response planning thresholds are provided in Table 6-2.

Table 6-2: Hydrocarbon thresholds for response planning

Hydrocarbon concentration (g/m^2)	Description
≥1	Estimated minimum floating hydrocarbon threshold used (in part) for operational and scientific monitoring planning, as described in Section 2.1 of the North West Shelf OSM-BIP (7715-650-ERP-0002)
≥50	Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
≥100	Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application Estimated minimum shoreline accumulation threshold for shoreline clean-up

6.3 Spill modelling results

6.3.1 Stochastic modelling results

Six selected worst-case credible spill scenarios (one subsea crude oil spill from a LOWC, two surface crude oil spills from a LOWC, and three surface MDO releases arising from a vessel collision) were modelled for Bedout Multi Well Drilling activities using a stochastic approach.

Subsea and surface crude oil spills were modelled by RPS (2025). One hundred spill simulations were modelled for each scenario for each season (i.e. 100 per season, 300 in total per scenario) using a number of unique environmental conditions sampled from historical metocean data. The simulations for the Caley Crude spill scenarios were tracked for a total period of 98 days.

The three surface MDO releases arising from a vessel collision were also modelled by RPS (2025). One hundred spill simulations were modelled for each season (i.e. 100 per season, 300 in total per scenario). The simulations for the MDO spill were tracked for a period of 30 days.

6.3.1.1 MDO scenarios

All three of the modelled scenarios involve a surface release of MDO from a vessel collision. These scenarios investigated the potential exposure to surrounding regions from a 325 m^3 surface release of MDO over one hour to simulate a worst-case vessel collision in three separate locations. The release was run for 30 days to allow for concentrations to decrease below the minimum threshold. The modelling for these scenarios assumed that no mitigation efforts were undertaken to collect or otherwise affect the natural transport and weathering of the oil. The results from each location are described below.

6.3.1.1.1 Surface release of MDO at the Ara location

The results demonstrate that floating oil concentrations ≥1 g/m^2 could extend up to 59 km from the release location, with the distance reducing to 38 km and 15 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2 respectively. The highest probabilities of exposure at concentrations ≥1 g/m^2 are forecast for Rowley Shoals surrounds (0.33%). There was no exposure at the ≥10 g/m^2 and ≥50 g/m^2 thresholds for any environmental value areas (EVAs). The shortest time for floating oil exposure at the ≥1 g/m^2 threshold is predicted at the Rowley Shoals surrounds (submerged receptor) after 60 hours (~2 days, 12 hours) after the commencement of the spill.

The highest probability of shoreline oil accumulation ≥10 g/m^2 threshold was forecast for Imperieuse Reef MP (0.67%), followed by Clerke Reef MP (0.33%). For these two receptors, the minimum time before the shoreline oil accumulation reached or exceeded the ≥10 g/m^2 threshold was 88 hours (~3 days, 16 hours) and 115 hours (~4 days, 18 hours), respectively. It should be noted that the maximum volume of oil accumulation for these two receptors was <1 m^3. No contact was predicted ≥100 g/m^2 at any EVAs.

WA State Waters were predicted to be contacted by dissolved hydrocarbons at a probability of 0.33% at the ≥10 ppb threshold, and a minimum time to exposure of 72 hours (3 days).

Refer to Table 6-3 for a summary of results.

6.3.1.1.2 Surface release of MDO at the Mestrel/Bancroft location

Floating oil concentrations ≥1 g/m^2 could extend up to 41 km from the release location, with the distance reducing to 26 km and 13 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2, respectively. No EVAs were predicted to be exposed to floating oil exposure ≥1 g/m^2.

No shoreline accumulation was observed for this scenario at the ≥10 g/m^2 threshold for any of the 300 simulations modelled and consequently, no results are reported.

No contact with WA State Waters was predicted for floating, entrained or dissolved hydrocarbons.

Refer to Table 6-3 for a summary of results.

6.3.1.1.3 Surface release of MDO at the Curie location

Floating oil concentrations ≥1 g/m^2 could extend up to 78 km from the release location, with the distance reducing to 51 km and 21 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2, respectively. No EVAs were predicted to be exposed to floating oil exposure ≥1 g/m^2.

Imperieuse Reef MP and Clerke Reef MP were the only EVAs to record shoreline contact at the ≥10 g/m^2 threshold, with a probability of 0.33% (1 out of 300 simulations). The minimum time before shoreline oil accumulation for the two receptors was 121 hours (~5 days, 9 hours) and 151 hours (~6 days 7 hours) at the ≥10 g/m^2 threshold, respectively. The maximum volume of oil accumulation was <1 m^3 at both receptors (at concentrations ≥10 g/m^2).

WA State Waters were predicted to be contacted by dissolved hydrocarbons at a probability of 0.33% at the 10 ppb threshold, and a minimum time to exposure of 113 hours (4 days, 17 hours).

Refer to Table 6-3 for a summary of results.

6.3.1.2 LOWC scenarios

The LOWC scenarios investigated the potential exposure to surrounding regions from various volumes of Caley Crude released over 77 days to simulate a LOWC event in three separate locations. Each release scenario was run for a total of 98 days to allow for concentrations to decrease below the minimum threshold following cessation of the well release scenarios. The modelling for these scenarios assumed that no mitigation efforts were undertaken to collect or otherwise affect the natural transport and weathering of the oil. The results from each location are described below. Two of the scenarios are surface release LOWC scenarios (Ara and Mestrel/Bancroft) while one scenario is a subsea release LOWC (Curie). A LOWC scenario for the Wallace OA was not modelled given its location and similar predicted worst case volume to Curie (and hence smaller than Ara and Mestrel/Bancroft).

6.3.1.2.1 Surface release of Caley Crude at the Ara location

A surface LOWC emergency pollution scenario of 6,400,000 bbl (1,017,519 m^3) of Caley crude released over 77 days was modelled from the Ara location. The results demonstrate that floating oil concentrations ≥1 g/m^2 could extend up to 934 km from the release location, with the distance reducing to 286 km and 150 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2 respectively. The highest probabilities of exposure at concentrations ≥1 g/m^2, ≥10 g/m^2 and ≥50 g/m^2 are forecast for Rowley Shoals surrounds (50.66%, 14.67% and 5.33% respectively). The shortest time for oil exposure at the ≥1 g/m^2 threshold is also predicted at Rowley Shoals surrounds at 35 hours (~1 day, 10 hours) after the spill started.

The highest probability of shoreline oil accumulation at the ≥10 g/m^2 threshold was forecast for Imperieuse Reef MP (34.00%), followed by Clerke Reef MP (18.33%). The shortest time before shoreline oil accumulation for the two receptors was 77 hours (~3 days, 5 hours) and 94 hours (~3 days, 22 hours), respectively, at the ≥10 g/m^2 threshold. The maximum volume of oil accumulation was predicted as 643 m^3 at the Imperieuse Reef MP and 506 m^3 along Clerke Reef MP.

WA State Waters were predicted to be contacted by:

- floating hydrocarbons at a probability of 40.33% at the ≥1g/m^2 threshold, and a minimum time to exposure of 61 hours (2 days, 13 hours);
- entrained hydrocarbons at a probability of 46.33% at the 1,000 ppb threshold, and a minimum exposure time of 70 hours (2 days, 22 hours);
- dissolved hydrocarbons at a probability of 55.33% at the ≥10 ppb threshold, and a minimum exposure time of 64 hours (2 days, 16 hours).

Refer to Table 6-4 for a summary of results.

6.3.1.2.2 Surface release of Caley Crude at the Mestrel / Bancroft location

A surface LOWC emergency pollution scenario of 8,600,000 bbl (1,367,291 m^3) of Caley crude released over 77 days was modelled from the Mestrel/Bancroft location. Floating oil concentrations ≥1 g/m^2 could extend up to 1,049 km from the release location, with the distance reducing to 497 km and 165 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2, respectively. The highest probabilities of exposure at concentrations ≥1 g/m^2 are forecast for Glomar Shoals (13.00%), followed by Montebello AMP (11.33%) and Montebello Islands (10.33%). The shortest time for floating oil exposure at the ≥1 g/m^2 threshold is predicted at Glomar Shoals after 166 hours (~6 days 22 hours) following the commencement of the spill. The highest probabilities of exposure at concentrations ≥10 g/m^2 are forecast for Dampier AMP, Dampier Archipelago, Montebello AMP and Ningaloo Offshore (all at 0.33%). The shortest time for floating oil exposure at the ≥10 g/m^2 threshold is predicted at the Montebello AMP after 318 hours (~13 days, 6 hours) following the commencement of the spill. No floating oil at concentrations ≥50 g/m^2 was predicted.

No shoreline oil accumulation was predicted ≥1,000 g/m^2. The highest probability of shoreline oil accumulation at the ≥10 g/m^2 threshold was forecast for Montebello Islands (8.33%), followed by Southern Islands Coast (4.00%). The probability oil accumulation along the Montebello Islands and Southern Islands Coast shorelines reduced to 3.00% and 1.00% as the threshold increased to ≥100 g/m^2. The minimum time before shoreline oil accumulation was predicted for Dampier Archipelago at 302 hours (~12 days 14 hours) at the ≥10 g/m^2 threshold. The maximum volume of oil accumulation for the Southern Islands Coast, Montebello Islands and Dampier Archipelago shorelines was 7 m^3, 7 m^3 and 15 m^3, respectively at the ≥10 g/m^2 threshold (decreasing to 6 m^3, 5 m^3, and 12 m^3, at the ≥100 g/m^2 threshold, respectively).

WA State Waters were predicted to be contacted by:

- floating hydrocarbons at a probability of 10.33% at the ≥1g/m^2 threshold, and a minimum time to exposure of 278 hours (11 days, 14 hours);
- entrained hydrocarbons at a probability of 33% at the 1,000 ppb threshold, and a minimum exposure time of 248 hours (10 days, 8 hours);
- dissolved hydrocarbons at a probability of 43% at the ≥10 ppb threshold, and a minimum exposure time of 248 hours (10 days, 8 hours).

Refer to Table 6-4 for a summary of results.

6.3.1.2.3 Subsea release of Caley Crude at the Curie location

A subsea LOWC emergency pollution scenario of 2,600,000 bbl (413,367 m^3) of Caley crude released over 77 days was modelled from the Curie location. Floating oil concentrations ≥1 g/m^2 could extend up to 673 km from the release location, with the distance decreasing to 210 km and 184 km as the thresholds increase to ≥10 g/m^2 and ≥50 g/m^2, respectively. The highest probabilities of exposure at concentrations ≥1 g/m^2 and ≥10 g/m^2 are forecast for the Rowley Shoals surrounds, at 12.33% and 3.00% respectively. Rowley Shoals surrounds was also the only EVA with exposure recorded at ≥50 g/m^2, with a probability of 0.33%. The same receptor is forecasted to experience the quickest floating oil exposure at the ≥1 g/m^2 threshold, occurring 60 hours (~2.5 days) after the spill began.

The highest probability of shoreline oil accumulation at the ≥10 g/m^2 threshold was forecast for Imperieuse Reef MP at 19.00%, followed by Clerke Reef MP at 10.67%. The probability oil accumulation along the Imperieuse Reef MP and Clerke Reef MP shorelines reduced to 4.67% and 2.00% respectively as the threshold increased ≥100 g/m^2. Imperieuse Reef MP is forecasted to experience the quickest shoreline oil accumulation at 123 hours (~5 days 3 hours) at the ≥10 g/m^2 threshold. The maximum volume of oil accumulation for the same EVA was 266 m^3 (at both the ≥10g/m^2 and ≥100g/m^2 thresholds).

WA State Waters were predicted to be contacted by:

- floating hydrocarbons at a probability of 10.67% at the ≥1g/m^2 threshold, and a minimum time to exposure of 90 hours (3 days, 18 hours);
- entrained hydrocarbons at a probability of 13.33% at the 1,000 ppb threshold, and a minimum exposure time of 162 hours (6 days, 18 hours);
- dissolved hydrocarbons at a probability of 37% at the ≥10 ppb threshold, and a minimum exposure time of 100 hours (4 days, 4 hours).

Refer to Table 6-4 for a summary of results.

Table 6-3: Summary of floating oil exposure and shoreline accumulation above response planning thresholds for a surface release of MDO from a vessel collision in the Ara, Mestrel/Bancroft and Curie operational areas

Receptor Contacted	Probability (%) of floating oil at concentrations ≥1 g/m^2^	Min. time for floating oil at concentrations ≥1 g/m^2 hours (days)^	Probability (%) of floating oil at concentrations ≥50 g/m^2	Min. time for floating oil at concentrations ≥50 g/m^2 hours (days)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m^2^	Min. time for shoreline accumulation at concentrations ≥10 g/m^2 hours (days)^	Maximum accumulated volume (m^3) along this shoreline ≥10 g/m^2^	Max length of shoreline accumulation ≥10 g/m^2^	Probability (%) of shoreline accumulation at concentrations ≥100 g/m^2	Min. time for shoreline accumulation at concentrations ≥100 g/m^2 hours (days)	Maximum accumulated volume (m^3) along this shoreline ≥100 g/m^2	Max length of shoreline accumulation ≥100 g/m^2
Ara operational area												
Rowley Shoals surrounds	0.33	60 (2 days, 12 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clerke Reef MP	NC	NC	NC	NC	0.33	115 (4 days, 19 hours)	<1	2	NC	NC	NC	NC
Imperieuse Reef MP	NC	NC	NC	NC	0.67	88 (3 days, 16 hours)	<1	1	NC	NC	NC	NC
Mestrel/Bancroft operational area												
No receptors predicted to be contacted by floating or accumulated shoreline hydrocarbons at or above the low threshold												
Curie operational area												
Clerke Reef MP	NC	NC	NC	NC	0.33	151 (6 days, 7 hours)	<1	2	NC	NC	NC	NC
Imperieuse Reef MP	NC	NC	NC	NC	0.33	121 (5 days, 1 hour)	<1	1	NC	NC	NC	NC

NC = No Contact

= submerged receptor

^ = *low threshold to inform operational and scientific monitoring response and capability, presented in Section 17 and Appendix N*

Source: RPS, 2025

Table 6-4: Summary of floating oil exposure and shoreline accumulation above response planning thresholds for a surface release of Caley Crude from a LOWC in the Ara, Mestrel/Bancroft and Curie operational areas

Receptor contacted	Probability (%) of floating oil at concentrations ≥1 g/m²^	Min. time for floating oil at concentrations ≥1 g/m² hours (days)^	Probability (%) of floating oil at concentrations ≥50 g/m²	Min. time for floating oil at concentrations ≥50 g/m² hours (days)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²^	Min. time for shoreline accumulation at concentrations ≥10 g/m² hours (days)^	Maximum accumulated volume (m³) along this shoreline at ≥10 g/m²^	Max length of shoreline accumulation at ≥10 g/m²^	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at ≥100 g/m² hours (days)	Maximum accumulated volume (m³) along this shoreline at ≥100 g/m²	Max length of shoreline accumulation at ≥100 g/m²
Ara operational area												
Barrow-Montebello Surrounds	1	351 (14 days, 15 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Barrow Island	0.33	1,805 (75 days, 5 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clerke Reef MP	23.33	61 (2 days, 13 hours)	0.67	259 (10 days, 19 hours)	18.33	94 (3 days, 22 hours)	506	11	13.33	115 (4 days, 19 hours)	506	8
Dampier AMP	1	279 (11 days, 15 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Dampier Archipelago	0.67	304 (12 days, 16 hours)	NC	NC	0.67	318 (13 days, 6 hours)	3	3	0.33	341 (14 days, 5 hours)	2	1
Eighty Mile Beach AMP	0.33	560 (23 days, 8 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Gascoyne AMP	0.33	849 (35 days, 9 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Glomar Shoals	1.33	357 (14 days, 21 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Imperieuse Reef MP	40.33	64 (2 days, 16 hours)	4.67	111 (4 days, 15 hours)	34.00	77 (3 days, 5 hours)	643	19	22.33	113 (4 days, 17 hours)	643	19
Kimberley AMP	1.67	389 (16 days, 5 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Madeleine Shoals	0.67	354 (14 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Mermaid Reef AMP	13.67	84 (3 days, 12 hours)	1.67	292 (12 days, 4 hours)	NC	NC	NC	NC	NC	NC	NC	NC
Montebello AMP	2.33	258 (10 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Montebello Islands	0.67	361 (15 days, 1 hour)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Muiron Islands	0.67	644 (26 hours, 20 hours)	NC	NC	1	779 (32 days, 11 hours)	2	4	NC	NC	NC	NC
Ningaloo – Offshore	5.67	333 (13 days, 21 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer North Coast	0.67	625 (26 days, 1 hour)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer NW	1.33	658 (27 days, 10 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo Coast North	0.33	2,207 (91 days, 23 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Outer Argo-Rowley Terrace AMP	10.67	138 (5 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rankin Bank	4	328 (13 days, 16 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rowley Shoals surrounds	50.66	35 (1 day, 11 hours)	5.33	52 (2 days, 4 hours)	NA	NA	NA	NA	NA	NA	NA	NA
Scott Reef South	0.33	689 (28 days, 17 hours)	NC	NC	0.67	696 (29 days, 0 hours)	11	15	0.33	740 (30 days, 20 hours)	3	1

Receptor contacted	Probability (%) of floating oil at concentrations ≥1 g/m^2^	Min. time for floating oil at concentrations ≥1 g/m^2 hours (days)^	Probability (%) of floating oil at concentrations ≥50 g/m^2	Min. time for floating oil at concentrations ≥50 g/m^2 hours (days)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m^2^	Min. time for shoreline accumulation at concentrations ≥10 g/m^2 hours (days)^	Maximum accumulated volume (m^3) along this shoreline at ≥10 g/m^2^	Max length of shoreline accumulation at ≥10 g/m^2^	Probability (%) of shoreline accumulation at concentrations ≥100 g/m^2	Min. time for shoreline accumulation at concentrations ≥100 g/m^2 hours (days)	Maximum accumulated volume (m^3) along this shoreline at ≥100 g/m^2	Max length of shoreline accumulation at ≥100 g/m^2
Southern Islands Coast	0.33	1,031 (42 days, 23 hours)	NC	NC	0.33	1,570 (65 days, 10 hours)	<1	1	NC	NC	NC	NC
WA State Waters*	40.33	61 (2 days, 13 hours)	4.67	111 (4 days, 15 hours)	NA	NA	NA	NA	NA	NA	NA	NA
Mestrel/Bancroft operational area												
Barrow-Montebello Surrounds	7.67	334 (13 days 22 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Barrow Island	3.33	527 (21 days, 23 hours)	NC	NC	0.67	764 (31 days, 20 hours)	2	3	NC	NC	NC	NC
Bedout Island	0.67	1,138 (47 days, 10 hours)	NC	NC	0.33	1,365 (56 days, 21 hours)	<1	2	NC	NC	NC	NC
Brewis Reef	0.67	971 (40 days, 11 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Cod Bank	0.67	960 (40 days, 0 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Dampier AMP	6.67	232 (9 days, 16 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Dampier Archipelago	4.67	280 (11 days, 16 hours)	NC	NC	2.67	302 (12 days, 14 hours)	15	13	1.00	371 (15 days, 11 hours)	12	3
Eighty Mile Beach AMP	2	291 (12 days, 3 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Exmouth Gulf Coast	0.33	725 (30 days, 5 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Gascoyne AMP	0.67	806 (33 days, 14 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Glomar Shoals	13	166 (6 days, 22 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Imperieuse Reef MP	0.33	1,442 (60 days, 2 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Karratha-Port Hedland	1	364 (15 days, 4 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Kimberley AMP	1.33	717 (29 days, 21 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Lowendal Islands	2.67	486 (20 days, 6 hours)	NC	NC	1.67	677 (28 days, 5 hours)	2	3	0.33	1,514 (63 days, 2 hours)	2	1
Madeleine Shoals	3.33	278 (11 days, 14 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Montebello AMP	11.33	273 (11 days, 9 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Montebello Islands	10.33	342 (14 days, 6 hours)	NC	NC	8.33	353 (14 days, 17 hours)	7	12	3.00	531 (22 days, 3 hours)	5	2
Muiron Islands	4.33	464 (19 days, 6 hours)	NC	NC	2.67	469 (19 days, 13 hours)	3	6	0.33	1,705 (71 days, 1 hour)	2	1
Ningaloo Offshore	4.00	334 (13 days, 22 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer Coast North	1.67	529 (22 days, 1 hour)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer NW	1.33	562 (23 days, 10 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA

Receptor contacted	Probability (%) of floating oil at concentrations ≥1 g/m²^	Min. time for floating oil at concentrations ≥1 g/m² hours (days)^	Probability (%) of floating oil at concentrations ≥50 g/m²	Min. time for floating oil at concentrations ≥50 g/m² hours (days)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²^	Min. time for shoreline accumulation at concentrations ≥10 g/m² hours (days)^	Maximum accumulated volume (m³) along this shoreline at ≥10 g/m²^	Max length of shoreline accumulation at ≥10 g/m²^	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² hours (days)	Maximum accumulated volume (m³) along this shoreline at ≥100 g/m²	Max length of shoreline accumulation at ≥100 g/m²
Ningaloo Coast North	1	653 (27 days, 5 hours)	NC	NC	0.33	1,531 (63 days, 19 hours)	<1	1	NC	NC	NC	NC
Northern Islands Coast	0.67	821 (34 days, 5 hours)	NC	NC	0.33	877 (36 days, 13 hours)	<1	1	NC	NC	NC	NC
Outer Argo-Rowley Terrace AMP	2.33	354 (14 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Penguin Bank	2.67	436 (18 days, 4 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Poivre Reef	1.67	871 (36 days, 7 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Port Hedland-Eighty Mile Beach	0.33	1,177 (49 days, 1 hour)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Rankin Bank	3.33	340 (14 days, 4 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ripple Shoals	0.33	1,304 (54 days, 8 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rosily Shoals	3.67	381 (15 days, 21 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rowley Shoals Surrounds	1	482 (20 days, 2 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Southern Islands Coast	5	372 (15 days, 12 hours)	NC	NC	4.00	407 (16 days, 23 hours)	7	10	1.00	506 (21 days, 2 hours)	6	2
WA State Waters*	10.33	278 (11 days, 14 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Thevenard Islands	2	604 (25 days, 4 hours)	NC	NC	0.33	1,320 (55 days, 0 hours)	<1	2	NC	NC	NC	NC
Trap Reef	1	1,238 (51 days, 14 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Curie operational area												
Barrow-Montebello Surrounds	0.33	326 (13 days, 14 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Clerke Reef MP	4	246 (10 days, 6 hours)	NC	NC	10.67	254 (10 days, 14 hours)	12	7	2.00	255 (10 days, 15 hours)	9	3
Dampier AMP	1.33	100 (4 days, 4 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Dampier Archipelago	0.33	142 (5 days, 22 hours)	NC	NC	0.67	167 (6 days, 23 hours)	2	6	NC	NC	NC	NC
Gascoyne AMP	0.33	1,297 (54 days, 1 hour)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Glomar Shoals	2.67	93 (3 days, 21 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Imperieuse Reef MP	10.67	90 (3 days, 18 hours)	NC	NC	19.00	123 (5 days, 3 hours)	266	11	4.67	213 (8 days, 21 hours)	266	11
Madeleine Shoals	0.33	269 (11 days, 5 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Mermaid Reef AMP	1	329 (13 days, 17 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Montebello AMP	1.67	118 (4 days, 22 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA

Receptor contacted	Probability (%) of floating oil at concentrations ≥1 g/m²^	Min. time for floating oil at concentrations ≥1 g/m² hours (days)^	Probability (%) of floating oil at concentrations ≥50 g/m²	Min. time for floating oil at concentrations ≥50 g/m² hours (days)	Probability (%) of shoreline accumulation at concentrations ≥10 g/m²^	Min. time for shoreline accumulation at concentrations ≥10 g/m² hours (days)^	Maximum accumulated volume (m³) along this shoreline at ≥10 g/m²^	Max length of shoreline accumulation at ≥10 g/m²^	Probability (%) of shoreline accumulation at concentrations ≥100 g/m²	Min. time for shoreline accumulation at concentrations ≥100 g/m² hours (days)	Maximum accumulated volume (m³) along this shoreline at ≥100 g/m²	Max length of shoreline accumulation at ≥100 g/m²
Montebello Islands	1	968 (40 days, 8 hours)	NC	NC	1.67	736 (30 days, 16 hours)	3	6	NC	NC	NC	NC
Muiron Islands	0.33	1,279 (53 days, 7 hours)	NC	NC	2.67	745 (31 days, 1 hour)	2	3	NC	NC	NC	NC
Ningaloo – Offshore	4	356 (14 days, 20 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer Coast North	0.33	905 (37 days, 17 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo – Outer NW	0.33	1,184 (49 days, 8 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Ningaloo Coast North	NC	NC	NC	NC	0.33	1,600 (66 days, 16 hours)	<1	1	NC	NC	NC	NC
Outer Argo-Rowley Terrace AMP	5.33	162 (6 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rankin Bank	1.67	313 (13 days, 1 hour)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Rowley Shoals surrounds	12.33	66 (2 days, 16 hours)	0.33	1,006 (41 days, 22 hours)	NA	NA	NA	NA	NA	NA	NA	NA
Southern Islands Coast	0.33	770 (32 days, 2 hours)	NC	NC	1.33	647 (26 days, 23 hours)	<1	2	NC	NC	NC	NC
WA State Waters*	10.67	90 (3 days, 18 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA
Thevenard Islands	0.33	1,266 (52 days, 18 hours)	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Trap Reef	0.33	1,267 (52 days, 19 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA

NC = No contact

NA = Not applicable

= submerged receptor

= intertidal receptor

^ = low threshold to inform operational and scientific monitoring response and capability, presented in Section 17 and Appendix N

** = Not an EVA defined by Santos*

Source: RPS, 2025

6.3.2 Deterministic modelling results

Deterministic modelling is a useful tool for response planning. It uses a single spill run selected 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 modelling was carried out for the following scenarios:

- Surface loss of well control at the Ara location;
- Subsea loss of well control at the Curie location.

The results of this modelling are described below and presented in Table 6-5.

6.3.2.1 Surface loss of well control at the Ara location

Maximum volume of oil ashore ≥100 g/m^2

A spill simulation commencing during transitional conditions (run 65) commencing on the 23rd April 2016 at 8 am, resulted in the maximum volume of oil ashore ≥100 g/m^2. The maximum volume ashore was 643 m^3, commencing at day 30 and peaking at day 35 at Imperieuse Reef, with a predicted maximum shoreline contact length of 11 km.

WA State waters were predicted to be contacted by:

- floating oil ≥1g/m^2 within 324 hours (13 days, 12 hours);
- entrained hydrocarbons ≥1,000 ppb within 734 hours (30 days, 13 hours);
- dissolved hydrocarbons ≥10 ppb within 730 hours (30 days, 10 hours).

Maximum swept area of floating oil ≥50 g/m^2

A spill simulation commencing during winter conditions (run 99) on the 10th May 2016 at 10am, resulted in the maximum swept area of floating oil ≥50 g/m^2 of 171 km^2. The highest volume of shoreline oil accumulation was 574 m^3 for Imperieuse Reef MP, with a maximum shoreline length of 11 km ≥100 g/m^2.

WA State waters were predicted to be contacted by:

- floating oil ≥1g/m^2 within 143 hours (5 days, 23 hours);
- entrained hydrocarbons ≥1,000 ppb within 218 hours (9 days, 2 hours);
- dissolved hydrocarbons ≥10 ppb within 405 hours (16 days, 21 hours).

6.3.2.2 Subsea loss of well control at the Curie location

Maximum volume of oil ashore ≥100 g/m^2

A spill simulation commencing during winter conditions (run 1) on the 14th May 2016 at 11 am, resulted in the maximum volume of oil ashore ≥100 g/m^2. The maximum volume ashore was 266 m^3, occurring 23 days after the spill commenced on Imperieuse Reef with a predicted maximum shoreline contact length of 11 km.

WA State waters were predicted to be contacted by:

- floating oil ≥1g/m^2 within 517 hours (21 days, 12 hours)'
- dissolved hydrocarbons ≥10 ppb within 254 hours (10 days, 13 hours).

No contact to WA State waters was predicted for entrained hydrocarbons at 1,000 ppb.

Table 6-5: Summary of deterministic modelling results

Receptor contacted	Min. time for floating oil hours (days)			Min. time for shoreline accumulation hours (days)			Maximum local accumulated concentration (g/m^2)	Maximum local accumulated volume m^3			Maximum length of shoreline contacted (km)			Entrained minimum time to receptor waters hours (days)	Maximum entrained hydrocarbon concentration ppb	Dissolved minimum time to receptor waters hours (days)			Maximum dissolved hydrocarbon concentration ppb
	≥1 g/m^2^	≥10 g/m^2	≥50 g/m^2	≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2		≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2	≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2			≥10 ppb^	≥50 ppb	≥400 ppb	
Summary of environmental value areas exposed by the spill simulation (transitional season, run 65) following a surface LOWC at Ara which resulted in the maximum volume of oil ashore ≥100 g/m^2																			
Clerke Reef MP	324 (13 days, 12 hours)	NC	NC	NC	NC	NC	5.3	NC	NC	NC	NC	NC	NC	NC	186	NC	NC	NC	<1
Gascoyne AMP	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	864	1,988 (82 days, 19 hours)	NC	NC	27
Imperieuse Reef MP	594 (24 days, 18 hours)	784 (32 days, 16 hours)	798 (33 days, 6 hours)	654 (27 days, 6 hours)	671 (27 days, 23 hours)	801 (33 days, 9 hours)	13,371	643	643	618	11	11	8	734 (30 days, 13 hours)	2,107	730 (30 days, 10 hours)	737 (30 days, 16 hours)	NC	202
Mermaid Reef AMP	919 (38 days, 6 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	138	NC	NC	NC	3
Montebello AMP	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	513	1,945 (81 days)	NC	NC	23
Ningaloo – Offshore	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,750 (72 days, 22 hours)	1,470	1,704 (71 days)	1,757 (73 days, 5 hours)	NC	169
Outer Argo-Rowley Terrace AMP	1,286 (53 days, 19 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,340 (55 days, 19 hours)	1,331	1,343 (55 days, 23 hours)	NC	NC	27
Rowley Shoals surrounds	172 (7 days, 3 hours)	289 (12 days)	793 (33 days)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	299 (12 days, 11 hours	4,150	272 (11 days, 8 hours)	272 (11 days, 8 hours)	NC	372
State Waters – WA*	324 (13 days, 12 hours)	784 (32 days, 16 hours)	798 (33 days, 6 hours)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	734 (30 days, 13 hours)	2,107	730 (30 days, 10 hours)	737 (30 days, 16 hours)	NC	202
Summary of environmental value areas exposed by the single simulation (winter, run 99) following a surface LOWC at Ara which resulted in the maximum swept area with floating oil ≥50 g/m^2																			
Clerke Reef MP	255 (10 days, 15 hours)	NC	NC	NC	NC	NC	8.6	NC	NC	NC	NC	NC	NC	NC	63	NC	NC	NC	<1
Eighty Mile Beach AMP*	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	220	2,199 (91 days, 15 hours)	NC	NC	20
Gascoyne AMP*	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	593	1,356 (56 days, 12 hours)	NC	NC	24
Imperieuse Reef MP	143 (5 days, 23 hours)	159 (6 days, 15 hours)	170 (7 days, 2 hours)	166 (6 days, 22 hours)	166 (6 days, 22 hours)	179 (7 days, 11 hours)	13,375	574	574	559	11	11	9	218 (9 days, 2 hours)	1,182	405 (16 days, 21 hours)	460 (19 days, 4 hours)	NC	57
Mermaid Reef AMP	628 (26 days, 4 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	117	NC	NC	NC	4
Montebello AMP*	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	437	1,119 (46 days, 15 hours)	NC	NC	15
Ningaloo Offshore*	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,129 (47 days, 1 hour)	1,048	1,093 (45 days, 13 hours)	1,098 (45 days, 18 hours)	NC	75
Outer Argo-Rowley Terrace AMP*	692 (28 days, 20 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	720 (30 days)	1,097	1,519 (63 days, 7 hours)	1,548 (64 days, 12 hours)	NC	94

Receptor contacted	Min. time for floating oil hours (days)			Min. time for shoreline accumulation hours (days)			Maximum local accumulated concentration (g/m^2)	Maximum local accumulated volume m^3			Maximum length of shoreline contacted (km)			Entrained minimum time to receptor waters hours (days)	Maximum entrained hydrocarbon concentration ppb	Dissolved minimum time to receptor waters hours (days)			Maximum dissolved hydrocarbon concentration ppb
	≥1 g/m^2^	≥10 g/m^2	≥50 g/m^2	≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2		≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2	≥10 g/m^2^	≥100 g/m^2	≥1,000 g/m^2			≥10 ppb^	≥50 ppb	≥400 ppb	
Rankin Bank*	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	369	1,073 (44 days, 17 hours)	NC	NC	20
Rowley Shoals Surrounds*	140 (5 days, 20 hours)	144 (6 days)	167 (6 days, 23 hours)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	208 (8 days, 16 hours)	3,831	215 (8 days, 23 hours)	222 (9 days, 6 hours)	NC	206
State Waters WA*	143 (5 days, 23 hours)	159 (6 days, 15 hours)	170 (7 days, 2 hours)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	218 (9 days, 2 hours)	1,182	405 (16 days, 21 hours)	460 (19 days, 4 hours)	NC	57
Summary of environmental value areas exposed by the spill simulation (winter season, run 1) following a subsea LOWC at Curie which resulted in the maximum volume of oil ashore ≥100 g/m^2																			
Clerke Reef MP	NC	NC	NC	403 (16 days, 18 hours)	NC	NC	31	<1	NC	NC	1	NC	NC	NC	94	NC	NC	NC	<1
Dampier AMP	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	243	1,862 (77 days, 13 hours)	NC	NC	35
Dampier Archipelago	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	168	1,996 (83 days, 4 hours)	NC	NC	13
Glomar Shoals	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	188	1,165 (48 days, 12 hours)	NC	NC	17
Imperieuse Reef MP	517 (21 days, 12 hours)	523 (21 days, 18 hours)	NC	530 (22 days, 1 hour)	531 (22 days, 2 hours)	535 (22 days, 6 hours)	3,129	266	266	262	11	11	10	NC	540	254 (10 days, 13 hours)	NC	NC	37
Madeleine Shoals	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	144	2,024 (84 days, 7 hours)	NC	NC	13
Ningaloo – Offshore	NC	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	384	1,201 (50 days)	1,209 (50 days, 9 hours)	NC	91
Outer Argo-Rowley Terrace AMP	411 (17 days, 3 hours)	NC	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	347	754 (31 days, 10 hours)	NC	NC	30
Rowley Shoals surrounds	330 (13 days, 18 hours)	358 (14 days, 22 hours)	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	562 (23 days, 10 hours)	1,033	253 (10 days, 12 hours)	415 (17 days, 6 hours)	NC	120
State Waters – WA*	517 (21 days, 12 hours)	523 (21 days, 18 hours)	NC	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NC	540	254 (10 days, 13 hours)	NC	NC	37

NC = No contact

NA = Not applicable

= submerged receptor

= intertidal receptor

^ = *low threshold to inform operational and scientific monitoring response and capability, presented in Section 17 and Appendix N*

** = Not an EVA defined by Santos*

Source: RPS, 2025

6.4 Evaluation of applicable response strategies

Based on the nature and scale of the credible spill scenarios outlined in Section 6.1 and spill modelling results (Section 6.3) the following spill response strategies have been assessed as potentially applicable for combatting an oil spill (Table 6-6) from the Bedout Multi-well activities.

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

Table 6-6: Evaluation of applicable response strategies

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
Source Control	Ship-board oil pollution emergency plan (SOPEP)	NA	NA	✓1	• MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. • This may include securing fuel via transfer to another storage area onboard the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). • Trimming the vessel may also be used to avoid further damage to intact tanks. • These actions will aim to minimise the volume of fuel spilled.
	Spill kits	NA	NA	✓1	• Relevant for containing spills that may arise onboard a vessel.
	Secondary containment	NA	NA	✓1	• Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment onboard a vessel. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable open deck drainage will be closed to prevent hydrocarbon draining into the marine environment.
	Blowout preventer – emergency activation	✓1	✓1	NA	• A blow-out preventer (BOP) stack will be installed prior to drilling of the reservoir well sections. The purpose of a BOP is to provide a secondary barrier to hydrocarbons by providing a mechanical means of shutting in the well if primary well control is lost, and hydrocarbons enter the wellbore.
	Relief well drilling	✓1	✓1	NA	• Relief well drilling is the primary method for killing a blow-out well.
	Capping stack	NA	✓2	NA	**Jack-up MODU LOWC:** • If a LOWC were to occur from a well during drilling with a jack up MODU, a subsea capping stack response strategy is not applicable given the BOP is at the surface. • Therefore, under a credible loss of well control event there are no connection points for capping stack installation. **Semi-submersible MODU LOWC:**

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					• A capping stack may be a viable option for controlling a subsea well drilled using a semi-submersible drilling rig. A capping stack can be used to divert the flow of hydrocarbons and potentially reduce the release rate of hydrocarbons prior to well kill via a relief well. Capping stack is a secondary response measure with deployment limited to appropriate conditions (e.g., within safe operating limits, safe vertical access) and when operating conditions permit (wind speed, wave height, current and plume radius). • Debris clearance using the Subsea First Response Toolkit (SFRT) would be implemented if required prior to capping stack installation.
	Subsea First Response Toolkit (SFRT)	NA	✓2	NA	**Jack-up MODU LOWC:** • Debris clearance equipment using the Subsea First Response Toolkit (SFRT) not anticipated to be required, as a capping stack or subsea dispersant would not be deployed for this scenario. **Semi-submersible MODU LOWC:** • Debris clearance equipment using the SFRT may be required as a capping stack or subsea dispersant could potentially be deployed for this scenario.
In Situ Burning	Controlled burning of oil spill	✗	✗	✗	• LOWC is not expected to result in a suitable thickness on the surface of Caley crude to allow for ignition and burning; Un-emulsified oil requires a slick thickness of 2–3 mm to initiate and sustain burning (Federici & Mintz, 2014). • In-situ burning is not normally considered as an acceptable response strategy due to the atmospheric emissions created.
Monitor and Evaluate Plan	Vessel surveillance	✓1	✓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.

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					• Limited to visual range from the vessel. • Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance	✓1	✓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	✓1	• Can be implemented rapidly. • Can provide indication of near-surface entrained/dissolved hydrocarbons (most other monitor and evaluate techniques rely on the hydrocarbon being on the surface or shoreline).
	Trajectory Modelling	✓1	✓1	✓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 100% accurate. • Requires in-field calibration.
	Satellite Imagery	✓1	✓1	✓1	• Can work under large range of weather conditions (e.g. night-time, cloud cover, etc.). • Mobilisation restricted to image availability. • Requires processing. • May return false positives.
Subsea dispersant injection (SSDI)	Subsea Dispersant Injection (SSDI)	NA	✓2	NA	**Jack-up MODU LOWC:** • Wellhead and BOP are dry for jack-up wells (surface) and there is no conduit for hydrocarbon flow at the seabed in a LOWC event. • Additionally, SSDI is unlikely to provide any benefit in shallower depths, as there is very limited time in the water column to allow

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					mixing. Shallower water depths also indicate that SSDI is highly unlikely to have any significant effect on VOC reduction at the surface (RPS, 2019). • Given that capping stack application is not considered applicable for the LOWC scenarios associated with the jack-up MODU wells, there is no benefit in SSDI for the purpose of facilitating this strategy for these wells. **Semi-submersible MODU LOWC:** • SSDI is known to reduce VOC levels at the sea surface and is shown to be effective at dispersing condensates when applied subsea (RPS, 2019), potentially making conditions safer for responders and source control personnel. SSDI is shown to reduce surface concentrations of hydrocarbons, thereby potentially reducing the exposure of seabirds and surfacing marine fauna to hydrocarbons. It also disperses hydrocarbons into a larger volume of water, reducing local concentrations and enhancing biodegradation (French McCay *et al*., 2018). • A potential drawback of SSDI is that it will result in smaller droplet sizes and increased entrainment of hydrocarbons into the water column, which may affect some oceanic and benthic organisms (e.g. fish, plankton). However, this is likely to be temporary and restricted to the top ~3 m of the water column whilst SSDI is being used (RPS, 2019). This increase in entrainment is partially offset by significant increases in biodegradation rates. • SSDI is only suitable for subsea LOWC scenarios. Caley Crude is considered a Group 2 oil (light-persistent) hydrocarbon that has high evaporation rates (approx. 48% within the first 12 hrs and an additional 19% in the first 24 hrs – refer to Appendix A). There is some potential for shoreline accumulation from a subsea LOWC and therefore, a minor direct environmental benefit from SSDI may be achieved through encouraging dispersion offshore in the water column, potentially reducing the shoreline impact. SSDI may therefore be employed as a secondary strategy and also if it was necessary to attempt to reduce VOCs in the atmosphere, improving the safety of response personnel working close to the well site (e.g. for BOP intervention and/or deployment of a capping stack).

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					• SSDI may have an overall beneficial environmental benefit by potentially reducing shoreline contact and/or enabling source control personnel improved access to the site through VOC reduction to bring the release under control.
Surface Chemical Dispersant Application	Surface dispersant: vessel application	✓1	✓1	✗	• Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50–100 g/m^2 on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. **MDO** • MDO contains low levels of persistent hydrocarbons and has high natural spreading, dispersion and evaporation rates in the marine environment. Generally, about 4% of the MDO mass should evaporate within the first 12 hours, a further 32% should evaporate within the first 24 hours and an additional 54% should evaporate over several days. The remaining 10% will not evaporate, though will slowly decay over time. • Dispersant use is not advised on light distillate fuels such as MDO as these oils will evaporate and naturally disperse quite rapidly under most conditions (IPIECA-IOGP 2016a). Therefore, considering the rapid evaporation rates of MDO and the tendency to naturally disperse, the addition of chemical dispersants would have little to no net environmental benefit whilst potentially increasing localised toxicity in the water column. **Caley Crude** • Spill modelling of the LOWC scenarios predicted that slicks ≥50 µm, which is typically considered the practical threshold for effective surface dispersant application, may extend for up to 184 km from the release location. Hence chemical dispersant application is a primary response strategy given that surface slick thickness is predicted to be ≥50 µm and over an exposure time that allows surface dispersant application to be implemented.
	Surface dispersant: aerial application	✓1	✓1	✗	
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil	✓1	✓1	✗	• Containment and recovery is not suitable for MDO given its rapid weathering nature and strong tendency to entrain into the upper water column in the presence of moderate winds (i.e. >10 knots). MDO will evaporate and spread quickly to a thin film, making recovery via skimmers difficult and ineffective.

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					• Spill modelling of the LOWC scenarios predicted that slicks ≥50 µm (which is typically considered the lowest threshold for effective containment and recovery), may extend for up to 184 km from the release location. Hence offshore containment and recovery is a secondary response strategy given that surface slick thickness is predicted to be ≥50 µm and over an exposure time that allows for mobilisation and deployment of containment and recovery resources.
Mechanical dispersion	Vessel prop-washing	✓2	✓2	✓2	• Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission may 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. • MDO can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. • Mechanical dispersion may be considered for targeted small breakaway patches of crude but may have limited effectiveness. • The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass ad macroalgae). This is most likely in shallow water of a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave induced entrainment 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 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

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					but support vessels in the field undertaking primary strategies may be used opportunistically.
Protection and deflection	Booming in nearshore waters and at shorelines	✓2	✓2	✓2	• Considered if monitor and evaluate shows or predicts contact with sensitive shorelines. • Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. • Modelling generally shows a low probability of contact with shorelines. **MDO** • Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. Given the high rates of natural dispersion and the high rate of biodegradation of MDO, it would be better to focus on priority areas for protection. This strategy is a secondary response strategy for MDO where it is safe and practical to implement and where priority protection areas are at risk of impact from MDO. **Caley Crude** • In the worst case stochastic scenario, modelling predicts a low probability of shoreline contact at the high floating oil threshold ($\geq$50g/m^2) for Clerke Reef MP and Imperieuse MP. In certain conditions or situations, shoreline protection and deflection may be a suitable strategy to prevent shoreline contact however, would be challenging to implement in remote offshore intertidal reef environments and is therefore considered a secondary response strategy for Caley Crude.
Shoreline clean up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✓1	✓1	✓2	• Intrusive activities such as physical removal of waste using manual labour or mechanical aids requires 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

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
					occur as the hydrocarbon is remobilised from rock shelves and hard substrates, while residual hydrocarbons will biodegrade over time. • Modelling generally shows a low probability of contact with shorelines. **MDO** • Shoreline clean-up activities can result in physical disturbance to shoreline habitats. Given the high rates of natural dispersion and biodegradation of MDO, it would be better to focus on priority areas for protection. This strategy is a secondary response strategy for MDO where it is safe and practical to implement and where protection priority areas are at risk of impacts from MDO. **Caley Crude** • In the worst case stochastic scenario, modelling predicts a low to moderate probability of shoreline accumulation at the moderate threshold (≥100g/m^2) for Clerke Reef MP and Imperieuse MP, with a worst case volume ashore of 643 m^3 at Imperieuse Reef resulting in 19 km of shoreline impacted. Shoreline clean-up is therefore considered a primary response strategy for Caley Crude.
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation	✓1	✓1	✓1	• 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.
Operational and Scientific Monitoring	The monitoring of the effectiveness and potential impacts of response strategies; and the monitoring of environmental receptors to	✓1	✓1	✓1	• Operational monitoring activities include: – hydrocarbon properties and weathering behaviour – water and sediment quality assessment – chemical dispersant effectiveness and fate assessment – rapid marine fauna surveillance

OSR Strategy	Tactic	Applicability and designated primary (1) or secondary (2) response strategy			Considerations
		LOWC (Jack-up MODU) (Caley Crude)	LOWC (Semi-submersible MODU) (Caley Crude)	Vessel collision (MDO)	
	determine the level of impact from the oil spill and associated response activities that is sufficient to inform any remediation activities				– shoreline clean-up assessment • Scientific 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 operational and scientific monitoring will depend upon the nature and scale of oil contact to sensitive receptor locations. Pre-defined initiation criteria exist for operational and scientific monitoring plans.

6.5 Identification of priority protection areas and initial response priorities

Prioritising receptors helps identify where available resources (for response and/or monitoring) should be directed for the best effect. It enables the control agency to make informed decisions, and ultimately in the development and execution of an effective response strategy.

Combined spill modelling results were used to predict the Environment that May be Affected (EMBA) for the Bedout Multi Well Drilling activities (refer to Section 3.1 of the Bedout Multi Well Exploration and Appraisal Drilling EP (7720-650-EMP-0005). The EMBA is the largest area within which effects from hydrocarbon spills associated with this activity, could extend. Within the EMBA, priority protection areas (PPAs) have been identified. Priority protection areas are emergent features (i.e. coastal areas and islands) that are predicted to be contacted above moderate exposure values at greater than 5% probability and would be targeted by nearshore spill response operations such as protection and deflection and shoreline clean-up. Sections 7.5.5.3 and 7.5.5.4 of the Bedout Multi Well Drilling EP (7720-650-EMP-0005) describes the basis for determining hot spots and PPAs. These are further described in EP Sections 7.6 and 7.7 for the LOWC and MDO spill scenarios respectively.

Table 6-7 shows the rationale for the hotspots that were selected as PPAs from the list of contacted receptors for the worst-case spill scenarios for a LOWC (Caley Crude) and surface release of MDO.

The HEV ranking of these receptors are consistent with the rankings in the Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara (Advisian 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 6-8. 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.

Note, the PPAs for response also correspond with the wildlife priority protection areas presented in Section 16.2, with further detail on the species that may be present and key locations provided in Table 16-3.

Table 6-7: Determination and rationale for the protection priority areas

Receptor	HEV Ranking	Hotspot	PPA	PPA Selection Rationale
Barrow-Montebello Surrounds	3	Y	N	Intertidal receptor, low probability of floating oil at ≥1 g/m^2 (7.67%)
Barrow Island	3	Y	N	No shoreline accumulation ≥ 100 g/m^2
Bedout Island	4	Y	N	No shoreline accumulation ≥100 g/m^2)
Clerke Reef MP	3	Y	Y	Large shoreline accumulation predicted – 506 m^3 (≥100 g/m^2)
Dampier Archipelago	3	Y	N	Low probability (1%) of shoreline accumulation ≥100 g/m^2 (12 m^3), 15 days to shoreline accumulation ≥100 g/m^2 and 11 days to floating oil contact ≥1 g/m^2
Gascoyne AMP	3	Y	N	Submerged receptor
Imperieuse Reef MP	3	Y	Y	Large shoreline accumulation predicted – 643 m^3 (≥100 g/m^2)
Lowendal Islands	3	Y	N	Low probability of shoreline accumulation ≥100 g/m^2 (2 m^3)
Mermaid Reef AMP	2	Y	N	Intertidal receptor, low probability of floating oil at ≥1 g/m^2 (13.67%)
Montebello AMP	3	Y	N	Submerged receptor
Montebello Islands	3	Y	N	No shoreline accumulation ≥100 g/m^2
Muiron Islands	2	Y	N	Low probability of shoreline accumulation ≥100 g/m^2 (2 m^3)
Ningaloo – Offshore	2	Y	N	Submerged receptor
Ningaloo - Outer Coast North	1	Y	N	Submerged receptor
Ningaloo - Outer NW	3	Y	N	Submerged receptor

Receptor	HEV Ranking	Hotspot	PPA	PPA Selection Rationale
Ningaloo Coast North	1	Y	N	No shoreline accumulation ≥100 g/m^2
Rowley Shoals surrounds*	3	Y	N	Submerged receptor

= Submerged receptor

= Intertidal receptor

Table 6-8: Initial response priorities for Bedout multi well drilling activities

Protection Priority Area	Key sensitivities	DTMI Ranking (Floating oil)	DTMI Ranking (Dissolved oil)	Key locations	Relevant key periods	Peak volume ashore ≥100 g/m² (m³)	Min. arrival time accumulated oil ashore ≥100 g/m² (hours)	Initial response priority
Clerke Reef MP **(Bedwell Island)**	<u>Turtles</u> Green and hawksbill turtles known to be present – however little nesting activity	2	1	NA	NA	Subsea LOWC: 9 Surface LOWC: 506 Surface MDO: *NC*	Subsea LOWC: 10 days, 15 hours Surface LOWC: 4 days, 19 hours Surface MDO: *NC*	Medium
	<u>Marine mammals</u> Humpback whale migration. Cetacean species including spinner and bottlenose dolphins (*Stenella longirostris*; *Tursiops truncatus*) as well as pilot and false killer whale (*Globicephala melaena*; *Pseudorca crassidens*)	2	1	NA	Humpback whale migration: Jun to Jul			Low
	<u>Birds</u> Bedwell Island is home to the Second largest breeding colony of red-tailed tropicbirds (*Phaethon rubricauda*) (Migratory) in Australia Wide range of seabirds observed.	2	1	Bedwell Island	Nesting: Sept to Feb			Medium
	Coral and other subsea benthic primary producers	3	4	NA	Coral spawning: Mar & Oct			Medium
	<u>Socio-economic</u> Tourism – charter boats, diving and snorkelling Recreational fishing (limited numbers due to distance from coast)	1	1	NA	Tourism: Sep to Dec			Low
Imperieuse Reef MP	<u>Turtles</u> Green and hawksbill turtles known to be present – however little nesting activity	2	1	NA	NA	Subsea LOWC: 266 Surface LOWC: 643	Subsea LOWC: 8 days, 21 hours Surface LOWC: 4 days, 17 hours	Medium
	<u>Marine mammals</u> Humpback whale migration. Cetacean species including	2	1	NA	Humpback whale migration: Jun to Jul			Low

Protection Priority Area	Key sensitivities	DTMI Ranking (Floating oil)	DTMI Ranking (Dissolved oil)	Key locations	Relevant key periods	Peak volume ashore ≥100 g/m^2 (m^3)	Min. arrival time accumulated oil ashore ≥100 g/m^2 (hours)	Initial response priority
	spinner and bottlenose dolphin, pilot and false killer whale.					Surface MDO: *NC*	Surface MDO: *NC*	
	Birds Wide range of nesting / resting seabirds observed	2	1	NA	NA			Medium
	Coral and other subsea benthic primary producers	3	4	NA	Coral spawning: Mar & Oct			Medium
	Socio-economic Tourism - charter boats, diving and snorkelling Recreational fishing (limited numbers due to distance from coast)	1	1	NA	Tourism: Sept to Dec			Low

6.5.1 Tactical response plans for priority protection areas

Santos' Tactical Response Plans (TRPs) are in place for the PPA's (Table 6-9), identifying suitable response strategies, equipment requirements, relevant environmental information, and access and permit requirements. 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 TRP considers the hydrocarbon type and 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 finalise and issue for use. The Sensitivity Ranking (HEV and DTMI), and accessibility (i.e. on mainland compared to a remote island location) are also considered. A TRP will also be considered should the impact from hydrocarbons be considerable (high accumulation, large floating oil contact). Existing Santos TRPs are detailed in Table 6-9. Santos also has access to the INPEX Browse Regional OPEP – Area Response Planning Guideline (document no. X060-AH-GLN-70005) via a collaborative agreement, which provides additional guidance for response at Clerke Reef and Imperieuse Reef within its Rowley Shoals Area Response Plan (Appendix A.6).

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 the DTMI Western Australia Marine Oil Pollution Risk Assessment (WAMOPRA). Additionally, TRPs for contacted receptors will be sought from other titleholders where possible.

Table 6-9: Tactical response plans for priority protection areas

PPA	TRP Evaluation	Existing TRP
Imperieuse Reef MP	Existing TRP in place for Imperieuse Reef MP	Yes
Clerke Reef MP	Existing TRP in place for Clerke Reef MP	Yes

6.6 Net environmental benefit analysis

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

Within Santos's IMT, the Environment Unit Leader is responsible for reviewing the priority receptors identified within the EP and this OPEP and coordinating the Operational NEBA 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, a 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 DTMI, 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 (refer to Table 6-10 and Table 6-11).

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

- Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally).
- Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority (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, a 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 6-10: Strategic net environmental benefit analysis matrix – LOWC release of Caley Crude

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Surface Dispersant	Sub Sea Dispersant Injection	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Imperieuse Reef MP											
Turtle habitat – green, hawksbill											
Coral and other subsea benthic primary producers								NA	NA	NA	
Marine mammals – humpback whale migration								NA	NA		
Seabirds											
Tourism – charter boats, diving, snorkelling, recreational fishing											
Clerke Reef MP											
Turtle habitat – green, hawksbill											
Coral and other subsea benthic primary producers								NA	NA	NA	
Marine mammals – humpback whale migration								NA	NA		
Seabirds – significant breeding for migratory species at Bedwell Island											
Tourism – charter boats, diving, snorkelling, recreational fishing											

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Surface Dispersant	Sub Sea Dispersant Injection	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring

Legend	
	Beneficial impact
	Possible beneficial impact depending on the situation (e.g. time frames and metocean conditions)
	Negative impact
NA	Not applicable for the environmental value or not applicable for hydrocarbon type

Table 6-11: Strategic net environmental benefit analysis matrix –Surface Release of MDO

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Surface Dispersant	Sub Sea Dispersant Injection	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Imperieuse Reef MP											
Turtle habitat – green, hawksbill				NA		NA	NA				
Coral and other subsea benthic primary producers				NA		NA	NA	NA	NA	NA	
Marine mammals – humpback whale migration				NA		NA	NA	NA	NA		
Seabirds				NA		NA	NA				
Tourism – charter boats, diving, snorkelling, recreational fishing				NA		NA	NA				
Clerke Reef MP											
Turtle habitat – green, hawksbill				NA		NA	NA				
Coral and other subsea benthic primary producers				NA		NA	NA	NA	NA	NA	
Marine mammals – humpback whale migration				NA		NA	NA	NA	NA		
Seabirds – significant breeding for migratory species at Bedwell Island				NA		NA	NA				
Tourism – charter boats, diving, snorkelling, recreational fishing				NA		NA	NA				

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Surface Dispersant	Sub Sea Dispersant Injection	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring

Legend	
(green)	Beneficial impact
(amber)	Possible beneficial impact depending on the situation (e.g. time frames and metocean conditions)
(red)	Negative impact
NA	Not applicable for the environmental value or not applicable for hydrocarbon type

6.7 Oil spill response ALARP assessment

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

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

7. External notifications and reporting requirements

For oil spill incidents, the Emergency Commander / Vessel Master will notify the Perth-based IMT for delegation of further notifications to relevant regulatory authorities and stakeholders, and for further spill response assistance for Level 2/3 spills.

7.1 Regulatory notification and reporting

The Incident Commander (IC) is to delegate the following regulatory reporting requirements. The typical delegated party will be the Planning Section Chief.

Contact details for the regulatory agencies outlined in Table 7-1 are provided within the Incident Response Telephone Directory (7700-670-PLA-0016.20).

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 on-site resources as well as larger Level 2/3 spills. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA Rescue Coordination Centre (RCC) and WA DTMI (MEER Unit).

In the event of a Level 2 or 3 spill event, Santos will review the relevant persons identification process described in Section 4.2 of the Bedout Multi Well Drilling EP (7720-650-EMP-0005). Relevant persons, whose functions, interests or activities that may be affected by the spill event or response arrangements will be identified and engaged in accordance with the Santos incident management process, noting notification and communications requests made by Relevant Persons during EP consultation with respect to emergency situations.

The Incident Response Telephone Directory (7700-670-PLA-0016.20) contains a more detailed list and contact information for ER support and is updated every six months with up-to-date revisions available within the IMT room and online (intranet procedures and ER pages).

7.2 Activation of external oil spill response organisations and support agencies

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

7.3 Environmental performance

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

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

Agency/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 OPGGS(E)R 2023	A spill associated with the activity in Commonwealth waters that has the potential to cause moderate to significant environmental damage.[1]	Notification by Planning Section Chief (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
National Offshore Petroleum Titles Administrator (NOPTA) (Titles Administrator)	Written report to NOPTA within seven days of the initial report being submitted to NOPSEMA.	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA.	Notification by Planning Section Chief (or delegate)	Provide same written report as provided to NOPSEMA.
AMSA RCC[2]	Verbal notification immediately following the event. Written POLREP form, within 24 hours on request from AMSA.	MARPOL	Santos to notify AMSA of any marine pollution incident.[1]	Notification by Planning Section Chief (or delegate)	https://www.amsa.gov.au/forms/harmful-substances-report-polrep-oil
Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) (Director of Monitoring and Audit Section)	Email notification as soon as practicable.	*Environment Protection and Biodiversity Conservation Act 1999*	If Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, or where there is death or injury to a protected species.	Notification by Planning Section Chief (or delegate)	Not applicable
Parks Australia (24-hour Marine Compliance Duty Officer)	Verbal notification as soon as practicable.	*Environment Protection and Biodiversity Conservation Act 1999*	An oil spill which occurs within a marine park or is likely to impact on an Australian Marine Park.	Notification by Planning Section Chief (or delegate)	Not applicable, but the following information should be provided: Titleholder's details. Time and location of the incident (including name of marine park likely to be affected). Proposed response arrangements as per the OPEP. Confirmation of providing access to relevant monitoring and evaluation reports when available.

Santos

Agency/Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
					Details of the relevant contact person in the IMT.
Australian Fisheries Management Authority (AFMA)	Verbal phone call notification within 24 hours of incident.	For consistency with Department of Primary Industry and Regional Development (DPIRD) Fisheries notification	Reporting of marine oil pollution.1 Fisheries within the EMBA. Consider a courtesy call if not in exposure zone.	Notification by Planning Section Chief (or delegate)	Not applicable
If Spill is Heading Towards WA Waters					
Department of Mines, Petroleum and Exploration (DMPE) (Petroleum Environment Duty Officer)	Verbal phone call within two hours of incident being identified. Follow up written notification within three days.	Regulations 28, 29 and 30 of the Petroleum (Submerged Lands) (Environment) Regulations 2012 Guidance Note on Environmental Non-compliance and Incident Reporting	All actual or impending spills in State waters.	Notification by Planning Section Chief (or delegate)	Environmental and Reportable Incident/Non-compliance Reporting Form: http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx
WA DTMI[2] (MEER Duty Officer)	Verbal notification within two hours. Follow up with Pollution Report (Appendix C) as soon as practicable after verbal notification. If requested, submit Situation Report (Appendix D) within 24 hours of request.	*Emergency Management Act 2005* SHP-MEE Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos to notify of actual or impending MOP incidents 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 or injury to a person or damage to the health of a person, property or the environment.[1]	Notification by Planning Section Chief (or delegate) MEER Duty Officer (contacted as per Incident Telephone Directory)	WA DTMI POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DTMI SITREP (Appendix D): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
DBCA (State Duty Officer and Pilbara Regional Office)	Verbal notification as soon as reasonably practicable.	WAOWRP	Santos to notify DBCA of any marine pollution incident.[1] Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the OWA).	Notification by Planning Section Chief (or delegate)	Not applicable

Agency/Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Primary Industry and Regional Development (DPIRD) Fisheries	Verbal phone call notification to DTMI Maritime Environmental Emergencies phone line, and by Email to DPIRD within 24 hours of incident.	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution.[1] Notify if spill has the potential to impact or has impacted fisheries in State waters.	Notification by Planning Section Chief (or delegate)	Not applicable
Department of Water and Environmental Regulation (DWER)	Initial verbal or electronic notification of the discharge as soon as practicable. Written notification of the incident to the CEO of the DWER, copied to the local DWER Industry Regulation Office, as soon as practicable.	Environmental Protection Act 1986 (Section 72) Environmental Protection (Unauthorised Discharge) Regulations 2004	Call DWER 24-hour Pollution Watch Hotline. Environmental Protection Act 1986: Spill or discharge of hydrocarbons to the environment that has caused, or is likely to cause pollution, or material or serious environmental harm (Level 2/3 spills). Environmental Protection (Unauthorised Discharge) Regulations 2004: Unauthorised discharge (where there is potential for significant impact or public interest) to the environment of Schedule 1 material.	Notification by Planning Section Chief (or delegate)	Reporting requirements: https://www.wa.gov.au/service/environment/pollutant-prevention/pollution-watch
Port of Dampier / Port of Ashburton	Verbal notification immediately to Harbour Master via Dampier / Ashburton VTS. Call to The Emergency Tower mobile POLREP to WA DTMI	*Port Authorities Act 1999* Pilbara Ports Authority, Port of Dampier Handbook or Port of Ashburton Handbook	For all spills within Port of Dampier or Port of Ashburton port limits	Notification by Planning Section Chief (or delegate)	WA DTMI POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf
Port of Varanus Island (VI) (Pilbara Ports Authority)	Verbal notification within 4 hours to Harbour Master via VI Port Control. Follow up report within 48 hours through the Pilbara Port	*Port Authorities Act 1999* Pilbara Ports Authority Port of VI Handbook	For all spills within Port of VI limits	Notification by Planning Section Chief (or delegate)	WA DTMI POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf

Agency/Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
	Authority Hazard and Incident Reporting Form: https://www.pilbaraports.com.au/safety-and-security/hazard-and-incident-reporting Follow up with POLREP as soon as practicable after verbal notification				
Varanus Island Contaminated Sites Auditor	Initial verbal or electronic notification followed by a report if confirmed contamination.	*WA Contaminated Sites Act 2003*	Applies if there is shoreline contact that could cause land contamination.	Notification by Planning Section Chief (or delegate)	Not applicable
Barrow Island Port Authority	Verbal notification within 4 hours. POLREP to WA DTMI.	*Shipping and Pilotage Act 1967* Barrow Island Port Information Manual	If spill EMBA is heading towards / reaches Barrow Island Port Authority limits	Notification by Planning Section Chief (or delegate).	WA DTMI POLREP (Appendix C): https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf
If Spill is Heading Towards International Waters					
DFAT (24-hour consular emergency centre)	Verbal phone call notification within 8 hours if the spill is likely to extend into international waters. Follow up with email outlining details of incident.	NP–GUI–007: National Plan Coordination of International Incidents: Notification Arrangements Guidance (AMSA, 2017b)	Notify DFAT that a spill has occurred and is likely to extend into international waters. Inform DFAT of the measures being undertaken to manage the spill. NOPSEMA, DISR and DFAT will form an inter-agency panel; the Australian Government Control Crisis Centre.	Notification by Planning Section Chief (or delegate)	Not applicable
Stakeholders (including Relevant Persons)					
Care for Hedland	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable
Kariyarra Aboriginal Corporation	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable

Agency/Authority	Type of Notification/Timing	Legislation/Guidance	Reporting Requirements	Responsible Person/Group	Forms
Murujuga Aboriginal Corporation	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable
Ngarluma Aboriginal Corporation	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable
Nhuwala Claim Group	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable
Wirrawandi Aboriginal Corporation	As soon as practicable. Oral or written notification.	As per consultation feedback	Notification of a spill event that may contact their area of interest	Notification by Planning Section Chief (or delegate)	Not applicable
Western Australian Fishing Industry Council (WAFIC) and WA commercial fisheries	Phone call within 24 hours of incident being identified with potential impact to the WA commercial fisheries. Follow up with email where available.	As per consultation with WAFIC	Should impact be expected to WA commercial fisheries	Notification by Planning Section Chief (or delegate)	Not applicable

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

2: Santos reporting requirements only listed. For oil spills from vessels, Vessel Masters also have obligations to report spills from their vessels to AMSA RCC for spills in Commonwealth waters and to WA DTMI MEER in State waters.

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 Duty Officer	As soon as possible but within two hours of incident having been identified.	Verbal Service Contract	Santos is a Participating Member of AMOSC and can call upon AMOSC personnel and equipment (including for 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, shoreline clean-up, oiled wildlife and communications equipment. Equipment is located in Geelong, Fremantle, Exmouth and Broome.	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC. **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required. Activate if spill response escalates in order to mobilise spill response resources consistent with the AMOSPlan. **Step 3.** Email confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment. Only a Santos call-out authority (registered with AMOSC) can activate AMOSC and will be required to supply their credentials to AMOSC. A signed contract note must also be completed by the Santos call-out authority and returned to AMOSC before mobilisation.	Planning Section Chief (or delegate) will notify AMOSC (upon approval from Incident Commander)
Aviation Service Provider	Within two hours of incident having been identified.	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	Phone call	Logistics Section Chief (or delegate)
Duty Officers/ Incident Commanders (Woodside, Chevron, Jadestone)	Within two hours of incident having been identified.	Verbal	Mutual aid resources (through AMOSC mutual aid arrangement).	Phone call	Incident Commander (or delegate)
Exmouth Freight and Logistics	Within two hours of incident having been identified.	Verbal	Assistance with mobilising equipment and loading vessels.	Phone call	Logistics Section Chief (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	OM1: Hydrocarbon Characterisation is activated (Section 17)	Verbal	Oil analysis including gas chromatography/mass spectrometry fingerprinting.	Phone call	Planning Section Chief (or delegate)

Organisation	Indicative timeframe	Type of communication	Resources available	Activation instructions	Santos person responsible for activating
OSM Services Provider	Operational and Scientific Monitoring Plan initiation criteria are met (Tables 9-1 and 9-2 of the Joint Industry OSM Framework [APPEA, 2021])	Verbal and written	Santos is a member of OSRL's OSM Services Supplementary Agreement, providing access to personnel and equipment for operational and scientific monitoring	**Refer North West Shelf OSM-BIP (7715-650-ERP-0002) Part B for full activation instructions** **Step 1.** Obtain approval from Incident Commander to activate OSM Services Provider **Step 2.** Verbally notify OSM Services Provider followed by the submission of the Call Off Order Form **Step 3.** OSM Service Provider commences activation process.	Environment Unit Leader (or delegate)
Waste Service Provider	As required for offshore and shoreline clean-up activities.	Verbal	Santos has contract arrangements in place with a waste service provider to take on the overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	Logistics Section Chief (or delegate)
OSRL Duty Manager	Within two hours of incident having been identified.	Verbal OSRL Mobilisation Authorisation Form	Santos has an SLA 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. **Step 4.** Mobilisation of personnel (beyond 5 technical advisors x 5 days) and equipment requires signed mobilisation form by designated call-out authorities.	Designated call-out authorities (including Incident Commanders)
The Response Group	As soon as possible but within two hours of incident having been identified.	Verbal and written	Santos has arrangements with TRG for the provision of trained field response personnel.	Contact TRG Duty Officer.	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	Contact RPS Group Duty Officer.	Planning Section Chief (or delegate)

Organisation	Indicative timeframe	Type of communication	Resources available	Activation instructions	Santos person responsible for activating
			any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group.		
Wild Well Control Inc.	Within four hours of a LOWC incident having been identified.	LOWC only Verbal	Well intervention services. Under contract.	As per Source Control Planning and Response Guideline (DR-00-OZ-20001): **Step 1.** Following Santos management confirmation of a LOWC, the Santos IMT Drilling Representative is to call the Wild Well Control 24-hour emergency hotline number to notify Wild Well Control of the incident. **Step 2.** As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form must be filled out, signed off by the authorised Santos Manager and sent through to Wild Well Control. Obtain the most current emergency mobilisation form from the Wild Well Control emergency hotline attendant. The form shall be submitted as directed by Wild Well Control, as advised by the emergency hotline attendant.	Drilling Representative

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 [EPS-ID]**	**Measurement criteria**
External Notifications and Reporting Plan	**Response preparedness**		
	Santos Incident Response Telephone Directory (7700-670-PLA-0016.20)	[EPS-RP-001] Incident Response Telephone Directory is revised every six months.	Incident Response Telephone Directory; Document revision history.
	OPEP communications test	[EPS-RP-002] OPEP contact details for regulatory and service provider notifications are checked annually.	OPEP communications test records
	Response implementation		
	External notifications and reporting tables	[EPS-RP-003] External notification and reporting undertaken as per Table 7-1 and Table 7-2.	Incident log

8. Incident action planning

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

1. Understand the situation.
2. Establish incident priorities, objectives and tasks.
3. Develop an IAP.
4. Prepare and disseminate the IAP.
5. Execute, evaluate and revise the IAP 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 ER 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 ER.

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

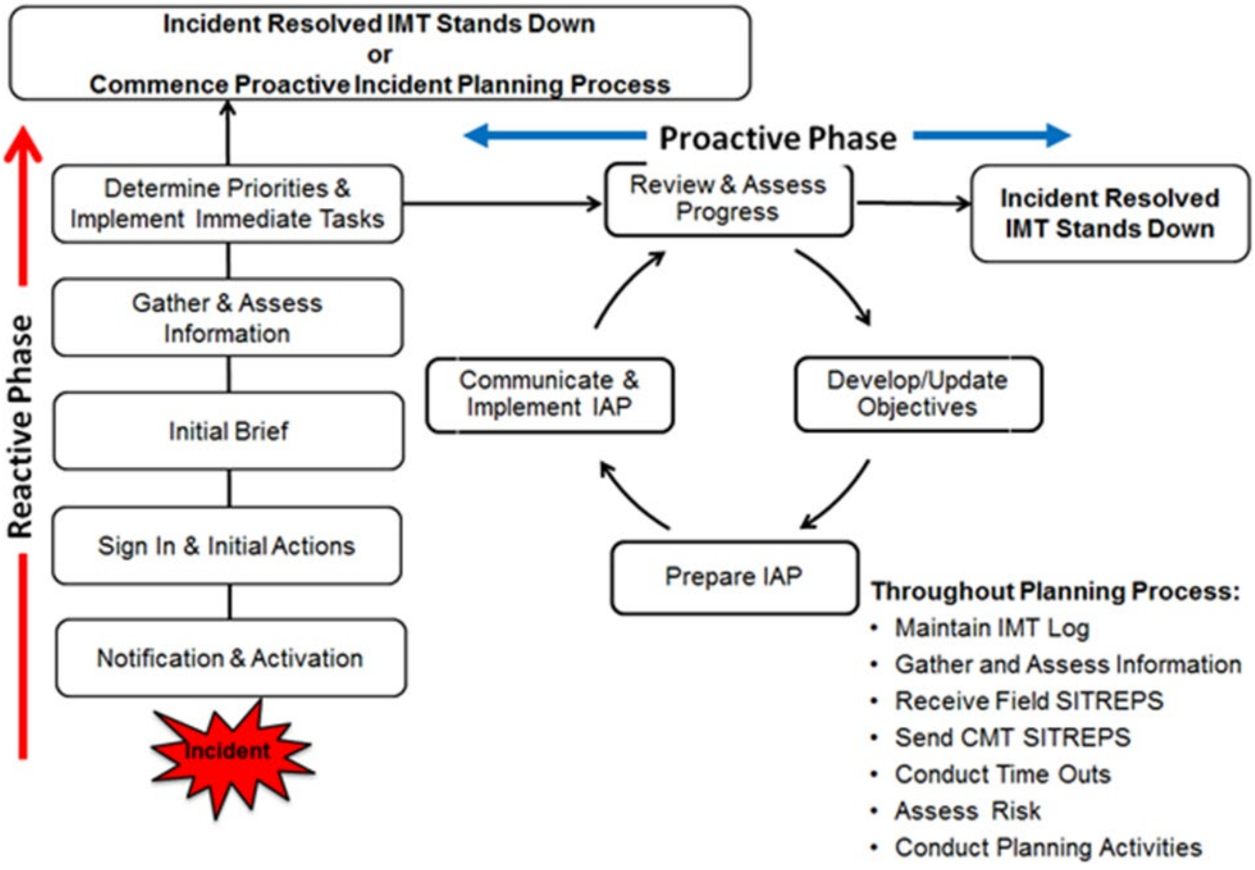

Figure 8-1: IAP process

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 IAP to follow (given the incident has just begun and details are still being established), however this OPEP 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 Table 2-1 and provide links to relevant oil spill strategy sections within the OPEP. These sections contain a more detailed list of implementation actions and considerations as well as performance standards that must be followed to ensure the initial response meets regulatory requirements and environmental performance outcomes.

For each credible oil spill scenario covered by this OPEP, the first-strike response actions have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic NEBA (also referred to as a SIMA). 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 ER.

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 ER 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 ER 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 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 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 (e.g. surveillance personnel, team leaders, laboratory chemists) who report on the effectiveness of the response strategies both verbally and through logs/reports/photos sent throughout the response.

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

8.3 Environmental performance

Table 8-1 lists the environmental performance outcome, control measures, 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 [EPS-ID]**	**Measurement criteria**
Incident action planning	**Response preparedness**		
	IMT Exercise and Training Plan	[EPS-RP-005] Incident action planning and NEBA is practiced by the IMT during exercises.	Exercise records
	Response implementation		
	IAP	[EPS-RP-006] IAP is completed for each operational period and approved by the Incident Commander.	Incident log; IAP/s.
		[EPS-RP-007] Monitor effectiveness of response strategies being implemented and use information in the development of IAPs.	Incident log; IAP/s.
	NEBA	[EPS-RP-008] An Operational NEBA will be undertaken for each operational period of the incident.	NEBA; IAP.

Environmental performance outcome	Manage incident via a systematic planning process		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
	IMT activation and de-escalation	[EPS-RP-009] IMT will be activated immediately once notified of a Level 2/3 spill (to Incident Commander).	IAP
		[EPS-RP-010] The decision to de-escalate the IMT will be made in consultation with the relevant Control Agency/s, Jurisdictional Authorities and other Statutory Authorities that play an advisory role.	NEBA; IAP.
	TRPs	[EPS-RP-011] If monitor and evaluate shows that shoreline contact of PPAs is likely, TRPs will be developed or sought from other titleholders/ regional industries prior to shoreline contact.	TRP

9. Source control

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

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

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

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

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

9.1 Vessel collision – fuel tank rupture

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

Table 9-1: Source control (vessel collision) 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**	**Caley Crude**
	✓1	✗
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 that MDO is released from a vessel due to a tank rupture, the relevant vessel-specific procedures will be applied. For support vessel collisions, the vessel's SOPEP will be followed to control the source, reduce the loss of hydrocarbons and prevent escalation of the incident. Table 9-9 lists the environmental performance standards and measurement criteria for this strategy.

Table 9-2: Implementation guidance – fuel tank rupture

Action		Consideration	Responsibility	Complete
Initial actions	The vessel's SOPEP, as applicable under MARPOL, or procedure for responding to a ruptured tank will be followed, as applicable.	Notwithstanding vessel-specific procedures for source control, the following activities would be evaluated immediately for implementation, providing it is safe to do so: • Reduce the head of fuel by dropping or pumping the tank contents into an empty or slack tank. • Consider pumping water into the leaking tank to create a water cushion to prevent further fuel inventory loss. • If the affected tank is not easily identified, reduce the level of fuel in the tanks in the vicinity of the suspected area so that the stability of the vessel will not be compromised.	Vessel Master	☐

Action		Consideration	Responsibility	Complete
		• 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 the hole or rupture.		

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 LOWC.

Table 9-3: Source control (LOWC) 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**	**Caley Crude**
	✗	✓1
Termination criteria	• The primary well is contained and killed to prevent any further release of hydrocarbon to the environment.	

9.2.1 Surface LOWC

9.2.1.1 Relief well drilling

Relief well drilling is the primary source control strategy to control a surface LOWC involving a jack-up MODU. The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

9.2.1.2 Relief well planning

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

- SPE Technical Report 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 (SCP).
- Offshore Energies UK (OEUK) (2024), Relief Well Planning for Offshore Wells Guideline, Issue 3, July 2024: This methodology is used to confirm a well complexity analysis and tailor required content for the well-specific SCP to the appropriate level of detail.

For each drilling campaign, a SCP will be developed to address the well specific requirements. A well specific SCP may be prepared for individual well activities or for multiple well activities where there is appropriate commonality between the activities (i.e. similar well designs). The SCP is a Santos controlled document and is encompassed in the Well Operations Management Plan (WOMP). The SCP will contain relief well planning information, specifically:

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

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

To ensure Santos has current MODU availability, Santos maintains a register of MODU activity within the region and reviews this on a monthly basis and updates if required (i.e. if MODUs enter or depart the region). The MODU capability register includes information about:

- MODU name;
- MODU contract status (operator and contract duration);
- current location;
- water depth capability range;
- MODU 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. diesel, base-oil, brine, drill-water, potable water, bulks);
- NOPSEMA safety case (yes/no).

The SCP includes a review of the most recent MODU capability register to identify the most suitable MODU for the well. In the event a suitable MODU is not in Australian waters, or is not predicted to be in Australian waters at the time of the activity, further work will be completed to identify a regionally suitable MODU, along with a mobilisation plan that demonstrates construction of a relief well within the timeframe outlined in Table 9-6. Once a MODU is allocated as a potential relief well MODU for a project, the MODU capability register will be annotated as such. As such, any change to the register on a month-to-month basis that affects a preferred MODU may trigger a revision if the capability of the MODU is materially different from that which was previously modelled in the SCP. The revision will be completed within 4 weeks of identifying the change.

Santos commits to reviewing the SCP assumptions for relief well MODU availability and verifying that a suitable relief well MODU is either in Australian waters, or there is a suitably robust plan in place to mobilise one outside of Australia. If a capable relief well MODU/s becomes unavailable during the activity, work will commence (if required) on an update to the SCP to identify a suitable replacement relief well MODU regionally along with any required pre-work (contracting/logistics plans etc).

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

A Safety Case Revision will be required for the relief well MODU to undertake the activity and 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 is to be submitted within 14 days from the well incident, however the critical path time allowed for the preparation 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 Jack-up relief well schedule

An indicative relief well drilling schedule for a jack-up MODU is provided in Table 9-4. This is based on control of a blow-out well by 11 weeks (77 days). This period is used as a base case well control timeframe by Santos based on indicative mobilisation durations, relief well planning and operations. It could take up to 43 days to have a MODU on location ready to spud. Long lead item equipment to enable a relief well to be drilled within the 77 day 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 initiative 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 jack-up MODU arriving on location and relief well operations

Task	Duration (days)	Controls
Surface LOWC (jack-up rig)		
• Event reported • Begin sourcing of rig for relief well drilling operations • Concurrently, stand up relief well drilling team and activate relief well specialists	3	• On-site communications • Active IMT on call including Operations Section Chief/Relief Well Operations Lead • Stand-up relief well team (as per Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialist services contract (Wild Well Control) • Regional MODU tracking • APPEA MoU: Mutual Assistance
• Relief well MODU confirmed. 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 (SCR) and submit to NOPSMEA • Concurrently, prepare relief well design and dynamic kill plan. Prepare relief well Well Operations Management Plan (WOMP) and submit to NOPSEMA	12	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (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 • Access relief well long lead equipment from inventory or other operators (e.g. casing and wellhead) • Drilling services contracted
• Contract relief well MODU • Concurrently, continue preparations for rig mobilisation • Concurrently, NOPSMEA assessment of relief well MODU SCR and relief well WOMP • Mobilise relief well MODU to location.	28	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (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	**43**	
• Drill and construct relief well and complete dynamic well kill operations	34	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Relief Well Drilling specialist services contract (Wild Well Control)
Total days from LOWC to well kill	**77**	

9.2.1.4 Emergency Surface BOP activation

As part of the drilling activities, a blow-out preventor (BOP) stack will be installed at the surface on the jack-up MODU, 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.

BOP 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 surface BOP activation procedures to immediately shut in the well. The relevant BOP rams will be activated via the BOP control panel located in the drill shack. There is an additional BOP control panel located remote to the drill shack. 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 / tubulars;

- 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 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, it cannot be opened without further hydraulic intervention. Well pressure acts to hold the ram closed. BOP shear rams often have a secondary lock to further ensure the well remains shut in.

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

9.2.1.5 Implementation guidance

Implementation guidance for relief well drilling is summarised in Table 9-5.

Table 9-5: Implementation guidance – relief well drilling

Action		Responsibility	Complete
Initial actions	Relief well		
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Relief Well Operations Lead	☐
	Notify Santos Drilling and Completions Team to assemble a Source Control Branch and immediately begin preparations.	Relief Well Operations Lead	☐
	Notify well control service provider personnel for mobilisation.	Relief Well Operations Lead and Source Control Branch Director	☐
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MoU.	Source Control Branch Director	☐
	Refine, as necessary, the relief well pre-planned work described in Section 9.2.2 to reflect the actual depths and asses the suitability of well locations.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief Source Control Branch Director	☐
	Deploy equipment and personnel to site to begin operations.	Relief Well Operations Lead	☐
Ongoing actions	Relief well		
	Design Relief Well, using relief well pre-planning work.	Source Control Branch Director	☐
	Assess relief well equipment and personnel requirements. Procure and make ready.	Logistics Section Chief	☐
	Deploy equipment and personnel to site to begin operations.	Relief Well Operations Lead	☐
	Monitor progress of relief well drilling and communicate to IMT.	Relief Well Operations Lead	☐

9.2.2 Subsea LOWC

9.2.2.1 Relief well drilling

Relief well drilling is the primary source control strategy to control a subsea LOWC involving a semi-submersible MODU. The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

9.2.2.2 Relief well planning

Relief well planning for a subsea LOWC is the same as described for the surface LOWC in Section 9.2.1.2 with the exception of the relief well schedule. The relief well schedule that applies to a subsea LOWC is described in Table 9-6.

9.2.2.3 Semi-Submersible relief well schedule

An indicative relief well drilling schedule for a semi-submersible MODU is provided in Table 9-6. This is based on control of the well by 77 days. This period is used as a base case well control timeframe by Santos based on indicative mobilisation durations, relief well planning and operations. It could take up to 19 days to have a relief well MODU onsite ready to spud. Long lead item equipment to enable a relief well to be drilled within this timeframe is held in the Santos inventory or 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 SCRI Working Group (as explained in Section 9.2.1.3).

Table 9-6: Schedule for semi-submersible MODU arriving on location and relief well operations

Task	Duration (days)	Controls
LOWC relief well		
• Event reported. • Begin sourcing of rig for relief well drilling operations. • Concurrently, Stand-Up Relief Well Drilling Team and activate relief well specialists.	3	• On-site communications. • Active IMT on call including Operations Section Chief/Relief Well Operations Lead. • Stand-up Relief Well Team (as per Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001). • Relief well drilling specialist services contract (Wild Well Control). • Regional MODU tracking. • APPEA MoU: Mutual Assistance.
• Relief well MODU confirmed. Relief well MODU suspends operations and prepares to mobilise to the relief well location. • Demobilisation of equipment from previous operator. • Concurrently, prepare relief well MODU SCR and submit to NOPSEMA. • Concurrently, prepare relief well design and dynamic kill plan. Prepare WOMP and submit to NOPSEMA.	13	• Active IMT. • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001). • Pre-completed well specific SCP complete with relief well study. • Relief well drilling specialist services contract (Wild Well Control). • Regional MODU tracking. • APPEA MoU: Mutual Assistance. • Access relief well long lead equipment from inventory or other operators (e.g. casing and wellhead). • Drilling services contracted.
• 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.	28	• Active IMT. • Santos Offshore Source Control Planning and Response Guideline (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.	**44**	
• Drill and construct relief well and complete dynamic well kill operations.	33	• Active IMT. • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001). • Relief well drilling specialist services contract (Wild Well Control).
Total days from notification of LOWC to well kill	**77**	

9.2.2.4 Emergency subsea BOP activation

As part of the Bedout multi well drilling activity, a BOP stack will be installed subsea for wells drilled using a semi-submersible MODU, in accordance with API Standard 53 (API, 2018).

BOP Manual Activation

Manual activation of a subsea BOP is as described above in Section 9.2.1.4. There are however additional relevant items to note for a subsea BOP system as detailed below.

BOP Automatic Activation

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

MODU Emergency Disconnect

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

Failure Intervention

In the unlikely event that attempts to activate the subsea BOP from the MODU have failed, and/or the fail-safe close operation of the BOP has malfunctioned, the BOP can be closed via remotely operated vehicle (ROV) hot-stab intervention. Either the ROV on the MODU or an ROV from a separate support vessel can actuate the BOP in this manner.

ROV deployment would commence as soon as practicable from the MODU if safe to do so. If an ROV was to be deployed from a support vessel, the IMT would immediately seek to source an ROV and suitable vessel to mobilise to the field and deploy the intervention ROV as soon as practicable. ROV operations would commence to navigate the ROV to the BOP and activate the BOP rams via a hydraulic hot-stab connection on the BOP side panel. This would serve to add hydraulic pressure to the BOP circuit from either the ROV pumps or an external hydraulic source, to enable manual close of the BOP rams to seal the well.

9.2.2.5 Capping stack

A capping stack can provide a temporary means of sealing the well until a permanent well kill can be performed. It is considered a secondary source control measure.

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

The installation of a capping stack may be applicable for a subsea loss of well control during drilling activities using a semi-submersible MODU where the BOP is present on the seabed. The use of the SFRT may also be applicable in assisting the installation of the capping stack.

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

The deployment vessel will need to meet the following criteria:

- require an active heave compensator, capability of lifting minimum of 120 Tonnes capping stack under dynamic conditions at maximum (mudline) depth (250 tonne rating preferred [OSRL, 2021d]);
- 500–1,000 m^2 of deck space;
- located within a 4-day sail radius of Singapore.

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

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

Case status. As an adaptive management measure and performed as part of the DCMP Assurance Review, Santos commits to verifying that a suitable deployment vessel is located in the region and can meet the criteria defined above. This review will occur monthly. In the event a suitable vessel is not located in the region, work will commence to identify a suitable vessel further afield, along with identifying any pre-work (contracting/logistics plans etc.) that might be needed to mobilise a vessel from further afield.

Santos has in place a contract with a specialist contractor highly experienced in the Safety Case revision process, to leverage their experience, reducing the timeframes required to develop a Safety Case revision that meets NOPSEMA's requirements.

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

9.2.2.5.1 Capping stack schedule

An indicative capping stack schedule is provided in Table 9-7. This period is passed on indicative mobilisation durations and is subject to weather conditions and availability of specialist personnel.

Table 9-7: Capping stack mobilisation schedule

LOWC capping stack timeline		
Task	**Duration (days)**	**Controls**
Event reported – source suitable deployment vessel (with approved safety case) (Santos) Concurrently deploy Capping Stack components from warehouse to quayside (including assembly and testing) (WWCI)	4	• On-site communications • Active IMT on call including Subsea Well Capping Lead • WellCONTAINED logistics plan • Monthly monitoring of suitable vessels
Capping Stack lifted on to barge, fastened and then tug operations transit to anchored deployment vessel (WWCI)	2	• Active IMT • Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Capping stack specialist services (Wild Well Control) • WellCONTAINED logistics plan • Capping stack logistics methodology
Handover of capping stack from WWCI to Santos (WWCI to continue to support via specialist personnel)		
Capping Stack mobilised to incident location by deployment vessel (Santos with support from vessel broker)	9	• Stood-up Subsea Well Capping Team (as per Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001) • Capping stack specialist services contract (Wild Well Control) • WellCONTAINED logistics plan
Total days to arrival, ready to commence capping stack operations	**15**	-
Days to installation of capping stack (worst case allowing for potential removal of debris and issues due to damaged wellhead, BOP and/or lower marine riser package)	**2 to 28 (estimated)**	-

9.2.2.6 Subsea First Response Toolkit

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

In the event of a loss of well control incident, Santos will mobilise the AMOSC SFRT from Fremantle to Dampier for transhipment to a suitable vessel for transport to and deployment at the incident location. The SFRT is located at Oceaneering's facilities at Jandakot. If required, the equipment would be mobilised via road from Jandakot to

Santos

Dampier. It is estimated this would take approximately 10 hours to arrange and 4-5 days to load and transport to Dampier, depending on the destination and time of year. A suitable vessel would be acquired by Santos during this timeframe and arrive in Dampier (within approximately 9 days of the call-out). Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day 12 from call-out. Specialist personnel to deploy the SFRT will be provided via Santos’ contract with Oceaneering and will be available in Dampier (within approximately 9 days of the call-out). A suitable vessel will be sourced through Santos’ contractors and vessel specifications are outlined in the Santos Offshore Source Control Planning and Response Guideline (DR-00-OZ-20001).

9.2.2.7 Implementation guidance

The Source Control Planning and Response Guideline (DR-00-OZ-20001) outlines the overarching process for planning and mobilising personnel and equipment into the field for source control methods. Implementation guidance for relief well drilling is summarised above in Table 9-5. Additional implementation guidance for the capping stack and SFRT is summarised in Table 9-8.

Table 9-8: Implementation guidance – Capping stack and SFRT

Action		Responsibility	Complete
Initial Actions	**Capping Stack**		
	Consider technical and safety constrains and assess the suitability of a Capping Stack or the incident.	Source Control Branch Director	☐
	Implement the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Source Control Branch Director	☐
	Notify Santos Drilling and Completions Team to assembly a Source Control Team and immediately begin preparations.	Source Control Branch Director	☐
	Notify Capping Stack service provider of incident for activation of personnel and equipment as per the Source Control Planning and Response Guideline (DR-00-OZ-20001).	Source Control Branch Director	☐
	Contract suitable vessel capable of deploying Capping Stack via freight contractor.	Logistics Section Chief Source Control Branch Director	☐
	SFRT		
	Activate SFRT equipment. Activate Oceaneering personnel for deployment	Designated call-out authority (Incident Commander) Source Control Branch Director	☐
	Contract suitable vessel capable of deploying SFRT equipment	Logistics Section Chief Source Control Branch Director	☐
	Arrange road transport of SFRT equipment from Jandakot to Dampier.	Logistics Section Chief Source Control Branch Director	☐
	Conduct initial ROV survey at the release point to determine the nature of the release, behaviour of the oil, and estimate the oil and gas flow rates.	Operations Section Chief Source Control Branch Director	☐
Ongoing Actions	**Capping Stack**		
	Take into consideration any feedback from ROV surveys in response planning.	Source Control Branch Director	☐
	Deploy equipment and personnel to site to begin capping process.	Source Control Branch Director	☐
	SFRT		
	Arrange equipment to be loaded on to vessel once in Dampier and authorise transit to field.	Logistics Section Chief Operations Section Chief Source Control Branch Director	☐
	Deploy equipment and personnel to site to begin SFRT operations.	Source Control Brand Director	☐

9.3 Environmental performance

Table 9-9 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for the source control response strategy.

Table 9-9: Environmental performance – source control

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
Response Preparedness			
Source control - vessel collision spill control	Vessel Spill Response Plan (SOPEP/ SMPEP)	[EPS-SC-001] Activity/support vessels have a SOPEP or SMPEP that outlines procedures to combat spills.	Audit records Inspection records
	Exercises conducted as per Vessel Spill Response Plan (SOPEP/ SMPEP)	[EPS-SC-002] Spill exercises on activity/support vessels are conducted as per the vessels' SOPEP or SMPEP.	Spill exercise close-out reports
Source control – BOP activation	BOP Unit	[EPS-SC-004] BOP E pressure/function tested as per API Standard 53 at regular intervals throughout the activity.	BOP pressure and function tests recorded in Daily Drilling Report; Pressure tests charted.
	BOP Unit (*note – for subsea BOP systems only*)	[EPS-SC-005] BOP battery and accumulators function tested prior to deployment	BOP battery and accumulators function test records.
	Emergency Disconnect System (EDS) (*note – for subsea BOP systems only*)	[EPS-SC-006] EDS function tested prior to deployment.	EDS Function Test records.
	ROV hot stab capability (*note – for subsea BOP systems only*)	[EPS-SC-007] Access to ROV capability for BOP hot-stab intervention maintained with MODU ROV contractor throughout the activity	ROV contractual arrangements
Source control – relief well drilling	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) provides guidance for well specific source control planning and response, and includes the Santos Source Control Emergency Response Plan in Section 7	[EPS-SC-022] The Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) is in place during the activity.	Source Control Planning and Response Guideline (DR-00-OZ-20001)
	Well specific SCP developed prior to drilling.	[EPS-SC-023] A Well Specific Source Control Plan (SCP) is in place prior to the activity taking place. SCP will identify suitable rig availability for relief well drilling.	Well specific SCP[19]
	Relief Well Rig Capability Register is maintained prior to and throughout the activity to monitor MODUs potentially available for relief well drilling	[EPS-SC-026] Relief Well Rig Capability Register, to monitor rigs currently present in Australasia and record relevant details including rig specifications, contract status and safety case approvals, is maintained prior to and throughout the activity through monthly monitoring.	Relief Well Rig Capability Register

[19] For each drilling campaign, a SCP will be developed to address the well specific requirements. A well specific SCP may be prepared for individual well activities, or for multiple well activities where there is appropriate commonality between the activities (i.e. similar well designs).

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
	Available MODU(s) confirmed to be suitable prior to drilling. (check point is the Assurance Review prior to commencing the activity)	[EPS-SC-054] If there is a suitable MODU in Australian waters, it will be mobilised in accordance with the APPEA MoU: Mutual Assistance for relief well drilling. In the event there are no suitable MODUs available in Australia, this will trigger an additional search for the closest suitable MODUs. Contact will be made with the vessel owners to understand rig readiness and draft a logistics plan to mobilise it to Australian waters. This will be documented as an addendum to the Well Specific SCP.	Relief Well Rig Capability Register; Well specific SCP; Assurance Review Presentation.
	Contract and Equipment Access Agreement with WWCI	[EPS-SC-024] Contract and Equipment Access Agreement with Wild Well Control Inc. (WWCI) are maintained providing technical support and equipment.	Contract with WWCI
	Arrangements for source control ER personnel	[EPS-SC-025] Arrangements for access to source control personnel are maintained during the activity.	Contract/MoUs for source control personnel
	Relief well drilling supplies readily available in Western Australia	[EPS-SC-035] Long lead equipment for relief well drilling will be readily available to Santos.	Relief well equipment contract(s)/ invoice(s); Relief well equipment inventory report(s); Well-specific SCP[20].
Source control – capping stack (*note – for semi-sub wells only*)	Arrangements to enable access to capping stack and trained personnel	[EPS-SC-014] Maintenance of access to capping stack and trained personnel.	Contract with capping stack service provider
	Arrangements in place to monitor availability of vessels capable of transporting capping stack	[EPS-SC-015] Vessel availability shall be monitored regularly via Santos' contracted vessel broker.	Shipbroker reports
	Capping stack deployment vessel availability is reviewed prior to the activity.	[EPS-SC-053] Ensure an intervention vessel sufficient to conduct a deployment of the capping stack is available in the DCMP Pre-Activity Assurance Review. Vessel specs are to be as per Capping Stack Supplier Recommendation for crane capacity for the capping stack. Additionally, where the well specific source control plan has identified the possibility of a large diameter gas boil that may preclude a number of vessels, a screening exercise is conducted to identify very large crane reach (boom out and load capacity) vessels. Vessels with Australian Safety cases to be identified as well as regionally possibly suitable vessels with crane capacity information (as reasonably available). A register is to be compiled with their current location as part of the pre-activity assurance review.	Shipbroker reports; Well-specific Source Control Plan; DCMP pre-activity Assurance Review.
	Monthly monitoring of shipbroker reports to	[EPS-SC-017] If a suitable capping stack deployment vessel is not located in the	Shipbroker reports

[20] For each drilling campaign, a SCP will be developed to address the well specific requirements. A well specific SCP may be prepared for individual well activities or for multiple well activities where there is appropriate commonality between the activities (i.e. similar well designs).

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
	ensure suitable Capping Stack deployment vessel is located in the region throughout the activity	region, Santos will commence work to identify a suitable vessel further afield. Vessel specs. are to be as per Capping Stack Supplier Recommendation for crane capacity for the capping stack.	
	Arrangements to enable timely mobilisation of capping stack	[EPS-SC-018] Capping stack mobilised to site and ready to commence deployment by day 15	Capping stack mobilisation schedule (Table 9-7)
	Maintenance of MSAs with multiple vessel providers. These MSAs can streamline access to vessels capable of deploying the capping stack and minimise mobilisation time.	[EPS-SC-019] Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
Source control – SFRT (*note – for semi-sub wells only*)	Arrangements to enable access to SFRT equipment and personnel	[EPS-SC-009] Maintenance of access to SFRT equipment and personnel	AMOSC SFRT participating member contract; OTA Agreement with Oceaneering.
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	[EPS-SC-010] Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers. These MSAs can streamline access to vessels capable of deploying the SFRT and minimise mobilisation time.	[EPS-SC-011] Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
Response Implementation			
Source control - vessel collision spill control	Vessel Spill Response Plan (SOPEP/SMPEP) implemented	[EPS-SC-003] Actions to control spill associated with a vessel incident followed in accordance with SOPEP or SMPEP.	Vessel logs
Source control – BOP activation	BOP installed in accordance with API Standard 53	[EPS-SC-008] BOP is activated manually in accordance with MODU Operator's ER Plan.	Incident log
Source control – relief well drilling	Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) provides guidance for well specific source control planning and response, and includes the Santos Source Control Emergency Response Plan in Section 7	[EPS-SC-028] Relief well drilling implemented in accordance with the Source Control Planning and Response Guideline (DR-00-OZ-20001) during a well release.	Incident log
	Santos Source Control Branch	[EPS-SC-029] Source Control Branch mobilised within 24 hours of being notified of the well release.	Incident log
	Well control specialists	[EPS-SC-031] Well control specialists mobilised within 72 hours of being notified of the well release.	Incident log

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.		
Response Strategy	**Control Measures**	**Performance Standards [EPS ID]**	**Measurement Criteria**
	Equipment/services for relief well drilling	[EPS-SC-030] Equipment/services for relief well drilling sourced within 5 days of the well release being identified.	Incident log
	Relief well MODU	[EPS-SC-032] MODU for relief well drilling to be onsite by Day 43 from the start of a well release for a jack-up MODU (as per Table 9-4); or Day 44 from the start of a well release for a semi-sub MODU (as per Table 9-6).	Incident log
	Relief well construction	[EPS-SC-033] Relief well completed within 77 days from the start of a well release.	Incident log
Source control – capping stack (*note – for semi-sub wells only*)	Access to capping stack and suitable vessel	[EPS-SC-020] Capping stack to be onsite and ready to commence deployment by day 15 from the start of the release	Incident log
	Access to trained personnel for the deployment and operation of the capping stack and well intervention equipment.	[EPS-SC-021] Capping stack trained personnel mobilised to site within 15 days.	Incident log
Source control – SFRT (*note – for semi-sub wells only*)	Access to suitable SFRT vessel	[EPS-SC-012] Vessel mobilised to Dampier within 9 days of IMT call-out	Incident log
	Access to personnel for the deployment of the SFRT	[EPS-SC-013] Oceaneering to mobilise personnel to Dampier within 9 days of IMT call-out.	Incident log

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 (OSTM);
- satellite imagery.

10.1 Vessel surveillance

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

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

Environmental performance outcome	Implement, monitor and evaluate tactics in order to provide situational awareness to inform IMT decision-making.	
Initiation criteria	Notification of a Level 2/3 spill – may be deployed in a Level 1 incident (to be determined by OSC).	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✓1	✓1
Termination criteria	• Vessel-based surveillance is undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, or • NEBA is no longer being achieved, or • Agreement is reached with Jurisdictional Authorities to terminate the response.	

Direct observations from field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea-state conditions or where fresh hydrocarbons at the surface pose safety risks.

10.1.1 Implementation guidance

Table 10-2 provides guidance to the IMT on the actions and responsibilities to be considered when selecting this strategy. Table 10-3 has a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources that are required to commence implementation of 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 10-2: 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 the Santos ER intranet page.	OSC Operations Section Chief	☐
	Source additional contracted vessels if required for assistance.	Refer to Santos Vessels for Oil Spill Response (7110-650-ERP-0001) for guidance on vessel availability monitoring and vessel types.	Logistics Section Chief	☐
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms (Appendix E) and provide to OSC (Level 1 spills) or IMT (Level 2/3 spills).	Photographic images are to be taken where possible and included with surveillance forms. Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by the IMT.	Vessel Observers	☐
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick) to the IMT within 60 minutes of completing vessel surveillance.	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms.	Vessel Master and/or OSC	☐
Ongoing actions	Review surveillance information to validate spill fate and trajectory.	-	Planning Section Chief (or delegate)	☐
	Use available data to conduct Operational NEBA and confirm that pre-identified response options are appropriate.	-	Environment Unit Leader	☐
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required.	Surveillance data is useful in updating the Common Operating Picture.	Planning Section Chief	☐

Table 10-3: Vessel surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Contracted vessels and VOO	Santos contracted vessel providers. VOO identified through AIS Vessel Tracking.	Availability dependent upon Santos and vessel contractor activities.	Vessels mobilised from Dampier, Varanus Island, Exmouth or offshore location. Locations verified through AIS Vessel Tracking Software.	Pending availability and location. Expected within 24 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
Santos contracted vessel or VOO on site for surveillance.		<48 hours (daylight dependent)
Minimum resource requirements		
One vessel. No specific vessel or crew requirements.		
Deployment location	**Approx. distance to operational area[21] (nautical miles)**	**Approx. steam time[22] (hours: minutes)**
Port Hedland	100 (185 km)	10:00
Dampier	205 (360 km)	20:30

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**	**Caley Crude**
	✓1	✓1
Termination criteria	• Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable, or • As directed by the relevant Control Agency.	

Aerial surveillance is used to record the presence and size of the hydrocarbon spill at the 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 implementation of initial aerial surveillance operations are listed

[21] *As measured to the furthest operational area (Ara OA)*
[22] *At average rate of 10 knots*

in Table 10-8. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 10-6: Implementation guidance – aerial surveillance

Action		Consideration	Responsibility	Complete
Initial actions	Contact contracted aviation provider – provide details of incident and request mobilisation to spill site for initial surveillance.	If aviation asset is available near spill location, use where possible to gather as much information about the spill. If aviation asset is not available at spill location, IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met before deployment. There should be an attempt to obtain the following data during initial surveillance: • Name of observer, date, time, aircraft type, speed and altitude of aircraft. • Location of slick or plume (global positioning system (GPS) positions, if possible). • Spill source. • Size of the spill, including approximate length and width of the slick or plume. • Visual appearance of the slick (e.g. colour). • Edge description (clear or blurred). • General description (windrows, patches etc.). • Wildlife, habitat or other sensitive receptors observed. • Basic metocean conditions (e.g. sea state, wind, current). • Photographic/video images.	Operations Section Chief Logistics Section Chief	☐
	Source available Santos Aerial Observers, arrange accommodation/logistics and deploy to Forward Operations/Air Base Location.	Santos Aerial Observer list available from First-strike Resources on Santos Offshore ER intranet page.	Operations Section Chief Logistics Section Chief	☐
	Develop flight plan to meet IMT expectations and consider other aviation operations. 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.	Operations Section Chief Air Operations Branch Director	☐
	Pre-flight briefing	-	Aerial Observers Contracted Aircraft Provider/Pilots	☐
	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna.	Operations Section Chief	☐
	Determine spill extent by completing Aerial Surveillance Log (Appendix F) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (Appendix G). Take still and/or video images of the slick.	Thickness estimates are to be based on the Bonn Agreement Oil Appearance Code (BAOAC) (refer to Appendix F).	Aerial Observers	☐

Action		Consideration	Responsibility	Complete
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (Appendix H).	Provide a copy of completed Record Sheets to Environment Unit Leader and OSM Implementation Lead.	Aerial Observers	☐
	Record shoreline habitat type and degree of oiling by completing the Aerial Surveillance Shoreline Observation Log (Appendix I).	Thickness estimates are to be based on the BAOAC (Appendix F).	Aerial Observers	☐
	Relay all surveillance records (logs, forms, photographic images, video footage) to the IMT.	Where possible, a verbal report via radio/telephone enroute providing relevant information should be considered if the aircraft has long transits from the spill location to base.	Aerial Observers Planning Section Chief Operations Section Chief	☐
Ongoing actions	Update flight schedule for ongoing aerial surveillance as part of the broader Aviation Subplan of the IAP.	Frequency of flights should consider information needs of the IMT to help maintain the Common Operating Picture and determine ongoing response operations.	Operations Section Chief Air Operations Branch Director Planning Section Chief	☐
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities.	-	Logistics Section Chief	☐
	Update Common Operating Picture with surveillance information and provide updates to spill trajectory modelling provider.	-	Planning Section Chief (or delegate)	☐

Table 10-7: Aerial surveillance resource capability

Equipment type/ personnel required	Organisation	Quantity available	Location	Mobilisation timeframe
Rotary-Wing Aircraft and Flight Crew	Santos contracted provider/s	2 x Contracted (1 x primary, 1 x backup) Additional as required	Karratha Port Hedland	Activation of aerial surveillance using helicopter pilots will occur <3 hours of the spill. Helicopter on site for surveillance <6 hours of the spill (daylight dependent).
Aerial Surveillance Crew	Santos aerial observers	7 x Santos Staff	Perth and Varanus Island	24 hours - available from Day 2 of the incident.
	AMOSC Industry Mutual Aid	6 x AMOSC Staff 2 x AMOSC Core Group personnel available Additional trained industry mutual aid personnel	Australia wide	24 hours - available from Day 2 of the incident.
Drones and Pilots **secondary response to assist vessel-based surveillance	AMOSC	Drones available 24/7 through AMOSC sub-contract 1 x Pilot	Fremantle	Response via duty officer within 15 minutes of first call. AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location.
	OSRL – Third Party Unmanned Aerial Vehicles (UAV) provider	2 x qualified remote pilots, however response is on best endeavour	Australia or international	Depending on the port of departure, one to two days if within Australia.
	Local WA hire companies	10+	Perth and regional WA	-

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

Task	Time from IMT call-out
Aircraft activated for aerial surveillance.	<3 hours
Aircraft on site for aerial surveillance.	<6 hours (daylight dependent)
Trained Aerial Observers mobilised to airbase (Karratha).	<24 hours (daylight dependent)

Minimum resource requirements

- Santos contracted helicopter and pilots (based in Dampier).
- Santos trained Aerial Observers.

Airport	Approx. distance[23] (nm)	Approx. flight time[24] (hours: minutes)
Port Hedland (PHE)	100 (185 km)	00:50
Dampier (Karratha) (KTA)	205 (360 km)	1:45

[23] *As measured to the furthest operational area (Ara OA)*
[24] *At average flight speed of 120 knots*

10.3 Tracking buoys

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

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

<table>
<tr><td>Environmental performance outcome</td><td colspan="2">Implement, monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.</td></tr>
<tr><td>Initiation criteria</td><td colspan="2">Notification of a Level 2 or 3 spill.
May be deployed for a Level 1 spill if deemed beneficial by the OSC.</td></tr>
<tr><td rowspan="2">Applicable hydrocarbons</td><td>MDO</td><td>Caley Crude</td></tr>
<tr><td>✓1</td><td>✓1</td></tr>
<tr><td>Termination criteria</td><td colspan="2">• 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.</td></tr>
</table>

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.

Table 10-12 provides a summary of AMOSC equipment mobilisation timeframes. Mobilisation times for the minimum resources that are required to commence implementation of this tactic are listed in Table 10-13.

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 10-10: 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 the Santos ER intranet page.	OSC / Operations Section Chief	☐
	Deploy two tracking buoys at leading edge of slick.	Note deployment details and weather conditions in the incident log.	Vessel Master	☐
	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys.	Refer login details of tracking buoy monitoring website on the Santos ER intranet site.	OSC Planning Section Chief (or delegate)	☐
	Use tracking buoy data to maintain Common Operating Picture.	Data tracked online.	Planning Section Chief (or delegate)	☐
	Relay information to spill fate modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief (or delegate)	☐
Ongoing actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	IAP to provide guidance regarding any additional deployments of tracking buoys.	Planning Section Chief	☐
	Mobilise additional tracking buoys if required from other Santos operations (Santos currently has 12 tracking buoys located on the North West Shelf) or from AMOSC stockpiles.	-	Logistics Section Chief	☐
	Organise vessel to deploy additional tracking buoys if required.	For continuous releases over multiple days, use a rolling deployment/collection of tracking buoys to provide better coverage of plume direction.	Operations Section Chief	☐
	Deploy tracking buoys.	-	Vessel Master	☐
	Monitor movement of tracking buoys.	-	Planning Section Chief (or delegate)	☐
	Relay information to spill trajectory modelling supplier for calibration of trajectory modelling.	-	Planning Section Chief (or delegate)	☐

Table 10-11: Tracking buoy resource capability

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

Table 10-12: Australian Marine Oil Spill Centre Equipment mobilisation timeframes (road freight)

	Perth	Dampier
Perth		1-2 days / 1,530 km
Exmouth	1-2 days / 1,250 km	<1 day / 555 km
Broome	<2 days / 2,240 km	<1 day / 855 km
Geelong	2-3 days / 3,395 km	4-5 days / 4,840 km

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

Task	Time from IMT call-out
Tracking buoys deployed from the MODU.	<2 hours
Tracking buoys deployed from Dampier using VOO.	<24-48 hours to site pending vessel availability
Minimum Resource Requirements	
Two tracking buoys for initial deployment.	

10.4 Oil spill trajectory modelling

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

Table 10-14: OSTM – 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**	**Caley Crude**
	✓1	✓1
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.	

OSTM 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 F2067-22: Standard Practice for Development and Use of Oil Spill Trajectory Models). RPS Group also provide the capacity for forecast air quality monitoring to enable an assessment of potential health and safety risks associated with VOCs released from a surface slick.

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 daytime use, and have limits imposed by the operating environment. Aerial surveillance and vessel-based monitoring are, however, essential for 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. Mobilisation times for the minimum resources that are required to commence implementation of this tactic are listed in Table 10-17. 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 10-15: Implementation guidance – OSTM

Action		Consideration	Responsibility	Complete
Initial actions	Initiate OSTM by submission of an OSTM request form (Santos ER SharePoint). Request for three day forecast trajectory modelling.	-	Environment Unit Leader	☐
	Determine requirement for gas/VOC modelling and request initiation.	Hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This is to be considered for any tactics that monitor/recover oil, especially at close proximity to the release site.	Safety Officer Environment Unit Leader	☐
	Operational surveillance data (aerial, vessel, tracking buoys) to be given to the modelling provider to verify and adjust fate predictions of the spill and improve predictive accuracy.	-	Planning Section Chief (or delegate)	☐
	Login to the RPS Group data sharing website and maintain connection. Download modelling results.	Data should be stored digitally and backed up on independent digital storage media. All datasets should be accompanied by a metadata summary and documented quality assurance and control procedures.	Planning Section Chief (or delegate)	☐
	Place RPS Group modelling data into GIS/Common Operating Picture.	RPS Group to provide at least daily updates to the IMT on trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly.	Planning Section Chief (or delegate)	☐
	If chemical dispersants are considered applicable strategy for spill scenario, request modelling provider to model how dispersant addition effects the distribution and concentration of floating oil, subsea oil and shoreline loading.	Planning and Operations to provide inputs for modelled simulation based on potential/planned dispersant operations. Outputs from dispersant addition modelling to inform NEBA.	Planning Section Chief Operations Section Chief	☐
	Identify the locations and sensitivities at risk based on the trajectory modelling and inform the IMT. Conduct Operational NEBA on proposed response strategies.	-	Environment Unit Leader	☐
Ongoing actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture.	-	Planning Section Chief (or delegate)	☐
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy.	-	Planning Section Chief (or delegate)	☐

Table 10-16: OSTM resource capability

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

Table 10-17: OSTM – first-strike response timeline

Task	Time from IMT call-out
RPS Group OSTM activated by the IMT	<2 hours
OSTM provided to the 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**	**Caley Crude**
	✓1	✓1
Termination criteria	• Satellite monitoring will continue until no further benefit is achieved from continuing, or as advised by the 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 requested through existing AMOSC and OSRL contracts. The most appropriate images for purchase will be based on the extent and location of the oil spill. Synthetic aperture radar and visible imagery may both be of value. Availability of satellite images for a specific location will be dependent on several factors including current satellite position, satellite availability/tasking and weather conditions (cloud cover obscures images).

10.5.1 Implementation guidance

Table 10-19 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy.

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

Table 10-19: Satellite imagery implementation guide

Action		Consideration	Responsibility	Complete
Initial actions	Assess requirement for satellite imagery.	-	Planning Section Chief	☐
	Notify AMOSC and OSRL Duty Officer to initiate request for available satellite imagery.	Formal written activation of resources from AMOSC and OSRL by designated call-out authorities (Santos Duty Managers/Incident Commanders) is required.	Planning Section Chief	☐

Action		Consideration	Responsibility	Complete
	Assess suitability and order imagery.	-	Planning Section Chief	☐
	Integrate satellite imagery into Common Operating Picture and provide to trajectory modelling provider for model validation.	-	Planning Section Chief (or delegate)	☐
Ongoing actions	Review satellite imagery to validate spill fate and trajectory.	-	Planning Section Chief	☐
	Use satellite imagery to periodically reassess the spill and modify the response (through the IAP), as required.	Use surveillance data when updating the Common Operating Picture.	Planning Section Chief	☐

Table 10-20: Satellite imagery resource capability

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

10.6 Environmental performance

Table 10-21 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for this response strategy.

Table 10-21: Environmental performance – monitor and evaluate

Environmental performance outcome	Implement, monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
Monitor and evaluate – vessel and aerial surveillance	**Response Preparedness**		
	Maintenance of MSAs with multiple vessel providers for surveillance vessel capability	[EPS-ME-001] Santos maintains MSAs with multiple vessel providers as specified in Table 10-3	MSAs with vessel providers
	Track location of potential surveillance vessels	[EPS-ME-003] Santos maintains access to Automatic Identification System (AIS) Vessel Monitoring System to track potential surveillance vessel locations.	AIS live tracking portal
	Minimum specifications list for surveillance vessels	[EPS-ME-002] Maintain minimum specifications list for surveillance vessels to aid in rapid vessel selection	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	MSA with aviation supplier for aerial surveillance capability	[EPS-ME-009] MSA in place with helicopter/aircraft provider throughout activity	MSA with aviation supplier
	Trained aerial observers available through Santos personnel	[EPS-ME-010] Santos to maintain a pool of Trained Aerial Observers.	Exercise records; Training records.
	Trained aerial observers available through mutual aid arrangements facilitated by AMOSC	[EPS-ME-011] Maintenance of AMOSC contract to facilitate mutual aid	AMOSC Participating Member Contract

Environmental performance outcome	Implement, monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
		arrangements for access to Trained Aerial Observers.	
	Access to certified UAV providers.	[EPS-ME-012] Maintenance of access to UAV providers.	List of certified UAV providers; AMOSC Participating Member Contract; OSRL Associate Member Contract.
	Aircraft charter companies for fauna observations.	[EPS-ME-013] Maintain a list of aircraft charter companies that could potentially provide fauna observation services.	List of providers
	Response Implementation		
	Vessel surveillance First Strike capability mobilised	[EPS-ME-004] First strike is mobilised in accordance with details and timings as specified in Table 10-4.	Incident log
	Vessel surveillance daily observation reports	[EPS-ME-007] Daily observation reports submitted to IMT until termination criteria is met.	Incident log
	Vessels and chartered surveillance aircraft compliant with Santos' Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003).	[EPS-ME-006] 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 and includes controls for minimising the risk of collision with marine fauna.	Vessel contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure; Completed vessel statement of conformance.
		[EPS-ME-014] Chartered surveillance 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 and includes controls for minimising interaction with marine fauna.	Aircraft contractor procedures align with Santos' Protected Marine Fauna Interaction and Sighting Procedure.
	Aerial surveillance First strike capability mobilised	[EPS-ME-015] First strike is mobilised in accordance with details and timings as specified in Table 10-8.	Incident log
	Aerial surveillance – two passes per day	[EPS-ME-016] Following initiation of aerial surveillance, two passes per day of spill area by observation aircraft provided.	Incident log; IAP

Environmental performance outcome	Implement, monitor and evaluate tactics in order to provide situational awareness to inform IMT oil spill response decision making.		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
	Aerial surveillance trained aerial observers	[EPS-ME-017] Trained Aerial Observers supplied from Day 2 of response.	Incident log
	Aerial surveillance flight schedules	[EPS-ME-019] Flight schedules are maintained throughout response.	IAP
	Aerial surveillance observer log	[EPS-ME-020] Observers completed aerial surveillance observer log following completion of flight.	Completed Aerial Surveillance observer logs
Monitor and evaluate – tracking buoys	**Response Preparedness**		
	Tracking buoys available	[EPS-ME-023] Maintenance of 10 tracker buoys throughout the activity.	Computer tracking software; Tracking buoy tests.
	Response Implementation		
	Tracking buoy first strike capability mobilised	[EPS-ME-024] First strike is mobilised in accordance with details and timings as specified in Table 10-11.	Incident log
Monitor and evaluate – oil spill modelling	**Response Preparedness**		
	Maintenance of contract for emergency response modelling	[EPS-ME-027] Maintenance of contract for forecast spill trajectory modelling services throughout activity.	Modelling services contract
	Maintenance of access to additional emergency response modelling	[EPS-ME-028] Access to additional spill modelling capability to ensure redundancy.	Membership in place with OSRL
	Response Implementation		
	Oil spill modelling provider first contact	[EPS-ME-029] Oil Spill Modelling provider will be contacted within two hours upon notification of a Level 2 or 3 spill.	Incident log
	Oil spill modelling provider output minimum timings	[EPS-ME-030] Modelling delivered to IMT within two hours of request to service provider.	Incident log
Monitor and evaluate – satellite imagery	**Response Preparedness**		
	Satellite imagery and analysis capability	[EPS-ME-032] Satellite imagery and analysis accessed through third party provider activated via AMOSC and/or OSRL.	AMOSC Participating Member Contract; OSRL Associate Member Contract.
	Response Implementation		
	Satellite imagery and analysis provided to IMT	[EPS-ME-033] Data incorporated into Common Operating Picture and provided to spill modelling provider.	Incident log IAP

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 and biodegradation.	
Initiation criteria	Monitor and evaluate data identifies thin oil patches at the sea surface that are not naturally dissipating and is posing risks to wildlife and shorelines by remaining on the surface.	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✓2	✓2
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, 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 / Vessel Master 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 and sea state. Possible impacts to sensitive shorelines and/or wildlife. This activity is to be conducted during daylight hours only and requires a safety plan to be developed prior to implementation.	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	Safety Officer to develop a safety plan for the activity with respect to potentially dangerous gases and VOCs (including applicable controls).	Ambient gas testing during spills providing safe levels for operation of personnel and vessels	Operations Section Chief Safety Officer	☐
	Notify vessel-based responders to trial mechanical dispersion.	-	Operations Section Chief	☐
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Section Chief for inclusion in Operational NEBA.	-	Vessel Master/s Santos/AMOSC Core Group Responders	☐

Table 11-3: Mechanical dispersion resource capability

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

11.3 Environmental performance

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

Table 11-4: Environmental performance – mechanical dispersion

Environmental performance outcome	To create mixing for oil and water to enhance natural dispersion and biodegradation.		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
Mechanical dispersion	**Response preparedness**		
	Mechanical dispersion capability in place	[EPS-MD-001] Mechanical dispersion capability in place based on Santos contracted vessels availability	Existing MSA(s) with multiple vessel providers
	Response implementation		
	Mechanical dispersion procedures in place to ensure safe and effective execution	[EPS-MD-002] Mechanical Dispersion to be conducted as per the Mechanical Dispersion Plan.	Mechanical Dispersion Plan; IAP; Incident Log.
	Operational NEBA to determine net environmental benefit	[EPS-MD-003] Operational NEBA confirms suitability and environmental benefit.	Incident Log; IAP.

12. Offshore containment and recovery plan

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

Table 12-1: Containment and recovery – environmental performance outcome, initiation criteria and termination criteria

Environmental Performance Outcome	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons and contact with protection priorities.	
Initiation criteria	Level 2 or 3 spills from a LOWC event. NEBA confirms the response strategy is beneficial.	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✗	✓1
Termination criteria	• NEBA is no longer being achieved, or • Agreement is reached with Jurisdictional Authorities to terminate the response.	

12.1 Overview

Booms and skimming equipment can be used to create physical barriers on the water surface to contain and recover the oil and to remove risk of oil contacting environmental, social and cultural sensitivities. This strategy is often used in the offshore environment near the hydrocarbon source. Once contained, an attempt to recover the hydrocarbons from the water surface can be undertaken. Table 12-2 provides applicability criteria on when containment and recovery may be a suitable response option.

Table 12-2: Containment and recovery application criteria

Criteria	Recommended	Not Recommended
Spill characteristics	• Patchy slick. • Extended operations. • Surface concentrations >50 g/m² (BAOAC of 4) at a minimum, >200 g/m² (BAOAC of 5) is optimal.	• Situation dependent. • Surface thickness <50 g/m² (BAOAC <4).
Hydrocarbon type	• Group 3 hydrocarbons and above. • Persistent components of Group 1 and 2 hydrocarbons may be suitable.	• Minor to moderate spills of Group 1 and 2 hydrocarbons are likely to weather rapidly. High volatiles of these hydrocarbons may be a safety risk to personnel.
Operating environment	• Waves <1 m for nearshore containment and recovery systems (Santos containment and recovery boom). • Waves <1.8 m for offshore systems. • Winds <20 knots.	• Wave heights exceed 1.8 m. • Current >0.75 knots.

12.2 Implementation guidance

Table 12-3 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 12-4 provides a list of resources that may be used to implement this strategy. Mobilisation times for the minimum resources required to commence initial containment and recovery operations are listed in Table 12-5. The OSC and/or 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 12-3: Implementation guidance – containment and recovery

Action		Consideration	Responsibility	Complete
Initial Actions	**Containment and recovery**			
	Identify and activate containment and recovery equipment stockpiles. Initial equipment mobilisation from Karratha and/or Exmouth.	Initial deployment from Karratha or Exmouth pending vessel availability. Up to date stockpile information accessed through Santos' ER intranet site.	Logistics Section Chief Supply Unit Leader Operations Section Chief	☐
	Identify suitable deployment vessels/crew. Mobilise resources to port location (Karratha and/or Exmouth).	Initial deployment from Karratha or Exmouth pending vessel availability. Preference will be for vessels and crew that are exercised in regular Santos booming exercises.	Logistics Section Chief Supply Unit Leader Operations Section Chief	☐
	Assess the spill trajectory modelling and other monitor and evaluate data to identify operational area for containment and recovery deployments.	Refer to Table 12-2 for guidance.	Operations Section Chief Planning Section Chief	☐
	Confirm conditions are suitable for containment and recovery activities.	Refer to Table 12-2 for guidance.	Operations Section Chief Planning Section Chief	☐
	Mobilise deployment personnel to nominated marine base(s).	Each vessel conducting containment and recovery is to be manned with a trained AMOSC, Santos or OSRL Oil Spill Responder who is the Team Leader tasked with controlling the operations and implementing them in a safe and responsible manner. The Team Leader has the responsibility of evaluating the effectiveness of the containment and recovery operations and communicating the information to the IMT Operations Section Chief.	Operations Section Chief Logistics Section Chief	☐
	Coordinate aerial surveillance support to vessels to ensure they are being directed to priority locations for containment and recovery activities within operational zones.	Focus on containment and recovery activities to areas of slick of a sufficient thickness whereby containment and recovery activities will be effective. Refer to Table 12-2 for guidance.	Planning Section Chief Operations Section Chief	☐
	Direct containment and recovery operations to designated operational zones.	The base case restrictions for containment and recovery is no operations within 25 km of well site.	Operations Section Chief	☐
	Decanting (if selected)			
	Obtain decanting approval from AMSA (Commonwealth waters) or DTMI (WA waters).	Under both MARPOL and POWBONS, decanting must be approved by the relevant Jurisdictional Authority where the discharge will occur. Approval should be sought to discharge water that has separated from oil into the apex of the already deployed containment boom system (with operational skimmer).	Environment Unit Leader	☐

Action		Consideration	Responsibility	Complete
		This will increase the oil storing capacity of storage tanks.		
	Ensure personnel onboard the vessels are familiar with the decanting procedure approved by AMSA (Commonwealth waters) or DTMI (WA waters).	-	Operations Section Chief	☐
	Commence decanting operations, ensuring that any discharged water is directed into the apex of the already deployed containment boom system (with operational skimmer).	-	Vessel Master/s	☐
	Ensure there is sufficient temporary storage for oily wastewater onboard vessel.	-	Operations Section Chief	☐
Ongoing Actions	**Containment and recovery**			
	Coordinate the dispatch of operationally ready (all equipment and personnel on board) vessels via the IAP.	Equipment will be maintained and replaced as necessary through existing stockpiles.	Operations Section Chief	☐
	Maintain operational zones and provide updates to Vessel Master/s on the most suitable locations for containment and recovery operations.	Continue to utilise aerial surveillance data to inform the location of operational zones.	Operations Section Chief	☐
	Develop a waste transfer process to secondary vessel/barge to enhance containment and recovery vessel operational time, reduce port visits for waste unloading and reduce contamination.	Consider location and size/type of waste collection vessel/barge and the suitability of equipment and waste receptacles for dynamic lifts. Consider waste transfer to Dampier Port rather than Exmouth which is a small multi-use port facility.	Operations Section Chief Planning Section Chief Logistics Section Chief	☐
	Decanting (if selected)			
	Record volumes of all water decanted.	This information must be supplied to the relevant Jurisdictional Authority.	Vessel Master/s	☐
	Manage any solid wastes generated.	-	Vessel Master/s	☐

Table 12-4: Containment and recovery – resource capability

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
Recovery booms and skimmers	Santos	Containment and recovery boom (Current Buster 4 / Expandi Boom) Comes with accessories and powerpacks Total – 4	Exmouth container – 2 x Expandi boom systems and accessories VI container – 1 x Expandi boom system and accessories, 1 x Current Buster 4 boom system and accessories	Within 24 hours (for Exmouth or Varanus Island based deployment).
		Desmi DBD16 brush skimmer (for inshore/calm seas deployment, comes with hoses/powerpacks). Total: 2	Exmouth: 1 Varanus Island: 1	Within 24 hours (for Exmouth or Varanus Island based deployment).
	AMOSC	Desmi Ro-boom 1500 (200 m offshore boom on hydraulic reel). Total: 18	Exmouth: 2 Fremantle: 6 Geelong: 10	Response via Duty Officer within 15 minutes of first call. AMOSC personnel available within 1 hour of initial activation call. Equipment mobilisation times vary according to stockpile location[25] (refer to Table 10-12).
		NOFI Current Buster 2 boom system Total: 1	Geelong: 1	
		Desmi Speed Sweep boom system Total – 1	Geelong: 1	
		Skimmers – refer to Table 14-3.		
	AMSA	Ro-boom (200 m) Total: 8	Karratha: 4 Fremantle: 4	Access to National Plan equipment[26] through AMOSC[27]. Equipment mobilisation times vary according to stockpile location.
		Vikoma Hi Sprint boom Total: 4	Karratha: 2 Fremantle: 2	
		LWS 500 weir skimmer Total: 8	Fremantle: 4 Karratha: 4	
		Desmi termite skimmer Total: 2	Fremantle: 1 Karratha: 1	
	Industry Mutual Aid Equipment	Offshore boom and skimmers	WA	Access to Industry Mutual Aid through AMOSPlan and facilitated by AMOSC.

[25] *The latest AMOSC equipment listings are available through AMOSC Members Hub: https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

[26] *The latest AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[27] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources.*

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
	OSRL (Guaranteed access to 50% by type of equipment available. Additional access considered on a case-by-case basis).	35x Ro-boom (200 m)	Singapore, UK, Bahrain, Fort Lauderdale.	Response via Duty Officer within 10 minutes of first call. Equipment mobilisation times vary according to stockpile location[28].
		1x Hi sprint boom (300 m)		
		15x Towing boom (current busters)		
		50 x Offshore recovery skimmers		
Offshore waste storage	AMOSC	Lancer barges (25 m^3 each) Total: 4	Fremantle: 2 Geelong: 2	Response via Duty Officer within 15 minutes of first call. AMOSC personnel available within 1 hour of initial activation call. Equipment mobilisation times vary according to stockpile location (refer to Table 10-12).
		Deck bladders (25 m^3 each) Total: 6	Fremantle: 3 Geelong: 3	
	AMSA	Vikoma flexidam (10 m^3 each). Total: 7	Fremantle: 4 Karratha: 3	Access to National Plan equipment through AMOSC. Equipment mobilisation times vary according to stockpile location.
		Canflex sea slug (10 m^3 each) Total: 2	Fremantle: 1 Karratha: 1	
		Vikoma frost barge (25 m^3 each) Total: 4	Fremantle: 2 Karratha: 2	
		Covertex tow tank (20 m^3 each) Total: 2	Fremantle: 1 Karratha: 1	
	North West Alliance Contract	Refer to Waste Management (Section 17) for details on Santos' Waste Service Provider (WSP)	Perth Karratha	<24 hours
	Santos OEG Contract	Liquid waste ISO tanks (4 m^3)	WA	<24 hours. Offshore rated ISO tanks are readily available via existing contract arrangements through OEG.

[28] *The latest OSRL equipment inventory available to members can be found in the SLA equipment stockpile status report: https://www.osrl.com/in-action/publications/.*

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
	OSRL (Guaranteed access to 50% by type of equipment available. Additional access considered on a case-by-case basis).	16x Storage barges (50 m^3 each) 25x Storage barges (25 m^3 each)	Singapore, UK, Bahrain, Fort Lauderdale.	Response via Duty Officer within 10 minutes of first call. Equipment mobilisation times vary according to stockpile location.
Offshore containment and recovery deployment vessels, towing vessels and vessel crew waste transfer vessels/barges for waste oil storage and transfer.	Santos contracted vessel providers. Preference for vessels used in Santos' deployment exercises.	Varies – check through vessel contractors/Santos vessel tracking system. Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) provides the required vessel specifications.	Exmouth, Dampier, NW locations, Singapore.	Varies subject to location/availability.
Personnel (field responders) for OSR strategies.	AMOSC Staff	12	Fremantle: 5 Geelong: 7	Response via Duty Officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel is dependent on location of the spill and transport to site.
	AMOSC Core Group (Santos)	16	Perth/NW locations: 14	From <12 hours (NW based personnel) From <24 hours (Perth personnel)
			Port Bonython (SA): 2	<48 hours to WA locations
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations across Australia.	Location dependent. Confirmed at time of activation.

Table 12-5: Containment and recovery – first strike response timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and begins sourcing containment and recovery resources for applicable spills.	<4 hours
Santos Offshore Core Group members mobilised to deployment port.	<24 hours
Containment and recovery equipment (offshore booms/skimmers) mobilised to deployment port.	<24 hours
Waste storage equipment mobilised to port.	<24 hours
Suitable containment and recovery vessels mobilised to port.	24–48 hours
Containment and recovery trained personnel mobilised to deployment port.	24-48 hours
Containment and recovery operation deployed to spill site (weather/daylight dependent).	60-72 hours (weather/daylight dependent)
Minimum Resources per Containment and Recovery Unit	
• Two suitable containment and recovery vessels (one deployment vessel, one tow vessel). Refer to Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) for vessel specifications. • 200 m of offshore boom. • 1x offshore skimmer appropriate to hydrocarbon type and operating conditions. • Waste storage (comprising of a combination of towable bladders, IBCs, ISO tanks, inbuilt vessel storage tanks allowing for 33 m³ of liquid waste volume storage per containment and recovery unit). • Personnel: – 2x Vessel masters (1 x deployment vessel, 1 x tow vessel); – 2x Trained supervisors (both on deployment vessel); – 4x Deployment crew; – 1 x deck hand (tow vessel). • Personal protective equipment.	

12.3 Resource requirements

12.3.1 Assumptions

Containment and recovery is more effective when a sufficient oil thickness can be achieved by the containment booms (minimum of 50 g/m²). Whilst containment and recovery would not be suitable for MDO, it could be suitable for Caley crude under suitable weather conditions (winds less than 20 knots and currents less than 0.75 knots) and if the actionable thickness is reached; deterministic run no. 99 for the Ara scenario resulted in the greatest area of floating oil ≥50 g/m², which was predicted to occur on day 17 at 171 km². The modelling predicted that the area on the surface ≥50 g/m² varied day-to-day as the oil weathered.

To help determine the likely encounter rate from containment and recovery operations, the Boom Encounter Rate Formula in the AMSA Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities (AMSA 2023b) has been used.

Boom Encounter Rate (BER) Formula =

(length of boom (LB) x 0.3) x velocity of vessel (knots/hr) x thickness of slick (mm)

- LB = assumed as 200 m (based on typical available minimum boom lengths of 200 m)
- Velocity = 1 knot
- Thickness of slick = 50 g/m² or 0.047 mm
- Note: percentage cover is assumed to be 100% during initial stages of the operation

BER = (200 x 0.3) x 1 x 0.047 = 2.82 m³ per operation / hour x 12 hours of operation

= 33 m³ / operation / day

12.3.2 Worst-case credible scenario requirements – LOWC Caley Crude

The resourcing needs for surface containment and recovery have been estimated using the Santos response needs calculator, which applies the above BER formula along with various other assumptions (Table 12-6). The response needs calculator has been developed by industry leaders in spill response and considers decades of oil spill response experience and peer-reviewed operational and scientific references. The basis of the calculation is the volume of recoverable oil on the sea surface, in m^3 per week, for the duration of the modelled scenario. 'Recoverable' oil is defined as oil of ≥50 μm thickness (i.e. ≥BAOAC 3 / 4). This information was provided by deterministic run no. 99 for the Ara scenario, which was the run that predicted the largest area of surface oil ≥50 g/m^2 of 171 km^2 (RPS, 2025).

The area of floating oil on the sea surface varies in every time step of the model as the oil weathers. For each week, the average surface oil volume (derived from the predicted area ≥50 g/m^2) was calculated from the time steps to input into the response needs calculator – this represents a highly conservative approach as this number is not constant and in reality varies in every model time step as the oil weathers.

The response needs calculator input, output and assumptions for containment and recovery are provided in Table 12-6. The estimated number of required containment and recovery units varies according to the recoverable oil on the sea surface. During the first week, 9 containment and recovery units are predicted to be required. This increases to 14 units for week 2, reducing to 10 units for week 3. It should be noted that the calculator assumes that all encountered oil is at 50 g/m^2 thickness; in reality, some oil encountered may be of a greater thickness and hence give rise to greater volumes recovered. Aerial surveillance assets would be utilised to direct vessels to areas where they are able encounter the thickest oil (IPIECA-IOGP, 2016b).

During the first week of the response containment and recovery operations will ramp up; as per the response needs calculator output for estimated number of required containment and recovery units, one containment and recovery unit will be on site ready to commence operations on day 4 (refer to Table 12-5). Following this, a further 2 units will be arranged to be on site for day 5, a further 3 units on days 6 and 7, and a further 5 units on day 8, meaning that 9 units will be operational by day 7 and 14 units operational by day 8.

It should be noted that the response needs calculator is a tool for planning purposes to assist with worst-case resources estimation using the oil spill modelling results. In a real pollution emergency response, the actual resources deployed will take account of a multitude of factors including monitor and evaluate data, operational monitoring data, operational NEBA outcomes, other response strategies considered/ deployed and regulatory bodies and stakeholders.

For a containment and recovery response, a range of vessels will be required; these are described in Section 12.4. The Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) provides information and broad vessel specifications for the required containment and recovery vessels, and the range of temporary waste storage vessels required to support the operations. It also provides the process for gaining access to the required vessels through the existing Santos MSAs with vessel providers.

Personnel resources for containment and recovery are provided in Table R-1 (Cumulative Response Capability Appendix R).

Table 12-6: Response needs calculation output for containment and recovery based on the Bedout Multi Well Exploration and Appraisal Drilling LOWC modelling results for floating oil ≥50g/m² (RPS, 2025)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Predicted volume of 'recoverable' oil on surface (m^3)	6,496	10,839	7,452	461	3,316	1,756	1,614	1,162	4,812	846	508	Predicted weekly average volume of recoverable oil on sea surface provided by modelling report (RPS, 2025). Recoverable oil is 50 µm or greater thickness.

Oil recovered based on thickness		
Boom length (m)	200	Length of a typical offshore containment boom.
Velocity of vessel (km/hr)	1.4	Preferred towing speed for a Ro-boom and most booms is 0.75 knots = 1.4 km/hr.
Thickness of slick (mm) - minimum ≥50g/m² or ≥BOAC 3 or 4	0.05	Aims to recover oil at ≥ 50g/m². Assumes encountered oil slicks are of this thickness.
Boom swathe	60	Boom opening or swathe is 0.3 x length of boom.
Vessel area covered/hour (km^2)	0.08	Velocity x boom swathe

Effectiveness of containment and recovery		
Percent cover of oil on water	40%	Reflects time spent recovering oil vs. time spent steaming between oil patches. Oil is expected to spread and fragment. An estimate of 40% may be used here, but is situation dependant (OSRL, 2021c).
Operational reliability	90%	Reflects time spent recovering oil vs. operational time lost deploying, maintaining or repairing equipment. An estimate of 90% is used, but is dependant on experience of operational personnel, access to back-up equipment, access to maintenance and repair parts and technicians, quality and age of equipment and operational conditions.
Waste management	100%	Reflects time spent recovering oil versus operational time lost managing waste through waste offtakes, transit time to waste transfer sites or decanting. An estimate of 100% may be used here, assuming that all waste management activities take place outside of operational hours.
Suitable weather	70%	This measure of effectiveness reflects the percentage of time where weather conditions are within operational limits. An estimate of 70% is used, broadly based on the metocean conditions presented in the modelling report (RPS, 2025).
Technique effectiveness	100%	Reflects the effectiveness of the response strategy when equipment is functioning as per manufacturers specifications and operating conditions are ideal. Where manufacturers specifications indicate that equipment can operate at 100% efficiency in ideal conditions, then 100% can be assumed here. Effectiveness of booms, pumps and associated equipment are incorporated into this factor.
Skimmer effectiveness	90%	Reflects the effectiveness of the skimmer when skimmers are functioning and operating conditions are ideal. This factor is based on the type of skimmer and the effectiveness of that skimmer. There is a wide variation in the effectiveness of different skimmer types. 90% is based on an oleophillic skimmer, which recovers ~10% water and ~90% oil. Conversely, a weir skimmer recovers ~70% water and ~30% oil (IPIECA-IOGP, 2013).
Overall effectiveness	23%	Combined effectiveness percentage.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Estimated volume of oil recovered per containment and recovery unit												
Operational hours per day	12	12	12	12	12	12	12	12	12	12	12	Approximate daylight hours for the region.
Operational days per week	7	7	7	7	7	7	7	7	7	7	7	Assumes seven days per week operation. First week assumed operations commence on day 4 with 1 x unit (refer to first strike response Table 12-5), then ramping up to 10 units by day 7, and 14 units by day 8 (refer to Section 12.3.2).
Vessel area covered per day (km^2)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	Area covered per hour x operational hours
Predicted oil recovery rate per unit (m^3/day)	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	Thickness x Area covered per day x Overall effectiveness
Predicted oil vol. recovered per unit (m^3/week)	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	Predicted oil recovery rate per unit x Operational days per week
Percent oil recovered by 1 C&R unit from total ‘recoverable’ oil	1.3%	0.7%	1.1%	17.2%	2.4%	4.5%	4.9%	6.8%	1.6%	9.3%	15.6%	Predicted oil recovery vol. per week as a percentage of total ‘recoverable’ oil.
Estimated Resource Requirements												
Credible containment and recovery target	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	Wadsworth (1995) cites 10% as a credible target.
No. of units required	9	14	10	1	5	3	3	2	7	2	1	Containment and recovery target % / Percent oil recovered from total ‘recoverable’ oil per unit
Trained C&R personnel required	18	28	20	2	10	6	6	4	14	4	2	Assumes 2 x containment and recovery expert supervisor per unit (on-board the deployment vessel)
Deployment crew required	36	56	40	4	20	12	12	8	28	8	4	4 x deployment crew per unit

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
No. booms required	9	14	10	1	5	3	3	2	7	2	1	1 x 200 m offshore boom per unit
No. skimmers required	9	14	10	1	5	3	3	2	7	2	1	1 x skimmer per unit
No. offshore ISO tanks required	18	28	20	2	10	6	6	4	14	4	2	2 x 4,000 litre ISO storage tanks per unit, stowed on deck
No. storage bladders required	9	14	10	1	5	3	3	2	7	2	1	1 x 25 m^3 inflatable storage bladder towed alongside the deployment vessel per unit
Waste												
Predicted oil recovery rate per unit (m^3/week)	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	79.4	Predicted daily oil recovery rate per unit x Operational days per week
Predicted water recovery rate per unit (m^3/week)	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	7.94	Predicted daily water recovery rate (based on skimmer effectiveness) x Operational days per week
Predicted total waste (oil and water) recovery rate per unit (m^3/week)	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	Total oil and water recovery rate
Total liquid oily waste generated (m^3/week)	786	1,223	873	87	437	262	262	175	611	175	87	Total oil and water recovery rate x No. of containment and recovery units required *Note: Week 1 is based on ramp-up of response in week 1 – refer to Section 12.3.2).*
Liquid oily waste – oil component (m^3/week)	707	1,100	786	79	393	236	236	157	550	157	79	Proportion of total liquid oily waste that is oil (90%)
Liquid oily waste - water component (m^3/week)	79	122	87	9	44	26	26	17	61	17	9	Proportion of total liquid oily waste that is water (10%)

12.4 Containment and recovery implementation plan

The minimum components required for implementing offshore containment and recovery operations are detailed in Table 12-5.

For planning purposes, a J-Sweep configuration (Figure 12-1) using two vessels; one deployment vessel and one towing vessel, is assumed for each containment and recovery unit.

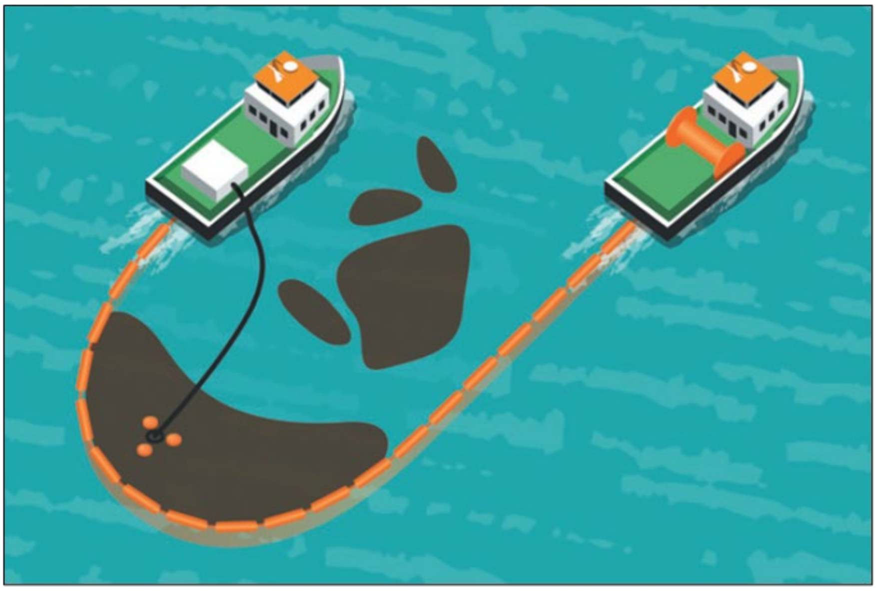

Figure 12-1: 'J' Configuration for Containment and Recovery Operations

Source: IPIECA (2016b)

The deployment vessel will have onboard an offshore containment boom, offshore skimmer and a temporary storage capacity of 33 m³. The deployment vessel will be tasked to carry out the deployment of boom, skimmer and towable temporary storage barge (if required) using the towing vessel for support. If required (depending on vessel type), 33 m³ of liquid oily waste temporary storage will be achieved using 1 x 25 m³ towable storage barge and 2 x 4 m³ offshore rated ISO tanks for each containment and recovery unit. The proposed vessel deck layout plan is shown in Figure 12-2.

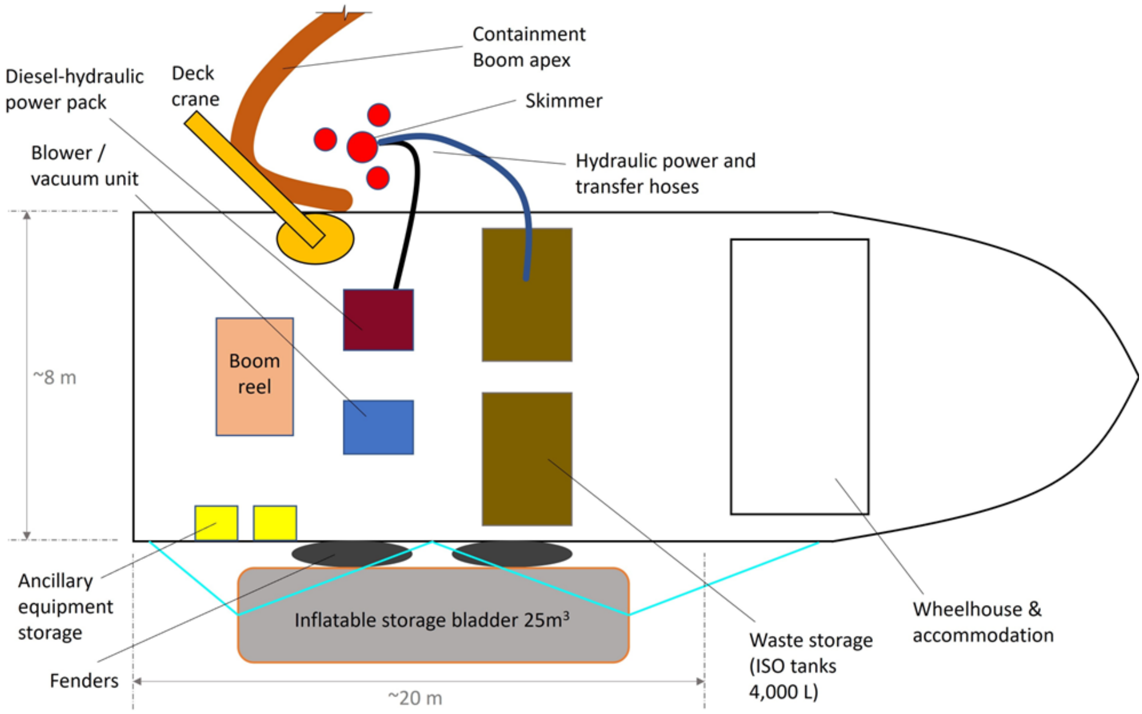

Figure 12-2: Containment and recovery vessel deck layout plan

Source: OSRL (2021)

The use of vessels of an appropriate specification is essential to ensure successful containment and recovery operations. The required specifications for deployment and towing vessels are defined in Table 7-1 and in Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001).

Table 12-7: Containment and recovery vessels specification

Deployment vessels specification	Towing vessels specification
• Clear deck space of at least 20 m x 8 m (to safely load, secure and deploy equipment) • Deck crane, capacity of ~1–2 t with 2 m reach • Minimum bollard pull of 8 t • Open stern (to allow pay-out of boom) • Ability to manoeuvre and tow at low speed • Accommodation and shelter for crew	• Ideally smaller vessel size than deployment vessel, to aid in manoeuvrability • Minimum bollard pull of 8 t • Suitable towing attachment point

The resources available to carry out containment and recovery operations are detailed in Table 12-4. Considering the requirement of one 200 m offshore boom and one offshore skimmer for each containment and recovery unit, Santos has access to sufficient resources through the arrangements with AMOSC, AMSA and OSRL.

Offshore temporary waste storage requirements for containment and recovery operations are assumed to be 33 m^3 per day on each containment and recovery unit. Temporary waste storage volumes could potentially be reduced through decanting of water during operations (refer to Section 12.5), however, it is assumed for worst-case planning purposes that decanting permission may not be granted by the relevant authority. It is assumed that temporary storage solutions from the OSRO stockpiles and Santos resources are required for each deployment vessel, in the event that vessels with integrated recovered oil storage tanks are not available, to meet the temporary storage requirements as per the configuration shown in Figure 12-1. The requirements can be met with the resources from Santos, AMOSC and AMSA as shown in Table 12-4.

Liquid waste collection, transport and final disposal of waste received at port will be through Santos' Waste Service Provider (as detailed in Section 18).

To ensure availability of appropriate vessels, the Santos Marine Logistics team maintains numerous service arrangements including MSAs with vessel operators, access to the IHS Maritime Portal and a service agreement with Clarksons for the provision of offshore market intelligence.

The IHS Maritime Portal allows Santos to access the real-time location of any vessel anywhere in the world which is transmitting an AIS signal. Through this portal, Santos can identify vessels in the region via the map function and access details about the basic specifications of the vessel along with the name of the vessel operator. Santos maintains MSAs with numerous vessel operators in Australia for the provision of marine services. The MSAs set out the high-level terms and conditions of engagement between the entities and will be used to gain access to additional vessels to support spill response activities. Through Clarksons Santos maintains offshore market intelligence globally with a focus on the south-east Asia region. The Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) provides full details of the process by which Santos monitors vessel availability for oil pollution emergency response to ensure vessel requirements can be met in the event of a spill.

For a sustained operation, it may be necessary for daily transfer of recovered oil onboard containment and recovery deployment vessels to a larger waste storage/transfer vessel (as per the waste transfer concept of operations – refer to 7710-650-ERP-0001). This would be achieved through the use of a barge or platform supply vessel (PSV) which would act as a temporary offshore waste oil storage vessel, before transiting to an approved port for waste transfer. Santos can gain access to barges and PSVs locally.

12.5 Decanting

Decanting is an important tool needed to make efficient use of waste management resources which are often a limiting factor in containment and recovery operations. The reduction of overall waste in some circumstances can create an environmental benefit which outweighs the minimal impact caused by the release of water with very low concentrations of oil.

Section 8 of the *Pollution of Waters by Oils and Noxious Substances (POWBONS) Act 1987* allows for decanting of combating specific pollution incidents. Additionally, Annex 1 of MARPOL (Regulation 9) allows for decanting of combating specific pollution events to minimise the damage from pollution. Under both MARPOL and POWBONS, decanting must be approved by the relevant Jurisdictional Authority. In State waters, this is DTMI (as the Hazard Management Agency under the *Emergency Management Act 2005*) and in Commonwealth waters, this is AMSA. Approval will be sought if decanting is required.

If decanting approval is not obtained through AMSA/DTMI, the complete collected oil and water will remain in the collection tanks and will be treated as waste. In this event, the duration of containment and recovery operations may be reduced due to restricted available sullage.

12.6 Environmental performance

Table 12-8 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-8: Environmental performance – containment and recovery

Environmental Performance Outcome	Implement containment and recovery tactics to reduce hydrocarbon contact to surface and shoreline PPAs.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
Offshore Containment and Recovery	**Response Preparedness**		
	Access to Santos containment and recovery equipment and personnel	[EPS-CR-001] Santos personnel and equipment stored and maintained / available as per Table 12-4.	Santos oil spill response team database; Santos equipment register; Exercise reports.
	Access to containment and recovery equipment and personnel	[EPS-CR-002] Maintenance of access to containment and recovery equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG maintained throughout activity as specified in Table 12-4.	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG Arrangements
	Waste disposal capability for containment and recovery operations in place	[EPS-CR-003] Contract for access to waste storage, transport and disposal services in place during the activity	Waste service provider contract
	Offshore waste transfer concept of operations in place.	[EPS-CR-004] Offshore waste transfer concept of operations to help maximise waste storage availability for containment and recovery vessels.	Waste transfer concept of operations (within Santos Vessel Requirements for Oil Spill Response [7710-650-ERP-0001]).
	Vessel capability for containment and recovery operations	[EPS-CR-006] Santos maintains MSAs with multiple vessel providers.	MSAs with multiple vessel providers
	Containment and recovery vessel requirements are identified	[EPS-CR-005] Maintenance of vessel specification for offshore containment and recovery vessels and waste storage and transport vessels	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response Implementation		
	First strike capability mobilised	[EPS-CR-007] First strike is mobilised in accordance with details and timings as specified in Table 12-5.	Incident log
	Aerial surveillance information to direct operations to areas with the greatest oil concentration	[EPS-CR-011] Aerial surveillance reports communicated to containment and recovery Team Leaders.	Incident log
	Decanting to maximise waste storage whilst minimising environmental impact and	[EPS-CR-008] Decanting operation not to commence until approved. Application for offshore decanting is made to AMSA (Commonwealth waters) or DTMI (State	Written decanting approval; Incident Log.

Environmental Performance Outcome	Implement containment and recovery tactics to reduce hydrocarbon contact to surface and shoreline PPAs.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	adhering to State and Commonwealth legislation	waters). Decanting of collected water by returning to boom apex collection area, to maximise waste storage.	
	Prepare operational NEBA to determine if containment and recovery activities are likely to result in a net environmental benefit	[EPS-CR-012] Records indicate operational NEBA completed prior to containment and recovery activities commencing. NEBA will consider the oil thickness and weather constraints as key factors. Operational NEBA to be undertaken each operational period.	Incident log; IAP

13. Chemical dispersant application plan

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

Table 13-1: Chemical dispersant application – objectives, initiation criteria and termination criteria

Environmental Performance Outcome	Implement dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities	
Initiation criteria	Level 2 or 3 spills where shorelines with identified protection priority areas will potentially be contacted.	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✗	✓1
Termination criteria	• Application of chemical dispersants will cease when dispersant efficacy is no longer providing a net environmental benefit as assessed through the NEBA process, and • Agreement is reached with Jurisdictional Authorities to terminate the response	

13.1 Overview

Surface application of dispersants is considered a potentially applicable response strategy for large (Level 2/3) spills of Caley Crude (see Section 6.4). Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50 - 100 g/m². Stochastic modelling demonstrates that the maximum distance floating oil at, or above ≥50g/m² would drift from the release location was predicted as 184 km for the subsea LOWC scenario (Caley crude) from the Curie location. Deterministic modelling demonstrated that the maximum area with floating oil ≥50g/m² was predicted as 171 km² from the Ara LOWC scenario, occurring on day 17 of the simulation. The modelling predicted that the area on the surface ≥50 g/m² varied day-to-day as the oil weathered. Based on these predictions, surface dispersant is recommended as a response option for LOWC scenarios based on the large area that may be amenable to dispersant for periods of time throughout the duration of a LOWC release.

Dispersants are chemicals that are sprayed onto floating oil slicks by vessels and/or aircraft. Dispersants are designed to separate the oil into small droplets and assist with dispersion in the water column to speed up the process of natural biodegradation. Chemical dispersants can be used to:

- decrease the concentration and volume of surface oil reaching sensitive receptors
- increase the natural biodegradation rate
- reduce the quantity of waste created.

The operational NEBA process will consider potential impacts of both oil and dispersant on sensitive receptors, taking into account information gained from monitor and evaluate activities. This will inform decisions on dispersant use throughout the response, including application location(s), the volumes and rates at which dispersant is applied, and when to limit or stop dispersant use.

13.2 Surface chemical dispersants

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50 - 100 g/m² on the sea surface. EMSA (2010) recommends thin layers of spilled hydrocarbons should not be treated with dispersant. This includes BAOACs 1 to 3 (EMSA, 2010) (Table 13-2). IPIECA (2016a) recommends that the thickest areas of oil should be targeted for surface dispersant application.

13.2.1 Dispersant application area

The base case for surface dispersant application is that no application is to occur:

- within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application permitted in the Multiple Use Zone);
- within State Marine Parks;
- within State Waters;
- within 10 km of water depths <10 m LAT;
- within exclusion zones of offshore facilities.

Table 13-2: Bonn Agreement oil agreement appearance codes

Code	Description	Layer Thickness (µm)	Litres per km²
1	Silvery sheen	0.04 to 0.30	40 to 300
2	Rainbow sheen	0.30 to 5.00	300 to 5,000
3	Metallic	5 to 50	5,000 to 50,000
4	Discontinuous true oil colour	50 to 200	50,000 to 200,000
5	Continuous true oil colour	More than 200	More than 200,000

13.3 Vessel-based dispersant operations

13.3.1 Implementation Guidance

Table 13-3 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic.

Table 13-4 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 dispersant operations are listed in Table 13-5. 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 13-3: Implementation guidance – vessel dispersant application

Action		Consideration	Responsibility	Complete
Initial Actions	Confirm operational NEBA supports surface chemical dispersant application.	Oil type suits dispersant application. Surveillance to confirm oil spill thickness supports use of dispersants from vessels (e.g. BAOAC 4 to 5). Liaise with third party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available. Guidance is provided as per AMSA guideline: Obtaining approval to use an oil spill control agent at sea or on a shoreline (AMSA, 2022)	Planning Section Chief Environment Unit Leader	☐
	For dispersant use in State waters – seek approval from DTMI. If dispersant use in Commonwealth waters could impact State waters, notify DTMI.	Approval is required from the HMA/SMPC if dispersant is to be used in State waters – refer to Section 4.6.2. The DTMI SMPC requests early notification if use of dispersant in Commonwealth waters could impact State waters – refer to Section 4.6.2.	Planning Section Chief	☐
	Activate Joint Industry OM4a: Surface Dispersant Effectiveness Monitoring via the OSM Services Provider (refer to North West Shelf OSM-BIP [7715-650-ERP-0002], Section 12)	Initiation criteria for OM4a: Surface Dispersant Effectiveness Monitoring is as follows: • Application of dispersant has been selected as a response option. • Therefore, this OMP requires immediate activation via the North West Shelf OSM-BIP (7715-650-ERP-0002), Section 12. • Note that the 'shake test' assessment does not form part of OM4a: Surface Dispersant Effectiveness Monitoring and is usually performed as an initial assessment of dispersant efficacy.	Planning Section Chief Environment Unit Leader	☐
	Source vessel/s for dispersant application and mobilise to nearest port for loading equipment and personnel (Exmouth or Dampier).	Vessel specification for dispersant vessels provided in ER Intranet – First Strike Resources and within Santos Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001).	Logistics Section Chief	☐
	Mobilise dispersant operations Team Leaders and Team Members (Santos Core Group and/or AMOSC staff/ Industry Core Group) to designated port.	Each vessel undertaking dispersant application is to have personnel trained in dispersant application (e.g. AMOSC staff, Santos or Industry Core Group member) who is the Team Leader tasked with controlling the operations and implementing in a safe and responsible method. For prolonged dispersant operations, OSRL responders via Singapore may also be used.	Logistics Section Chief	☐
	Mobilise vessel-based dispersant application equipment and dispersant shake test kits to the designated deployment port.	Dampier Supply Base/ Exmouth Freight & Logistics to assist with local logistics and vessel loading of vessel spray systems and dispersant movement in Exmouth.	Logistics Section Chief	☐
	Mobilise AMOSC (Exmouth)/ AMSA (Karratha) dispersant stock to nominated vessel deployment location (Exmouth and/or Dampier ports).	Check up to date dispersant stockpile inventories can be accessed via ER Intranet – First Strike Resources.	Logistics Section Chief	☐

Action		Consideration	Responsibility	Complete
	Use aerial surveillance to determine priority areas for dispersant application an define operational area for response.	Aerial surveillance reports of oil location and thickness.	Planning Section Chief Operations Section Chief	☐
	Identify safety requirements and controls associated with spraying dispersants and working over oil.	-	Safety Officer	☐
	Ensure shake jar test is conducted in-field to determine likely effectiveness of dispersant application and report results to IMT	Refer to NP-GUI-013: National Plan oil spill dispersant effectiveness field test kit operational guide, for guidance on how to conduct a dispersant field test.	Operations Section Chief	☐
	First vessel onsite is to test spray dispersant on the oil – confirm effectiveness.	Effectiveness to be recorded with photos.	Operations Section Chief	☐
	Confirm operational NEBA supports surface chemical dispersant application.	Use forecast modelling, monitor and evaluate data and dispersant efficacy results in operational NEBA.	Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	If dispersant application is shown to be effective and approved for ongoing use by the Incident Commander, continue vessel operations and defining operational area.	Use real-time or most recent visual surveillance observation data to develop operational zones for vessel dispersant operations. The base case restrictions for dispersant application are – no application: • Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone) • Within State Marine Parks • Within State Waters • Within 10 km of water depths <10 m LAT • Within exclusion zones of offshore facilities The above applies unless justified otherwise by the Operational NEBA, noting that no application is allowed in AMPs (outside multi-use zone) or State waters without relevant authority approval (refer to Section 4.6.2 for the process on obtaining consent for dispersant use in State waters and on notification to DTMI of use in adjacent Commonwealth waters).	Incident Commander Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	Monitor for efficacy using the SMART Protocol (Section 13.7) as described in OM4a: Surface Dispersant Effectiveness Monitoring and provide results to the IMT.	Initial monitoring is likely to only include Tier I (visual monitoring) of the SMART Protocol. Observers trained in visual observation techniques should be used.	Operations Section Chief	☐
Ongoing Actions	Reassess dispersant use, utilising the NEBA process for each operational period. Cease application if no net environmental benefit.	-	Incident Commander Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
			Environment Unit Leader Planning Section Chief	
	Continue to mobilise additional chemical dispersant stocks.	Refer to dispersant supply and logistics plan summary (Appendix Q)	Logistics Section Chief	☐
	Maintain operational zones and provide updates to Vessel Masters on most suitable locations for application.	-	Operations Section Chief Environment Unit Leader Planning Section Chief	☐

Table 13-4: Vessel dispersant application – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos Vessel Dispersant Spray Systems	Santos owned	2x containers (each c/w 3x systems – dual arm, single arm & Afedo head)	Exmouth (Exmouth Freight & Logistics) Dampier (Toll Supply Yard)	Within 48 hours mobilised to port
AMOSC Vessel Dispersant Spray System	AMOSC	1) Afedo Spray systems 2) Vikospray 3) Boom vane 4) Global Dispersant spray system	1) Broome – 2; Exmouth – 1; Fremantle – 5; Geelong – 4 2) Exmouth – 1; Geelong – 2; Fremantle - 3 3) Fremantle – 1; Geelong – 1 4) Fremantle – 1	Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12
AMSA Vessel Dispersant Spray System	AMSA	Ayles Fernie Boat Spray	Darwin – 2; Karratha – 2; Fremantle – 2	Access to National Plan equipment[29] through AMOSC[30] Equipment mobilisation times vary according to stockpile location..
Dispersant stocks	AMOSC[31]	Refer to Table 13-16		Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12

[29] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[30] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

[31] *The latest AMOSC equipment listings are available through AMOSC Members Hub: https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	AMSA	Refer to Table 13-16		Access to National Plan equipment through AMOSC.
Dispersant spray system vessels	Santos contracted vessel providers Preference for vessels used in Santos deployment exercises	Varies – check through vessel contractors/ Santos vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability
Dispersant shake test kits	Santos	2 x systems at each location	Exmouth (Exmouth Freight & Logistics) Dampier Supply Base	Mobilised to port within 48 hours
Personnel (field responders) for OSR strategies.	AMOSC Staff	12	Fremantle: 5 Geelong: 7	Response via Duty Officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel is dependent on location of the spill and transport to site.
	AMOSC Core Group (Santos)	16	Perth/NW locations: 14 Port Bonython (SA): 2	From <12 hours (NW shelf based personnel) From <24 hours (Perth personnel) <48 hours to WA locations (Perth-based personnel)
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations across Australia	Location dependent; confirmed at time of activation

Table 13-5: Vessel based dispersant application – first-strike response timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and begins sourcing vessel dispersant resources for applicable spills	<3 hours
Suitable Dispersant Vessels mobilised to nearest deployment port (Exmouth and/or Dampier)	<48 hours
Santos Offshore Core Group mobilised to deployment port (Exmouth and/or Dampier)	<48 hours
Vessel spray system equipment mobilised to deployment port	<48 hours
Dispersants mobilised to port	<48 hours
Vessel spray operation commenced at spill site (weather/daylight dependent)	<72 hours
Minimum Resource Requirements	
• Suitable dispersant application vessel - refer Santos Offshore ER Intranet for vessel specification • One vessel dispersant spray system • Dispersant (10 m^3) • 2x trained responders • Personal protective equipment (PPE)	

13.4 Aerial dispersant operations

13.4.1 Implementation guidance

Table 13-6 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 13-7 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 dispersant operations are listed in Table 13-8. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-6: Implementation guidance – aerial dispersant application

Action		Consideration	Responsibility	Complete
Initial Actions	Confirm operational NEBA supports surface chemical dispersant application.	Oil type suits dispersant application. Surveillance to confirm oil spill thickness supports use of dispersants from vessels (e.g. BAOAC 4 to 5). Liaise with third party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available. Guidance is provided as per AMSA guideline: Obtaining approval to use an oil spill control agent at sea or on a shoreline (AMSA, 2022)	Planning Section Chief Environment Unit Leader	☐
	For dispersant use in State waters – seek approval from DTMI. If dispersant use in Commonwealth waters could impact State waters, notify DTMI.	Approval is required from the HMA/SMPC if dispersant is to be used in State waters – refer to Section 4.6.2. The DTMI SMPC requests early notification if use of dispersant in Commonwealth waters could impact State waters – refer to Section 4.6.2.	Planning Section Chief	☐
	Activate Joint Industry OM4a: Surface Dispersant Effectiveness Monitoring via the OSM Services Provider (Refer to North West Shelf OSM-BIP [7715-650-ERP-0002], Section 12)	Initiation criteria for OM4a: Surface Dispersant Effectiveness Monitoring is as follows: • Application of dispersant has been selected as a response option. Therefore, this OMP requires immediate activation via the North West Shelf OSM-BIP (7715-650-ERP-0002) , Section 12). Note that the 'shake test' assessment does not form part of OM4a: Surface Dispersant Effectiveness Monitoring and is usually performed as an initial assessment of dispersant efficacy.	Planning Section Chief Environment Unit Leader	☐
	Mobilise initial resources for aerial application. After initial AMOSC notifications are complete, contact AMOSC Duty Officer and confirm requirements for these resources: • Access to and mobilisation of required AMOSC dispersant stocks and associated equipment into Exmouth (AMOSC will arrange through their contracted transport provider). • Activation of the Fixed Wing Aerial Dispersant Capability (FWADC) (AMOSC will activate this on behalf of Santos). • Provision of trained spill responders to support operations (AMOSC Staff and Core Group).	Refer Joint Standard Operating Procedures for FWADC. AMOSC will deploy appropriate aircraft to a designated airstrip close to the spill location (e.g. Port Hedland, Broome, Dampier, Learmonth or Exmouth Airports), and arrange for pilots, Air-Attack Supervisors, observation aircraft (one per two attack aircraft) and trained observers.	Air Operations Branch Director Logistics Section Chief Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
	Finalise Fixed Wing Air Operations Plan and Air Operations Plan in consultation with AMOSC, AMSA, Aerotech First Response and other stakeholders and AMSA.	Ensure flight schedule in Air Operations Plan considers requirements for other activities such as aerial surveillance sorties.	Operations Section Chief Air Operations Branch Director Planning Section Chief	☐
	Using real-time or most recent visual surveillance observation data, develop operational zones for aerial dispersant operations.	Focus on applying dispersant to areas of slick that threaten priority receptors and are of a sufficient thickness whereby chemical dispersants will be effective. The base case restrictions for dispersant application are – no application: • Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone) • Within State Marine Parks • Within State Waters • Within 10 km of water depths <10 m LAT • Within exclusion zones of offshore facilities The above applies unless justified otherwise by the Operational NEBA, noting that no application is allowed in AMPs (outside multi-use zone) or State waters without relevant authority approval (refer to Section 4.6.2 for the process on obtaining consent for dispersant use in State waters and on notification to DTMI of use in adjacent Commonwealth waters).	Operations Section Chief Incident Commander Environment Unit Leader Planning Section Chief	☐
	Ensure shake jar test is conducted in-field to determine likely effectiveness of dispersant application and report results to IMT	Refer to NP-GUI-013: National Plan oil spill dispersant effectiveness field test kit operational guide, for guidance on how to conduct a dispersant field test.	Operations Section Chief	☐
	Depending on the results of the shake jar test, aircraft are deployed to conduct a test spray (if vessel-based test is unavailable). Monitor for efficacy using the SMART Protocol (Section 13.7) as described in OM4a: Surface Dispersant Effectiveness Monitoring and provide results to the IMT.	Initial monitoring is likely to only include Tier I (visual monitoring) of the SMART Protocol. Observers trained in visual observation techniques should be used.	Operations Section Chief	☐
	Conduct aerial dispersant spraying reporting effectiveness to IMT.	-	Operations Section Chief Planning Section Chief	☐
Ongoing Actions	Conduct operational NEBA during each operational period to reassess effectiveness of application rates and dispersant efficacy.	-	Environment Unit Leader Planning Section Chief	☐

Action		Consideration	Responsibility	Complete
	Continue to mobilise additional chemical dispersant stocks.	Refer to dispersant supply and logistics plan summary (Appendix Q)	Logistics Section Chief	☐
	Maintain operational zones and provide updates to pilots on most suitable locations for application.	-	Operations Section Chief Environment Unit Leader Planning Section Chief	☐

Table 13-7: Aerial dispersant application – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Aerotech First Response fixed wing aircraft, pilots and ground crew (Trained field response personnel - surge capacity; details provided in Appendix R: Cumulative Response Capability Assessment)	AMOSC - Fixed Wing Aerial Dispersant Contract	4 under FWADC contract Additional aircraft potentially available through Aerotech First Response	Operations from Learmonth or Onslow airbase Aircraft initially mobilised from four bases around Australia: • Jandakot (WA) • Batchelor (NT) • Parafield (SA) • Scone (NSW)	4 x air contractors to have wheels up in 4 hours from locations around Australia. Mobilisation times depend on the flight time from the location of the aircraft. Supporting equipment mobilisation (dispersants etc.) as per equipment mobilisation timeframes (Table 10-12)
Hercules C130 aircraft (Trained field response personnel - surge capacity; details provided in Appendix R: Cumulative Response Capability Assessment)	OSRL	One aircraft	Senai, Malaysia	Wheels up in six hours Total flight time from Senai (JHB) to Karratha (KTA) is 14 hours (including one technical stop at Darwin).
Air attack (and SAR) helicopter	Santos contracted helicopter provider/s + contracted fixed wing	2 (contracted) + additional subject to availability	Karratha (primary base) Learmonth Onslow	Wheels up within one hour for Emergency Response
Dispersant	AMOSC	Refer to Table 13-16		Response via duty officer within 15 minutes of first call – AMOSC personnel available within one hour of initial activation call; for equipment mobilisation timeframes refer to Table 10-12

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	AMSA	Refer to Table 13-16		Access to National Plan equipment[32] through AMOSC[33]. Equipment mobilisation times vary according to stockpile location.
FWADC operational personnel include Air Attack Supervisor and Dispersant Coordinator	AMOSC and subcontractors via Fixed Wing Aerial Dispersant Contract	AMOSC staff + contractors as per FWADOps Plan (AMOSC, 2022)	AMOSC Fremantle AMOSC Geelong	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
Search and Rescue (SAR) vessel (can be double use vessel)	Santos contracted vessel providers.	Varies – check through vessel contractors/ Santos vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability

[32] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[33] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources*

Table 13-8: Aerial dispersant application- first strike response timeline

<table>
<tr><th>Task</th><th>Time from IMT call-out</th></tr>
<tr><td>IMT confirms applicability of strategy and activates Fixed Wing Aerial Dispersant Capability (FWADC)</td><td><3 hours</td></tr>
<tr><td>AMOSC to mobilise Fixed Wing aircraft to nominated airbase</td><td><12 hours</td></tr>
<tr><td>AMOSC to mobilise dispersants to nominated airbase</td><td><24 hours</td></tr>
<tr><td>AMOSC to mobilise all FWADC capability personnel to nominated airbase</td><td rowspan="4"><48 hours (weather/daylight dependent)</td></tr>
<tr><td>AMOSC/Santos to mobilise air attack/ aerial observation aircraft to nominated airbase to support air-attack surveillance</td></tr>
<tr><td>AMOSC/Santos to mobilise vessel to nominated port to provide SAR support</td></tr>
<tr><td>First FWADC test spray</td></tr>
<tr><td colspan="2">Minimum Resource Requirements</td></tr>
<tr><td colspan="2">

1 fixed wing aircraft (Aerotech First Response)
1 air attack / aerial observation aircraft
1 SAR Vessel
WA AMOSC dispersant stocks to deployment airbase (refer to Table 13-3 and Appendix Q)
AMOSC contracted FWADC capability personnel:

Pilots
Air Attack Supervisor
Aerial Observer
FOB Commander
Airbase Manager
Dispersant Coordinator
Dispersant Loading Crew
Log/ Admin.

</td></tr>
</table>

13.5 Subsea dispersant injection operations

SSDI has been observed to break-up oil droplets, forcing greater entrainment of the oil into the water column below the sea surface (Adams *et al.*, 2013). SSDI has additional benefits over surface dispersant application including its ability to reduce volatile organic compounds in the vicinity of a spill, making the area safer for responders (IPIECA, 2015; French-McCay *et al.*, 2021) and enabling them to bring the release under control quicker (e.g. via Capping Stack for subsea wells) and reducing the overall volume of hydrocarbons being released into the environment. It typically requires smaller volumes of dispersant to be used as it has a higher encounter rate with the hydrocarbons than surface application. SSDI can also be used day and night; whereas surface application via vessel or aircraft can only occur during daylight hours.

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

Personnel resources for SSDI are provided in Table R-1 (Cumulative Response Capability Assessment - Appendix R).

13.5.1 Implementation guidance

Table 13-9 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Mobilisation times for the minimum resources that are required to commence initial SSDI operations are listed in Table 13-11. The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 13-9: Implementation guidance – subsea dispersant injection

Action		Consideration	Responsibility	Complete
Initial Actions	Confirm operational NEBA supports subsea chemical dispersant injection.	As described in Section 6.4, subsea dispersant application has been identified as secondary strategy for subsea LOWC scenarios only. The operational NEBA will identify if this strategy is activated. Use forecast modelling and any operational monitoring results in operational NEBA. Guidance is provided as per AMSA guideline: Obtaining approval to use an oil spill control agent at sea or on a shoreline (AMSA, 2022).	Incident Commander Operations Section Chief Environment Unit Leader Planning Section Chief	☐
	For dispersant use in State waters – seek approval from DTMI. If dispersant use in Commonwealth waters could impact State waters, notify DTMI.	The DTMI SMPC requests early notification if use of dispersant in Commonwealth waters could impact State waters – refer to Section 4.6.2.1.	Planning Section Chief	☐
	Activate Joint Industry OM4b: Subsea Dispersant Injection Effectiveness Monitoring via the OSM Services Provider (Refer to North West Shelf OSM-BIP [7715-650-ERP-0002], Section 12)	Initiation criteria for OM4b: Subsea Dispersant Injection Effectiveness Monitoring is as follows: • Application of dispersant has been selected as a response option. Therefore, this OMP requires immediate activation via the North West Shelf OSM-BIP (7715-650-ERP-0002), Section 12).	Planning Section Chief Environment Unit Leader	☐
	If viable and if the Operational NEBA supports SSDI, activate Subsea First Response Toolkit (SFRT) equipment and activate Oceaneering personnel for deployment.	As described in Section 6.4, SSDI is considered a secondary response strategy for a subsea LOWC for this activity. Separate contracts in place for SFRT (AMOSC) and Oceaneering.	Designated call-out authority (Incident Commander) Source Control Branch Director	☐
	Refer to Section 9.2.2.6 for implementation guidance associated with the SFRT.			
	If viable, conduct initial ROV survey at the release point to determine the nature of the release, behaviour of the oil, estimate the oil and gas flow rates and determine DOR for injection.	Information to be used to help determine injection method/s.	Operations Section Chief Source Control Branch Director	☐
	If viable, commence dispersant subsea injection adjusting DOR based on real-time monitoring.	-	Operations Section Chief Source Control Branch Director	☐
	Continue operational monitoring (including operational water quality monitoring and surveillance) near the release point to help determine dispersant effectiveness.	Use guidance provided in OM4b: Subsea Dispersant Injection Effectiveness Monitoring to determine subsea dispersant efficacy. Surveillance should have commenced prior to any dispersant being added to the release so that changes	Source Control Branch Director Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
		and efficacy can be determined. Once baseline data has been collated, commence injection to help determine DOR and modify accordingly.		
	If dispersant application is shown to be effective and approved by the Incident Commander, continue operations.	-	Source Control Branch Director Operations Section Chief Incident Commander	☐
Ongoing Actions	Reassess dispersant use, utilising the NEBA process for each operational period. Cease application if no net environmental benefit.	Continue to use forecast modelling, operational monitoring data and dispersant efficacy results in operational NEBA.	Source Control Team Leader Operations Section Chief Incident Commander Planning Section Chief Environmental Unit Leader	☐

Table 13-10: Subsea dispersant injection – first strike response timeline

Task	Time from IMT call-out
IMT Source Control Branch activated	<24 hours
If viable response strategy, suitable SFRT-dispersant injection vessel/s mobilised to Dampier	<10 days
If viable response strategy, Oceaneering to mobilise personnel to Dampier	<10 days
If viable response strategy, AMOSC to mobilise SFRT and dedicated dispersant to Dampier	<10 days
If viable response strategy, load equipment, steam to site and commence SSDI	<12 days
Minimum Resource Requirements	
• Suitable vessel and crew; • SFRT; • Dispersant (with SFRT); • Oceaneering personnel.	

13.6 Dispersant selection process

13.6.1 Dispersant use

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

Most of the knowledge on the biological impacts of dispersants has been developed via laboratory experiments (Quigg et al., 2021) rather than from in-situ use. This is also the case for those dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA). Before a dispersant can be considered for use by AMSA, its toxicological impact must be tested on a diverse range of aquatic taxa, including algae, invertebrates and fish (Hook & Lee, 2015). This screening process ensures that these compounds have comparatively low toxicity (according to US Environmental Protection Agency criteria; Hemmer et al., 2011) and that they are much less toxic than oil (Hook & Lee, 2015).

Although surface dispersants have been used as an oil spill response technique for multiple spills across the globe since the 1970s, there is a lack of information about the long-term consequences of dispersant use in the marine environment (Quigg et al., 2021). However, the available research has found no compelling evidence that at low to moderate oil concentrations that chemically dispersed oil was any more toxic than oil alone (NASEM, 2020). However, at high concentrations the combination of oil and dispersant appeared more toxic (Quigg et al., 2021), suggesting caution should be applied when considering dispersant application rates and volumes. This also shows the importance of ongoing dispersant effectiveness monitoring (Section 13.7) and its application through the operational NEBA process.

13.6.2 Dispersant selection

Chemical dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA) are to be prioritised for use. OSCA listed dispersants are readily available to Santos from AMOSC, OSRL and AMSA. These include Slickgone NS, Slickgone EW, Corexit EC9500A, Corexit 9527 (transitional acceptance) and Finasol 52. As described in Section 13.8, there are sufficient stockpiles of these dispersants in Australia to service the entire duration of surface application. Safety data sheets for these products are available at the AMSA register of oil spill control agents, and for Corexit 9527 (which has transitional acceptance), at the manufacturer's website.

If dispersant types additional to those on the OSCA register are required, Santos will use its Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) before application. The procedure requires a dispersant to be risk assessed and deemed environmentally acceptable. The criteria used for environmental acceptability includes aquatic toxicity, biodegradation and bioaccumulation potential data. Finasol OSR 52 has been pre-assessed as low risk using this procedure and therefore is designated as acceptable for use.

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

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

During a response, chemical dispersant shall be tested on the released oil at a laboratory as part of the initial operational monitoring (refer to Section 17) as well as through field testing using dispersant shake test kits/ vessel-based spray systems. The DBCA ESC can also advise on the location of AMSA National Plan Dispersant Effectiveness Test Kits, which could be used in addition to Santos' dispersant efficacy testing resources.

13.7 Dispersant Effectiveness Monitoring

Santos will conduct dispersant effectiveness monitoring in accordance with the North West Shelf OSM-BIP (7715-650-ERP-0002) Joint Industry OSM Framework (APPEA, 2021). For surface dispersant, this calls for the implementation of the OM4a: Surface Dispersant Effectiveness Monitoring. This monitoring is conducted after the initial shake test and is based on the SMART protocol. For subsea dispersant, the OM4b: Subsea Dispersant Injection Effectiveness Monitoring is implemented, which is based on the Industry Recommended Subsea Dispersant Monitoring Plan. Refer to Section 17, the North West Shelf OSM-BIP (7715-650-ERP-0002), and the relevant OMPs for further information.

13.8 Surface dispersant supply and logistics requirements

13.8.1 Aerial dispersant application resourcing

The resourcing needs for aerial surface dispersant application have been estimated using the Santos response needs calculator. The basis of the calculation is the well flow rate, in m^3 per day for the duration of the modelled scenario. For the purposes of dispersant application estimation, a constant flow rate throughout has been assumed in Table 13-11. The calculator assumes that all oil will be expressed at the sea surface. It should be noted that the response needs calculator is a tool for planning purposes to assist with worst-case resources estimation using the oil spill modelling results. In a real pollution emergency response, the actual resources deployed will take account of a multitude of factors including monitor and evaluate data, operational monitoring data, operational NEBA outcomes, other response strategies considered/ deployed and regulatory bodies and stakeholders.

The response needs calculator input, output and assumptions for aerial dispersant operations are provided in Table 13-11. For the Bedout multi well drilling activities, the worst-case LOWC scenario for surface dispersant is considered to be a surface blowout in the Mestrel/Bancroft operational area, as this is the highest flowrate of the credible worst case LOWC scenarios considered for the activities (17,757 m^3/day). The aerial dispersant response assumes that 4 x AT-802 aircraft will be available through the AMOSC fixed wing aerial dispersant capability (FWADC) (AMOSC, 2022), and will commence operations on day 3, with a test spray taking place within 48 hours as per the first strike mobilisation (refer to Table 13-8). The OSRL C-130A Hercules aircraft, mobilised from OSRL Singapore (Senai International Airport [JHB]), is also assumed to be available to Santos, and will also commence operations on day 3 (total flight time from Senai to Karratha [KTA] is 14 hours, which includes one technical stop at Darwin [DRW]).

Sorties are assumed to take place 7 days per week with 3 sorties per day for each aircraft, however in the first week of response, 5 operational days are assumed, as dispersant resources are mobilised into position at Karratha airport, which will be the FOB for aerial dispersant operations.

The response needs calculator indicates a total dispersant use of 5,625 m^3 from aerial application throughout the duration of the response (Table 13-11) (also refer to Appendix Q - Dispersant Supply and Logistics Plan).

The personnel requirements for the AMOSC FWADC are shown in Table 13-12 and the OSRL C-130A personnel requirements in Table 13-13.

Table 13-11: Response needs calculation output for surface dispersant application (aerial) for the Bedout Multi Well drilling activity LOWC scenario

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Well flow rate (m^3/week)	124,299	124,299	124,299	124,299	124,299	124,299	124,299	124,299	124,299	124,299	124,299	
Volatisation (%)	67%											Predicted % volatilisation over 48 hours – constant (calm) wind case (RPS 2025).
Submersion (%)	2%											Predicted % submersion over 48 hours based on test modelling results – constant (calm) wind case (RPS 2025).
Vol. remaining (m^3/week)	38,533	38,533	38,533	38,533	38,533	38,533	38,533	38,533	38,533	38,533	38,533	Volume of oil remaining following 48 hours weathering.
Dispersant to oil ratio	1:30											Dispersant dosages recommended by IPIECA-IOGP (2016a) are between 1:20 and 1:25, however dosages of 1:40 have been shown to be effective (SL Ross, 2011). A dosage of 1:30 has been used.
No. operational days per week	5	7	7	7	7	7	7	7	7	7	7	In the first week, it will take some time to ramp up response resources (operational by day 3 – refer to Section 13.8.1).
Aerial Dispersant Application												
AMOSC Fixed Wing Aerial Dispersant Capability (FWADC)												
No. AT-802 used	4*	4	4	4	4	4	4	4	4	4	4	Aircraft available through AMOSC FWADC. * Note – Aircraft available from day 3.
AT-802 dispersant use per sortie (m^3)	3	3	3	3	3	3	3	3	3	3	3	FWADC air tractor capacity: 3,000 litres.
AT-802 no. sorties per day	3	3	3	3	3	3	3	3	3	3	3	Based on aircraft range and endurance, and distance of 205 nm to the furthest operational area from nearest airport with the logistics required to support operations (KTA).
AT-802 total dispersant use per day (m^3)	36*	36	36	36	36	36	36	36	36	36	36	No. aircraft used x No. sorties per day x Dispersant use per sortie ** Note, assumed FWADC dispersant application to start on day 3.*

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
OSRL Singapore Aerial Dispersant Capability												
No. C-130A used	1*	1	1	1	1	1	1	1	1	1	1	OSRL C-130A 'Hercules' from Singapore (Malaysia) base. ** Note – assumed C-130 dispersant application to start on day 3.*
C-130A dispersant use per sortie (m^3)	13	13	13	13	13	13	13	13	13	13	13	Based on details within the OSRL SLA equipment report.
C-130A no. sorties per day	3	3	3	3	3	3	3	3	3	3	3	Based on aircraft range and endurance, and distance of 205 nm to the furthest operational area from nearest airport with the logistics required to support operations (KTA).
C-130A total dispersant use per day (m^3)	39*	39	39	39	39	39	39	39	39	39	39	No. aircraft used x No. sorties per day x Dispersant use per sortie ** Note, assumed OSRL C-130 dispersant application to start on day 3.*
Aircraft totals												
Total application aircraft	5	5	5	5	5	5	5	5	5	5	5	
Total spotter aircraft	2	2	2	2	2	2	2	2	2	2	2	One spotter aircraft to coordinate morning sorties and one to coordinate afternoon sorties
Total dispersant use per day (m^3)	75	75	75	75	75	75	75	75	75	75	75	Combined AT-802 and C-130A use
Total dispersant use per week (m^3)	**375**	**525**	**525**	**525**	**525**	**525**	**525**	**525**	**525**	**525**	**525**	
Total dispersant use (m^3)	**5,625**											**Total dispersant used throughout the duration of the response for aerial application.**
Oil treated per week (m^3)	12,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	17,500	Based on dosage of 1:30 and total volume of dispersant applied
Efficacy (%)	80											Estimate of 80% may be used (OSRL, 2021a), dependent on wind conditions, application accuracy, overspray, etc.

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Oil dispersed per week	10,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	14,000	Volume of oil dispersed based on the efficacy
Oil remaining on surface after aerial dispersant application (m^3)	28,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	Theoretical volume of oil remaining on the sea surface following aerial dispersant operations (Vol. remaining following 48 hours weathering – oil dispersed). *Note: This is the volume taken forward for vessel dispersant application planning (refer to Section 13.8.2).*

Table 13-12: FWADC aerial dispersant application – Field resourcing

Aerial dispersant resource	No. required per aircraft	No. aircraft	Total no. required	Source of personnel
Support location (AMOSC FWADC Airbase FOB, likely to be Karratha Airport [KTA])*				
FOB Commander*	NA	NA	1	AMOSC FWADC contract
Airbase Manager*			1	AMOSC FWADC contract
Safety Officer*			1	AMOSC FWADC contract
Dispersant Operations Coordinator*			1	AMOSC FWADC contract
Dispersant Loading Crew*			2	AMOSC FWADC contract
Log/Admin*			1	AMOSC FWADC contract
Airbase FOB total:			**7**	
AMOSC FWADC Dispersant Ops. Group (at sea ops. at application site)				
Dispersant Application Air Tractors				
Air Tractor Pilot†	1	4	4	AMOSC FWADC contract / Ad-hoc contract~
Air Tractor First Officer†	1	4	4	AMOSC FWADC contract / Ad-hoc contract~
Air Attack Helicopters				
Secondary Overhead Aircraft Pilot†	1	1	1	Santos contracted
Secondary Overhead Aircraft First Officer†	1	1	1	Santos contracted
Air Attack Supervisor*	1	1	1	AMOSC
Dispersant Group total:			**11**	
Total personnel:			**18**	

** These roles as per Aerotech First Response (AFR)/AMOSC/Core Group fixed wing aerial response personnel resourcing in AMOSC FWADOps Plan (AMOSC, 2022)*

† As stated in the FWADOps Plan, these roles are subject to Civil Aviation Safety Authority (CASA) requirements. The numbers stated above are reasonable estimates.

Table 13-13: OSRL C-130A (Hercules) aerial dispersant application – Field resourcing requirements

Aerial dispersant resource	No. required per aircraft (minimum)	No. aircraft	Total no. required	Source of personnel
Support location (onshore Airbase FOB, likely to be Karratha Airport [KTA])*				
OSRL Ground Supervisor	1	1	1	OSRL
Dispersant Ops. Group (at sea ops. at application site)				
OSRL C-130				
C-130 Pilot†	1	1	1	OSRL C-130 contract
C-130 First Officer†	1	1	1	OSRL C-130 contract
C-130 Flight Engineer†	1	1	1	OSRL C-130 contract
C-130 Contractor ground/ops. crew	4	1	4	OSRL C-130 contract
Dispersant Ops. Group Total:			**8**	
Total personnel:			**9**	

† As per OSRL IAR Hercules C-130 Mobilisation and Logistics Plan (OSRL, 2021b). These roles are subject to Civil Aviation Safety Authority (CASA) requirements. Note, an additional flight crew may be supplied for extended operations for crew-changes..

13.8.2 Vessel dispersant application resourcing

The resourcing needs for vessel surface dispersant application have been estimated using the Santos response needs calculator. The vessels dispersant calculation works on the basis that, of the volume of oil remaining on the sea surface following aerial dispersant operations (refer to final row of Table 13-11), there is a proportion of this remaining oil that may be amenable to dispersant application via vessel, i.e. will still be of sufficient thickness and area. This proportion is assumed to be 1/3 of the remaining oil volume (OSRL, 2021a). Assuming that each vessel can effectively apply 5 m^3 of dispersant each day, the number of dispersant vessels required can then be calculated. The response needs calculator input, output and assumptions for vessel dispersant operations are provided in Table 13-14.

The vessel dispersant response requires 9 vessels per week after the first week. During the first week, as aerial and vessel dispersant activities ramp up, 1 vessel will be available from day 4 as per first strike mobilisation (Table 13-5). It is expected that vessel dispersant units could then be effectively ramped up to the required number over the first week; for the purposes of estimating dispersant volumes it is assumed that 1 dispersant spray vessel will be in-field by day 4, 4 vessels by day 5, and 6 vessels by day 7.

The response needs calculator indicates a total dispersant use of 3,225 m^3 from vessel application throughout the duration of the response (Table 13-14) (also refer to Appendix Q - Dispersant Supply and Logistics Plan).

Table 13-14: Response needs calculation output for surface dispersant application (vessel) for the Bedout Multi Well Drilling Activity LOWC scenario

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Vessel Dispersant Application												
Oil remaining on surface after aerial dispersant application (m^3)	28,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	24,533	Theoretical volume of oil remaining on the sea surface following aerial dispersant operations (from Table 13-11)
Proportion of remaining oil amenable to vessel dispersant (%)	33%											Following aerial ops., a proportion of the remaining surface oil would be of sufficient thickness and still be amenable to chemical dispersion by vessels. An estimate of 1/3 (33%) can be used (OSRL, 2021b), but is dependent on oil type, metocean conditions, etc.
Remaining oil amenable (m^3)	9,511	8,178	8,178	8,178	8,178	8,178	8,178	8,178	8,178	8,178	8,178	
Un-treated oil	19,022	16,355	16,355	16,355	16,355	16,355	16,355	16,355	16,355	16,355	16,355	This is the remaining oil that would not be amenable to dispersant (refer to details in the cell above) and would continue to disperse naturally.
Efficacy (%)	80											Estimate of 80% may be used (OSRL, 2021a), dependent on encounter rate, wind conditions, application accuracy, overspray, etc.
Dispersant required per week (m^3)	357	307	307	307	307	307	307	307	307	307	307	Volume required to treat the remaining oil considering the DOR and the efficacy. Note: this volume is extremely high and reflects an absolute worst case scenario for dispersant planning purposes.
Dispersant applied per vessel per day (m^3)	5	5	5	5	5	5	5	5	5	5	5	Mainly constrained by encountering amenable oil. Less so by the stocks stowed on board the vessel (which allows greater time on station before port re-supply).
Dispersant applied per vessel per week (m^3)	20†	35	35	35	35	35	35	35	35	35	35	In the first week, it will take some time to ramp up response resources (operational by day 4 – refer to Section 13.8.2).
No. vessels (in association with the above aircraft)*	6†	9	9	9	9	9	9	9	9	9	9	Total number of vessel dispersant systems required to disperse the remaining amenable oil at 80% efficacy. ** Note – This is the number calculated to be required, with the exception of week 1, where response resources are being ramped up.* *†Assumes 1 vessel by day 4, 4 vessels by day 5, 6 vessels by day 7 (refer to Section 13.8.2).*

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details/ assumptions
Total dispersant stock required per week (m^3)	75	315	315	315	315	315	315	315	315	315	315	Total dispersant required for vessel dispersant operations.
Total dispersant use for the duration of the response (m^3)	**3,225**											**Total dispersant used throughout the duration of the response for vessel application.**

13.9 SSDI supply and logistics requirements

If a subsea LOWC was to occur, the site would require a detailed assessment to determine the most suitable intervention methods for the incident. This may be achieved through the use of ROVs (supplied by Santos) and the Subsea First Response Toolkit (refer to Section 9.2.2.6), which is stationed in Fremantle and Jandakot and managed by AMOSC. The SFRT includes debris clearance equipment and subsea dispersant equipment, including a dedicated dispersant stockpile (500 m³ of Dasic Slickgone NS) and ancillary equipment (e.g., pumps, flying leads, coiled tubing head, dispersant wands). Santos can access a suitable vessel for transportation of the subsea dispersant injection system, dispersants and ancillary equipment including ROVs through its contracted vessel providers.

The volumes of dispersant required will depend on the DOR used at the injection point. It has been assumed that the release would require a DOR of 1:100. To achieve a DOR of 1:100 that IPIECA-IOGP (2015) recommend for a flow rate of 20,000 bbl./day, a dispersant pump rate of 22 L/min is required. Scaling this dispersant application rate up in line with the credible flow rate (from day 12 when SSDI is expected to commence) for the Curie subsea LOWC scenario (the only subsea LOWC scenario, with a flow rate of 33,766 bbl/day [5,368 m^3/day]) results in a required dispersant pump rate of 37 L/min (~54 m³/day). The AMOSC SFRT Package can deliver up to 110 L/min (~158 m^3/day), therefore, a second SSDI package is not required to meet the SSDI demand.

13.9.1 SSDI application resourcing

The resourcing needs for SSDI have been estimated using the Santos response needs calculator. The basis of the calculation is the well flow rate, in cubic metres per day for the duration of the modelled scenario, provided by Santos in the Technical File Note (TFN).

The response needs calculator input, output and assumptions for SSDI are provided in Table 13-15. The SSDI calculation works on a DOR of 1:100. The AMOSC SFRT will be operational by day 12 of the response.

The calculator assumes an efficacy of 90%. There will be some oil therefore left-over following treatment, which will then be subject to further weathering processes in the marine environment. Some of this oil may emerge at the sea surface and some may remain in the water column. Of the oil that emerges at the sea surface, it may not be amenable to further treatment by surface chemical dispersant, given that it was already treated at the source by SSDI and was not responsive.

A subsea dispersant supply and logistics plan has been prepared (Appendix Q) considering the daily / weekly application requirements, daily volume of dispersant arriving in Dampier and balance on hand after each day using the Curie subsea LOWC scenario. The dispersant budget is based on the dispersant available globally as per Table 13-15, noting that full surface dispersant application will not occur if SSDI is selected, and that the full SFRT dispersant stock of 500 m^3 will be available. The total dispersant demand for subsea application is 3,564 m^3. This volume can be covered by the existing dispersant stocks (Table 13-16).

Table 13-15: Response needs calculation output for SSDI application for the Bedout Multi Well Drilling Activity worst case subsea LOWC scenario (Curie)

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Details / assumptions
Well flow rate (m^3/week)	37,576	37,576	37,576	37,576	37,576	37,576	37,576	37,576	37,576	37,576	37,576	Provided by Santos (via Technical File Note).
No. operational days per week (% days utilisation)	0 (0%)	3 (43%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	7 (100%)	SSDI will be operational by day 12.
Dispersant required at 1:100 (m^3/week)	0	161	376	376	376	376	376	376	376	376	376	Dispersant to oil ratio (DOR) of 1:100 has been used. It is best to use the lowest DOR to avoid adverse water column impacts from the dispersant. SSDI commences with AMOSC SFRT system on day 12.
Dispersant required at 1:100 (m^3/day)	0	54	54	54	54	54	54	54	54	54	54	
Dispersant applied (m^3/week)	0	162	378	378	378	378	378	378	378	378	378	This is the dispersant actually applied given the ~158 m3/day delivery rate limit of the AMOSC SFRT. SSDI commences on day 12 with AMSOC SFRT system at delivery rate of ~149 m^3/day. A second SSDI package is not required.
Dispersant applied (m^3/day)	0	54	54	54	54	54	54	54	54	54	54	
Total dispersant stock required (m^3)	**3,564**											**Total dispersant stocks required based on the dispersant applied.**
Efficacy	90%											The response to the Macondo incident suggested high efficacy (OSRL, 2021e). 90% has been used.
Oil dispersed (m^3/week)	0	14,494	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	33,818	Volume of oil dispersed per week, based on a SSDI efficacy of 90%.
Oil remaining (un-dispersed	37,576	23,082	3,758	3,758	3,758	3,758	3,758	3,758	3,758	3,758	3,758	Remaining, based on a SSDI efficacy of 90%. Note that the fate of this oil will be subject to weathering;

oil) (m^3/week)												oil may either surface or remain entrained in the water column.
Oil remaining (un-dispersed oil) (m^3/day)	5,368	3,297	537	537	537	537	537	537	537	537	537	

13.10 Dispersant stocks

Existing dispersant supply stocks are shown in Table 13-16. Santos has a dispersant supply and logistics plan for the Bedout Multi Well activities (Appendix Q) that ensures dispersant requirements can be met for the duration of the worst-case LOWC scenario. Dispersant stockpiles are made available via AMOSC membership or via AMSA with most supplies within Australia being available within 48 to 55 hours. Santos can supply all required road logistics to meet these timeframes through its contracted logistics provider. Santos can also provide air logistics for all other stockpiles throughout Australia and internationally. Due to the volume of dispersant required over the 77 day application period, dispersant stocks would have to be imported from international stockpiles.

For SSDI, there is enough capacity in existing global stockpiles to cover the dispersant demand for the duration of the response. However, response specific manufacturing would be required in order to meet demand if surface dispersant application is implemented, with manufactured dispersant stocks required to start arriving on site at the start of week nine 9 of the response (refer to Appendix Q, Table Q-1).

Table 13-16: Dispersant supply stock locations and volumes

Source	Stock Location	Volume (m^3)	Type	Total Volume (m^3)
AMSA	Adelaide	10	Slick Gone EW	355
		10	Slick Gone NS	
	Brisbane	10	Slick Gone EW	
		10	Slick Gone NS	
	Townsville (QLD)	10	Slick Gone EW	
		15	Slick Gone NS	
	Karratha	10	Slick Gone EW	
		10	Slick Gone NS	
	Darwin	10	Slick Gone EW	
		10	Slick Gone NS	
	Devonport (TAS)	10	Slick Gone EW	
		10	Slick Gone NS	
	Fremantle	48	Slick Gone NS	
		52	Slick Gone EW	
	Horne Island (QLD)	10	Slick Gone NS	
	Melbourne	10	Slick Gone EW	
		10	Slick Gone NS	
	Sydney	45	Slick Gone NS	
		55	Slick Gone EW	
AMOSC	Exmouth	75	Slick Gone NS	511 (761 subsea dispersant)
	Perth (Welshpool)	8	Slick Gone NS	
		27	Corexit 9500	
		500 (SFRT stockpile* 50% for surface dispersant)	Slick Gone NS	
	Altona North (VIC)	75	Slick Gone NS	
		62	Corexit 9500	
	Broome	14	ARDROX 6120	
OSRL (SLA stockpile)	Various (Singapore, UK, Bahrain, US)	circa. 750[†]	Slick Gone NS Slick Gone EW Slickgone LTSW Finasol OSR 52 Corexit 9500	750

Source	Stock Location	Volume (m³)	Type	Total Volume (m³)
Total				**1,616** **(1,866 for subsea dispersant ops.)**
OSRL Global Dispersant Stockpile (GDS)	Various (Singapore, UK, France, South Africa, USA, Brazil)	5,000†	Slick Gone NS Finasol OSR 52 Corexit 9500	5,000
Total (including additional OSRL GDS stocks)				**6,616** **(6,866 for subsea dispersant ops.)**

* As per the AMOSPlan, there is a provision made by the SFRT Steering Committee to provide up to 250 m³ of dispersant into a surface spill response, given certain provisions are met in the first instance by AMOSC (AMOSC, 2021).

† Subject to re-supply considerations, a Member may access up to 100% of the global SLA stockpile if required.

13.11 Environmental performance

Table 13-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-17: Environmental performance – dispersant application

Environmental Performance Outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
Chemical dispersant application - surface	**Response Preparedness**		
	Arrangements to enable access to dispersants, equipment and personnel	[EPS-CD-001] Maintenance of access to dispersant, application equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity as specified in Table 13-4 and Table 13-7.	Access to National Plan resources through AMSA
			AMOSC Participating Member contract
			OSRL Associate Member contract and GDS Supplementary Agreement
			TRG arrangements
	Maintenance of MSAs with multiple vessel providers	[EPS-CD-010] Santos maintains MSAs with multiple vessel providers that could be used to source vessels for dispersant application	MSAs with vessel providers
	Dispersant application vessel requirements are identified	[EPS-CD-009] Maintenance of vessel specification for dispersant application vessels	Vessel specification within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Access to dispersant stocks	[EPS-CD-026] Develop and maintain surface dispersant supply and logistics plan to ensure worst case dispersant requirements for volume and logistics can be met	Dispersant supply and logistics plan
	Response Implementation		
	Mobilisation of first strike resources	[EPS-CD-013] First-strike is mobilised in accordance with details and timings as specified in first-strike response timeline tables (Vessel-based dispersant application – Table 13-5, Aerial dispersant operations –Table 13-8)	Incident log
	Process in place for dispersant selection	[EPS-CD-002] Only chemical dispersants that are listed as approved on the National Plan Oil Spill Control	National Plan Oil Spill Control Agent (OSCA) list;

Environmental Performance Outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
		Agent (OSCA) list, or are evaluated as acceptable as per the Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001), are to be used	Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001); Chemical Dispersant Application Plan; Incident Log.
	Chemical Dispersant Application Plan	[EPS-CD-015] Santos will have access to dispersants specified in Table 13-16	Incident Log
	Operational monitoring of surface dispersant efficacy will be conducted	[EPS-CD-020] Santos will conduct surface dispersant efficacy monitoring in accordance with the North West Shelf OSM-BIP (7715-650-ERP-0002) and OM4a: Surface Dispersant Effectiveness Monitoring (APPEA, 2021).	Incident Log; Chemical Dispersant Application Plan.
	Field testing of dispersant amenability	[EPS-CD-021] Analysis of dispersant amenability provided to IMT within 24 hours of oil delivery to laboratory	Incident Log; Dispersant Amenability Report.
	Field testing of dispersant / oil samples for ecotoxicity	[EPS-CD-022] If amenable to surface dispersants, and required oil volume can be collected, oil and dispersant samples to be sent for laboratory ecotoxicity testing of oil and chemically dispersed oil.	Incident Log; Dispersant Ecotoxicity Report.
	Test spray for assessment of dispersant effectiveness – aerial	[EPS-CD-024] If dispersant application is approved by the Incident Commander for aerial application, a test spray run via the National Plan Fixed-wing Aerial Dispersant Contract will be conducted to assess dispersant effectiveness	Incident Log; IAP.
	Manufacture of dispersant stocks for extended operations	[EPS-CD-023] If dispersant application is approved by the Incident Commander, request OSRL to initiate dispersant manufacture in week 1 to ensure a build-up of supply.	Incident Log; IAP.
	Extended capability in place	[EPS-CD-014] Santos will maintain access to ongoing dispersant and equipment to achieve the dispersant supply and logistics plan in Appendix Q	Incident Log
	Test spray for assessment of dispersant effectiveness – vessel	[EPS-CD-011] If dispersant application is approved by the Incident Commander for vessel application, a test spray will be conducted to assess dispersant effectiveness	Incident Log; IAP.
	Prepare operational NEBA to determine if chemical dispersant application activities are likely to result in a net environmental benefit	[EPS-CD-016] Records indicate operational NEBA completed prior to chemical dispersant activities commencing. Operational NEBA to be undertaken each operational period and included in development of following period IAP. NEBA will consider the following information: • forecast spill modelling of oil comparing simulations with and	Incident Log; IAP.

Environmental Performance Outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
		without effect of chemical dispersants • laboratory dispersant efficacy testing results • Monitor and evaluate and operational monitoring results showing distribution of floating, stranded oil and location of sensitive fauna and habitats • operational water quality monitoring results showing distribution and concentration of subsea oil (once available) • scientific monitoring water quality sampling results (once available) • consultation with Control Agency and/or key stakeholders	
	Dispersant application area to be defined to minimise impacts to sensitive areas	[EPS-CD-018] Surface Dispersant Application Area will be defined as part of the IAP. The base case for dispersant application is that no dispersants to be applied within: • 10 km of water depths <10 m LAT • safety exclusion zones of offshore facilities • a Habitat Protection Zone or National Park Zone of an AMP (application considered in the Multiple Use Zone) • State Marine Parks • State waters	IAP
	Dispersant application to target thick oil to maximise efficacy and minimise over application	[EPS-CD-019] Surface dispersant will only be applied in the dispersant application area and target oil above BAOAC 4 and 5	Operational monitoring reports; IAP; Incident Log.
Chemical dispersant application - subsea	**Response Preparedness**		
	Arrangements to enable access to dispersants, equipment and personnel	[EPS-CD-006] Maintenance of access to dispersant, application equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	Access to National Plan resources through AMSA
			AMOSC Participating Member contract
			AMOSC SFRT Participant
			OTA Agreement with Oceaneering
			OSRL Associate Member contract and GDS Supplementary Agreement

Environmental Performance Outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	[EPS-CD-003] SFRT Vessel availability shall be monitored regularly via Santos' contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers. These MSAs streamline access to vessels capable of transporting the SFRT and minimise mobilisation time.	[EPS-CD-004] Santos maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Arrangements to enable fast access to subsea application platform and dispersant supply	[EPS-CD-005] SFRT and dedicated dispersant stockpile mobilised to site within 9 days	AMOSC SFRT Participant; OTA Agreement with Oceaneering; Source Control Planning and Response Guideline.
	Process in place for dispersant selection	[EPS-CD-002] Only chemical dispersants that are listed as approved on the National Plan Oil Spill Control Agent (OSCA) list, or are evaluated as acceptable as per the Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001), are to be used	National Plan Oil Spill Control Agent (OSCA) list; Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001); Chemical Dispersant Application Plan; Incident Log.
	Access to dispersant stocks	[EPS-CD-026] Develop and maintain subsea dispersant supply and logistics plan to ensure worst case dispersant requirements for volume and logistics can be met	Dispersant supply and logistics plan (Appendix Q)
	Response Implementation		
	Field testing of dispersant amenability	[EPS-CD-021] Analysis of dispersant amenability provided to IMT within 24 hours of oil delivery to Laboratory	Incident log; Dispersant Amenability Report.
	Well site monitoring for SSDI	[EPS-CD-007] If dispersant application is approved by the Incident Commander for subsea injection, ROV monitoring of the site will commence to help determine injection method/s	Incident log; IAP.
	Extended capability in place	[EPS-CD-014] Santos will maintain access to ongoing dispersant and equipment to achieve the dispersant supply and logistics plan in Appendix Q	Incident Log
	Operational monitoring of subsea dispersant efficacy will be conducted	[EPS-CD-008] If dispersant application is approved by the Incident Commander for SSDI, operational monitoring of dispersant efficacy will be conducted as per the North West Shelf OSM-BIP (7715-650-ERP-0002) and OM4b: Subsea Dispersant Injection Effectiveness Monitoring (APPEA, 2021).	Incident log; IAP.
	Prepare operational NEBA to determine if chemical dispersant application activities are	[EPS-CD-016] Records indicate operational NEBA completed prior to chemical dispersant activities commencing. Operational NEBA to be	Incident log; IAP.

Environmental Performance Outcome	Implement chemical dispersant application to enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	likely to result in a net environmental benefit	undertaken each operational period and included in development of following period IAP. NEBA will consider the following information: • forecast spill modelling of oil comparing simulations with and without effect of chemical dispersants; • laboratory dispersant efficacy testing results; • Monitor and evaluate and operational monitoring results showing distribution of floating, stranded oil and location of sensitive fauna and habitats; • operational water quality monitoring results showing distribution and concentration of subsea oil (once available); • scientific monitoring water quality sampling results (once available); • consultation with Control Agency and/or key stakeholders.	

14. Shoreline protection and deflection plan

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

Table 14-1: Shoreline protection and deflection – objectives, initiation criteria and termination criteria

<table>
<tr><td>Environmental Performance Outcome</td><td colspan="2">Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priority areas.</td></tr>
<tr><td>Initiation criteria</td><td colspan="2">Level 2 or 3 spills where shorelines with identified protection priority areas will potentially be contacted.
Approval has been obtained from the relevant Control Agency to initiate the response strategy.</td></tr>
<tr><td rowspan="2">Applicable hydrocarbons</td><td>MDO</td><td>Caley Crude</td></tr>
<tr><td>✓2</td><td>✓2</td></tr>
<tr><td>Termination criteria</td><td colspan="2">• NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s, or
• Agreement is reached with Jurisdictional Authorities to terminate the response strategy.</td></tr>
</table>

14.1 Overview

Protection and deflection tactics are used 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 the spill characteristics, hydrocarbon type, and the operating environment. 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. Where Santos is not the Control Agency (refer to Table 4-2), 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 to North West Shelf OSM-BIP [7715-650-ERP-0002]).

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 monitor and evaluate activities and 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 the following.

- 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 dykes – 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 before 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, wind conditions and available resources.

14.2 Implementation guidance

Table 14-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. Table 14-3 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 otherwise directed by the relevant Control Agency, are listed in Table 14-4. The Incident Commander of the Control Agency's IMT (once they assume control) and/or the OSC is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 14-2: 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.	Planning Section Chief	☐
	Collect and provide monitor and evaluate information, operational monitoring data and existing sensitivity information/mapping to the Control Agency for confirmation of PPAs and NEBA.	-	Environment Unit Leader 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 (North West Shelf OSM-BIP [7715-650-ERP-0002]).	TRPs exist for most of the PPAs for this activity, further described in Section 6.5.1. TRPs are available on the Santos ER Intranet page[34]. Engage a Heritage Adviser if spill response activities overlap with potential areas of cultural significance.	Environment Unit Leader	☐
	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: • 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,	Operations Section Chief Planning Section Chief Environment Unit Leader	☐

[34] *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
		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 (use existing roads and tracks first). • Shift rotation requirements.		
	If required, identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with the 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 Section Chief	☐
	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 Shoreline Response Group Supervisor Deputy Division Commander (DTMI FOB) OSC	☐
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 Group Supervisor 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 set-up at mainland locations under direction of the Control Agency. Response crews will be rotated on a roster basis, with new personnel sourced on an as needs basis from existing HR suppliers.	Shoreline Response Group Supervisor Deputy Division Commander (DTMI FOB)	☐

Table 14-3: Shoreline protection and deflection – resource capability

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
Santos owned nearshore boom/skimming equipment	Santos	Beach Guardian (25 m lengths) Total: 6	Varanus Island: 4 Exmouth: 2	Within 12 hours for deployment by vessel from Varanus Island.
		Zoom Boom (25 m lengths) Total: 13	Varanus Island: 8 Exmouth: 5	
		Desmi DBD16 brush skimmer Total: 2	Exmouth: 1 Varanus Island: 1	
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Total: 5	Karratha: 5	Access to National Plan equipment[35] through AMOSC[36]. For mobilisation timeframes refer to Table 10-12.
		Structureflex inflatable Total: 25	Karratha: 10 Fremantle: 15	
		Versatech zoom inflatable Total – 18	Karratha: 5 Fremantle: 13	
		Slickbar – solid buoyancy Total: 2	Karratha: 2	
		Structureflex – solid buoyancy Total: 13	Karratha: 3 Fremantle: 10	
		Structureflex – land sea Total: 60	Karratha: 30 Fremantle: 30 Other locations around Australia	
AMOSC nearshore boom and skimming equipment.	AMOSC	Beach Guardian Shoreseal boom (25 m lengths) Total: 89	Broome: 4 Exmouth: 20 Fremantle: 19 Geelong: 46	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[37]. For mobilisation timeframes refer to Table 10-12
		Zoom Boom (25 m lengths) Total: 185	Broome: 6 Exmouth: 19	

[35] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[36] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources.*

[37] *The latest AMOSC equipment listings are available through AMOSC Members Hub: https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
			Fremantle: 34 Geelong: 126	
		Lamor HDB 1300 Boom (200 m) on reel Total: 2	Broome: 2	
		Lamor HDB 1500 Boom (100 m) on reel Total: 3	Fremantle: 1 Geelong: 2	
		Lamor SFB-18 GP Solid Flotation Curtain Boom (30 m lengths) Total: 58	Fremantle: 18 Geelong: 40	
		Minimax 12 brush skimmer Total: 5	Broome: 1 Exmouth: 1 Fremantle: 2 Geelong: 1	
		Komara 12k disc skimmer Total: 4	Exmouth: 1 Fremantle: 1 Geelong: 2	
		Komara 20k disc skimmer Total: 1	Fremantle: 1	
		Komara 30k disc skimmer Total: 2	Geelong: 2	
		Passive weir skimmer Total: 3	Exmouth: 1 Fremantle: 1 Geelong: 1	
		Ro-vac vacuum skimmer Total: 4	Exmouth: 1 Geelong: 3	
		Desmi GT 185 brush/weir skimmer Total: 2	Exmouth: 1 Geelong: 1	
		Desmi Ro-mop 240 oil mop skimmer Total: 2	Exmouth: 1 Geelong: 1	
		Desmi Ro-mop 260 oil mop skimmer Total: 2	Fremantle: 1 Geelong: 1	

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
		Skimmer-Lamor Rock Cleaner Brush Total: 4	Fremantle: 2 Geelong: 2	
		Skimmer-Lamor LWS500 Brush/Weir skimmer Total: 6	Fremantle: 3 Geelong: 3	
		Desmi 250 weir skimmer Total: 1	Geelong: 1	
		Canadyne Multi Head Brush/Disc/Drum Total: 1	Geelong: 1	
		Versatech Multi Head Brush/Disc/Drum Total: 1	Geelong: 1	
		Egmopol barge with brush skimmer Total: 1	Geelong: 1	
Industry Mutual Aid nearshore boom and skimming equipment	Facilitated by AMOSC	Nearshore boom and skimmers	WA/NT	Access to Industry Mutual Aid through AMOSPlan and facilitated by AMOSC
OSRL nearshore boom/skimming equipment. Note: further booms are available and the listed items are shown as an example. Guaranteed access to 50% of stockpile by equipment type. Access to more than 50% on a case-by-case basis.	OSRL	Air-skirt boom 10 m: 228 Air-skirt boom 20 m: 658 Air-skirt boom 200 m: 4 Beach sealing boom 10 m: 154 Beach sealing boom 15 m: 65 Beach sealing boom 20 m: 113 Inshore recovery skimmers: 126 Range of ancillaries to support above equipment.	OSRL global stockpiles at base locations: UK. Singapore. Bahrain. Fort Lauderdale.	Response from OSRL Duty Manager within 10 minutes. Equipment logistics varies according to stockpile location[38].
Personnel (field responders) for OSR strategies.	AMOSC Staff	Total: 12	Fremantle: 5 Geelong: 7	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.

[38] *The latest OSRL equipment inventory available to members can be found in the SLA equipment stockpile status report: https://www.osrl.com/in-action/publications/.*

Equipment type/ Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
	AMOSC Core Group (Santos)	Total: 16	Perth/NW Australia facilities: 14 Port Bonython (South Australia): 2	From 24 hours <48 hours to WA locations
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations across Australia.	Location dependent. Confirmed at time of activation.

Table 14-4: Shoreline protection and deflection – first-strike response timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, whether protection of shoreline sensitivities is required and begins sourcing resources.	<4 hours
Santos Core Group mobilised to the deployment port location.	<24 hours
Protection booming equipment mobilised to the deployment port location.	<24 hours
Waste storage equipment mobilised to the deployment port location.	<24 hours
Boom deployment vessel mobilised to the deployment port location.	<24 hours
AMOSC Staff and Industry Core Group mobilised to the deployment port location.	24–48 hours
Protection/deflection operation deployed to the protection location.	60–72 hours (weather/daylight dependent)
Minimum Resource Requirements	
Note: Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and DTMI, have been developed for various NWS locations and are available on the Santos ER Intranet Page. TRPs exist for most of the PPAs for this activity, further described in Section 6.5.1 [39]. 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(s). • Waste storage equipment. • One Protection and Deflection Team. • Personal protective equipment.	

14.3 Worst-case resourcing requirements

Protection and deflection resourcing requirements have been determined from stochastic modelling for affected shorelines. A LOWC in the Ara OA was selected to guide resourcing estimates for protection and deflection, which showed 19 km of shoreline affected (at ≥100 g/m^2) at Imperieuse Reef in the worst-case simulation, with a contact time of 113 hours (4 days, 17 hours) in the worst-case simulation (refer to Table 6-4, and also summarised in Table 14-5).

A single spill may contact other receptors and at different volumes, as presented in the stochastic modelling results in Section 6.3. Further interrogation of the modelling output revealed that the minimum arrival time and maximum length of shoreline oiled in Table 14-5 are from different model runs. However, both these criteria can be met by the resources available.

Consideration of resourcing based on stochastic modelling based on the maximum volume of oil ashore ≥100 g/m^2 also shows a requirement for 2 teams (refer to Table M-2 in Appendix M).

Table 14-5: Shoreline protection and deflection resource requirements based on surface LOWC stochastic modelling in the Ara OA

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m²	Maximum length of shoreline oiled (km) ≥100 g/m²	Estimated no. of required protection and deflection teams to set up and monitor
Imperieuse Reef	4 days, 17 hours (in the worst-case simulation)	19 (in the worst-case simulation)	2
Total estimated Protection and Deflection Teams required			2

Source: RPS (2025)

Capability allows for mobilisation of protection and deflection resources (refer to Table 14-3) by Day 3 if required (refer to Table 14-4). However, the shortest timeframe to shoreline accumulation (≥100 g/m^2) is not predicted until

[39] *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*

the end of day 4 at Imperieuse Reef (Table 14-5). This allows sufficient time to organise, mobilise and deploy protection and deflection personnel and equipment prior to hydrocarbon contact, guided by the ongoing monitoring and evaluation, and operational monitoring. However, it should be noted that protection and deflection activities on the offshore intertidal reefs such as Imperieuse Reef and Clerke Reef pose additional challenges to response (refer to Section 15.4.1.1).

A typical shoreline protection and deflection team would consist of 12 personnel as a minimum, comprised of the following:

- 1 x Incident Commander/Site Supervisor;
- 1 x Shallow Draft Vessel Skipper;
- 1 x Shallow Draft Vessel Deckhand;
- 9 x Protection and Deflection Operatives.

It is estimated that two teams would be required to cover the Imperieuse Reef (a total of 24 personnel required). The resourcing requirements will be determined based on feedback from SCAT activities, on the Operational NEBA, and in consultation with DTMI. Shoreline effort will likely consist of a combination of protection and deflection and clean-up (refer to Section 15.3), with resources often working together and/or in parallel.

Resource requirements for protection and deflection will be situation/receptor specific. TRPs are held by Santos and DTMI and have been developed for most of the PPAs (refer to Section 6.5.1).

14.4 Environmental performance

Table 14-6 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-6: Environmental performance – shoreline protection and deflection

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priority areas.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response Preparedness**		
	Access to Santos protection and deflection equipment and personnel	[EPS-PD-001] Santos personnel and equipment stored and maintained / available as per Table 14-3	Santos oil spill response team database; Santos equipment register; Exercise reports.
	Access to protection and deflection equipment and personnel	[EPS-PD-002] Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG throughout activity as per Table 14-3.	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG arrangements
	Protection and deflection small vessel providers for nearshore booming operations are identified	[EPS-PD-004] Maintenance of a list of small vessel providers operating in the North West Region that could be used for nearshore booming.	List of small vessel providers
	Response Implementation		
	First strike capability mobilised	[EPS-PD-005] First strike is mobilised in accordance with details and timings as specified in Table 14-4 unless directed otherwise by Control Agency.	Incident log
	IMT and Control Agency to agree protection priorities	[EPS-PD-007] Santos IMT to confirm protection priorities in consultation with the Control Agency.	IAP; Incident log.
	Prepare operational NEBA to determine if shoreline protection and	[EPS-PD-008] Records indicate operational NEBA completed prior to shoreline protection and deflection	Operational NEBA; Incident log;

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priority areas.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	deflection activities are likely to result in a net environmental benefit	activities commencing. Operational NEBA to be undertaken each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination.	IAP.
	IAP Protection and Deflection Sub-plan is developed to ensure effective execution and environmental impacts from response are minimised	[EPS-PD-006] IAP Shoreline Protection and Deflection Sub-plan including shoreline/nearshore habitat/bathymetry assessment and waste management is developed to provide oversight and management of shoreline protection and deflection operation, prior to shoreline protection and deflection operations commencing.	Incident Log; IAP Shoreline Protection and Deflection Sub-plan.
	Use of shallow draft vessels for shoreline and nearshore operations.	[EPS-PD-009] Shallow draft vessels are used for shoreline and nearshore operations, unless directed otherwise by the designated Control Agency.	Vessel specifications documented in IAP
	Conduct rapid shoreline/nearshore habitat/bathymetry assessment.	[EPS-PD-010] Unless directed otherwise by the designated Control Agency, a rapid shoreline/nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records; Assessment records.

15. Shoreline clean-up plan

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

Table 15-1: 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 priority areas and facilitate habitat recovery.	
Initiation criteria	Level 2 or 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. Approval has been obtained from the Control Agency to initiate response strategy.	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✓2	✓1
Termination criteria	As directed by DTMI.	

15.1 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 shoreline clean-up assessments (North West Shelf OSM-BIP [7715-650-ERP-0002]) 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 monitoring and evaluation tactics (refer to Section 10) and operational monitoring (Section 17), 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 the NEBA.

MDO is considered a Group II light persistent oil (RPS, 2025). MDO is likely to be difficult to remove given its light nature and high weathering potential. It can be readily washed from sediments by wave and tidal flushing. The likely waste products from a MDO spill shoreline response would be contaminated sand and debris. Spill modelling for the worst-case MDO release scenario indicated that no shoreline contact was predicted at, or above, the 100 g/m^2 threshold, however there were low probabilities of shoreline accumulation above the 10 g/m^2 threshold for Clerke Reef MP and Imperieuse MP (0.33% and 0.67%, respectively) from the Ara and Curie OA MDO release scenarios.

Caley crude is also considered a Group II light persistent oil (RPS, 2025), however, it should be noted that Caley crude also has properties that align it with a Group I oil as per the ITOPF (2023) classifications (RPS, 2025). When exposed to the atmosphere at local temperatures, approximately 48% of the product is expected to evaporate within the first 12 hours (BP < 180°C) and a further 19% should evaporate within the first 24 hours (180°C < BP < 265°C). Due to its low viscosity, if spilt on the sea surface, the crude would rapidly spread and thin out. Stochastic spill modelling for the worst-case Caley crude release scenario indicated that the greatest probability of shoreline oil accumulation ≥100 g/m^2 was predicted for Clerke Reef MP (13.33 %) and Imperieuse Reef MP (22.33%) from a surface LOWC in the Ara OA.

Shoreline clean-up techniques include:

- Shoreline clean-up assessment – uses assessment processes (refer to North West Shelf OSM-BIP [7715-650-ERP-0002]) to assess shoreline character and shoreline oiling and develop recommendations for response. Typically, this would 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.

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. 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 15-4. The OSC and/or 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 15-2: 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 North West Shelf OSM-BIP (7715-650-ERP-0002) for additional information. UAVs may be necessary for some sensitive environments and where personnel safety is at risk (e.g. dangerous fauna in remote locations).	Environment Unit Leader	☐
	Using results from the Shoreline Clean-up Assessment, conduct an Operational NEBA to assess shoreline clean-up suitability and recommended tactics for each shoreline location.	SCAT 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.	Environment Unit Leader	☐
	If the Operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP.	Shoreline Clean-up Plan may include: • Clean-up objectives. • Clean-up end points (may be derived from the Shoreline Clean-up Assessment). • Clean-up priorities (may be derived from the Shoreline Clean-up Assessment). • Assessment and location of staging areas and worksites (including health and safety constraints, zoning). • 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 on-site personnel. • List of resources (personnel, equipment, personal protective equipment (PPE)) 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 (use existing roads and tracks first). • Shift rotation requirements.	Environment Unit Leader Planning Section Chief Operations Section Chief	☐

Action		Consideration	Responsibility	Complete
		Refer to IPIECA guide: A Guide to Oiled Shoreline Clean-up Techniques (IPIECA-IOGP 2016c) 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.	-	Logistics Section Chief Supply Unit Leader Deputy Logistics Officer (DTMI IMT) Deputy Division Commander (DTMI FOB)	☐
	Deploy SCAT 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 Leader, who could be an AMOSC Core Group Member or trained member of the AMSA administered National Response Team. Clean-up teams and equipment will be deployed and positioned as per observations by the SCAT teams and in consultation with the Control Agency. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change.	Operations Section Chief SCAT Specialist / Coordinator Logistics Section Chief Deputy Logistics Officer (DTMI IMT)	☐
Ongoing Actions	Shoreline Response Team Leader shall communicate daily reports to the IMT Operations Section Chief to inform of the 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, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end points have been met.	Shoreline Response Group Supervisor Operations Section Chief	☐
	The IMT Operations Section Chief shall work with the Planning Section Chief to incorporate recommendations into the IAPs for the following operational period, and ensure all required resources are released and activated through the Supply Unit Leader and Logistics Section Chief.	-	Operations Section Chief Planning Section Chief Supply Unit Leader Logistics Section Chief	☐
	Monitor progress of clean-up efforts and report to the Control Agency.	-	Operations Section Chief OSC Deputy Division Commander (DTMI FOB)	☐

Table 15-3: Shoreline clean-up – resource capability

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
Manual clean-up tools (shovels, rakes, wheelbarrows, bags, etc.)	AMOSC	Boom Accessories Beach Guardian Deployment Kit Total: 14	Fremantle: 2 Geelong: 8 Broome: 1 Exmouth: 3	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	Shoreline clean-up container	Varanus Island: 1	Within 12 hours for deployment from Varanus Island
	Hardware suppliers	As available	Karratha/Dampier/ Exmouth/ Perth	-
Shoreline flushing (pumps/hoses)	AMOSC[40]	Shoreline flushing kit 3” Total: 2	Fremantle: 1 Geelong: 1	Response via duty officer within 15 minutes of first call. AMOSC personnel available within one hour of initial activation call. For mobilisation timeframes see Table 10-12.
		Shoreline flushing kit 4” Total: 1	Geelong: 1	
		Shoreline impact lance kit Total: 1	Geelong: 1	
Nearshore booms/ skimmers	AMOSC AMSA Industry Mutual Aid	Refer to Protection and Deflection (Table 14-3)	-	-
Decontamination/staging site equipment	AMOSC	Decontamination kit (PPE) Total: 3	Broome: 1 Exmouth: 1 Geelong: 1	Response via duty officer within 15 minutes of first call. AMOSC personnel available within one hour of initial activation call. For mobilisation timeframes see Table 10-12.
		Decontamination kit locker Total: 3	Exmouth: 1 Fremantle: 1 Geelong: 1	
		Decontamination – vehicle washdown trailer Total: 2	Fremantle: 1 Geelong: 1	
		Decontamination – support trailer Total: 1	Geelong: 1	

[40] *The latest AMOSC equipment listings are available through AMOSC Members Hub: https://amosc.sharepoint.com/sites/HUB/SitePages/CollabHome.aspx*

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
	AMSA	Decontamination station Total: 4	Karratha: 2 Fremantle: 2	Access to National Plan equipment[41] through AMOSC[42].
	Oil spill equipment provider (e.g. Global Spill)	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 and 3,000 L) Total: 8	Geelong: 4 Fremantle: 2 Exmouth: 2	Response via duty officer within 15 minutes of first call. AMOSC personnel available within one hour of initial activation call. For mobilisation timeframes see Table 10-12.
		Vikotank (13,000 L) Total: 2	Broome: 1 Geelong: 1	
		Lamor (11,400 L) Total: 4	Fremantle: 4	
		IBCs (1 m^3) Total: 18	Geelong: 18	
	AMSA temporary storage	Fast tanks (10 m^3) Total: 22	Darwin: 2 Karratha: 2 Fremantle: 4 Adelaide: 1 Brisbane: 2 Devonport: 2 Melbourne: 1 Sydney: 4 Townsville: 4	Access to National Plan equipment through AMOSC
		Structureflex (10 m^3) Total: 3	Brisbane: 1 Adelaide: 2	
		Vikoma (10 m^3) Total: 20	Darwin: 1 Adelaide: 1 Brisbane: 1 Devonport: 2	

[41] *Updated AMSA equipment listings for locations around Australia can be found at the AMSA National Environmental Maritime Operations Portal: https://www.amsa.gov.au/marine-environment/pollution-response/national-environmental-maritime-operations*

[42] *Santos will enter a contractual arrangement with AMSA to access the National Plan resources.*

Equipment type / Personnel required	Organisation	Equipment specifications / Total quantity available	Location / Quantity available	Mobilisation timeframe
			Fremantle: 7 Melbourne: 2 Sydney: 2 Townsville: 4	
	Santos Waste Management Service Provider	Refer to waste management (Section 18).	Perth, Karratha	<12 hours
Personnel (field responders) for OSR strategies	AMOSC Staff	Total: 12	Fremantle: 5 Geelong: 7	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)	Total: 16	Perth/NW Australia facilities: 14 Port Bonython (South Australia): 2	From 24 hours <48 to WA locations
	AMOSC Core Group (Industry)	As per monthly availability	Office and facility locations 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 15-4: 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 Core Group mobilised to deployment port location.	<24 hours
Clean-up equipment mobilised to deployment port location.	<48 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 deployed to clean-up area under advice from Shoreline Assessment Team.	<60–72 hours (weather/daylight dependent)
Minimum Resource Requirements	
Resource requirements for shoreline clean-up will be situation/receptor specific. If developed for the area/receptor, TRPs will outline suggested resource requirements and recommend shoreline assessments (as part of operational monitoring) be conducted prior to clean-up to confirm techniques. TRPs are held by Santos and DTMI. For further description on relevant TRPs for this activity, refer to Section 6.5.1. 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. • PPE. One clean-up team comprises of: • One team leader (AMOSC Staff, Industry Core Group or Santos Core Group). • 5[43] shoreline clean-up responders (AMOSC Core Group, Santos contracted labour hire personnel).	

15.3 Shoreline clean-up resources

Shoreline clean-up equipment available for use by Santos is a combination of Santos owned, AMOSC, AMSA, DTMI 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 Karratha, Broome, Perth and other regional centres. Where vessel deployments are required, Santos will leverage from existing contracted vessel providers in the first instance, and if required will source vessels from vendors that Santos already has a MSA with, or spot hiring vessels as needed. The Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) contains the specifications for various types of vessels that may be required in an oil spill response, including vessels for shoreline clean-up support.

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 operations 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 clean-up assessments (refer to the North West Shelf OSM-BIP [7715-650-ERP-0002] and Appendix M) will provide information to guide the clean-up strategy and deployment of resources.

[43] *Remote islands and ecologically sensitive locations may have reduced personnel numbers to reduce impacts from clean-up operations (Refer to Section 15.4.1)*

15.4 Worst-case resourcing requirements

Shoreline clean-up requirements have been determined for affected shorelines based on deterministic run 65 (surface LOWC of Caley crude from the Ara OA) given that this run results in the maximum volume of oil ashore (643 m^3 at the ≥100g/m^2 threshold). Based on the total potential waste generated and practicality in training and mobilising shoreline clean-up teams to remote/sensitive locations, 6 teams are recommended over a nine week duration (Table 15-5).

Resourcing requirements for shoreline oil operations have been conservatively determined based on a manual clean-up rate of 1 m^3 of oily waste per person per day (6 m^3 total per day, per team). A bulking factor of 10 has been applied to manual clean-up activities (IPIECA-IOGP, 2016b). The resourcing estimate considers:

- The size of a shoreline clean-up team for a remote/sensitive location (six persons, consisting of one Shoreline Clean-up Supervisor/Incident Commander and five operatives, given accumulation is only expected on remote offshore intertidal reefs and small sandy cay islands).
- The timeframe in which teams could achieve manual clean-up of all shorelines (Table 15-5).

Daily accumulation data from LOWC deterministic run 65 for the Ara scenario has been used to inform calculations for resourcing requirements as presented in Table 15-5. For deterministic run 65 (surface LOWC at the Ara OA), shoreline accumulation is predicted to occur at Imperieuse Reef MP at week 5 and peak during week 6, after which no more oil is predicted to accumulate and the remaining shoreline oil continues to weather slowly (Table 15-5).

Note that this does not include all possible spill scenarios and that a single spill may contact other receptors and at different volumes, as presented by the stochastic modelling results in Section 6.3. The information presented in Table 15-3 and Table 15-5 is to demonstrate that Santos can obtain the resources to scale up to the predicted worst-case shoreline accumulation volumes. In the event of an incident, Santos would use initial monitor and evaluate data (e.g. trajectory modelling and aerial surveillance) to determine where the available resources should be allocated for an effective clean-up response.

15.4.1 Operational and environmental considerations affecting resourcing

15.4.1.1 Imperieuse Reef and Clerke Reef

Stochastic spill modelling for the worst-case LOWC release scenarios indicated that the greatest probability of shoreline oil accumulation ≥100 g/m^2 was forecast for Clerke Reef MP (13.33 %) and Imperieuse Reef MP (22.33%) from a surface LOWC in the Ara OA, with a worst case accumulation of 643 m^3 and shoreline length of 19 km at Imperieuse Reef MP. Shoreline clean-up on the offshore intertidal reefs such as Imperieuse Reef and Clerke Reef poses additional challenges to those described for remote islands in Section 15.4.1.2. Santos has an existing TRP for these locations (Section 6.5.1) and this TRP will assist to plan the shoreline clean-up response.

Imperieuse Reef is the largest of the coral reef atolls of the Rowley Shoals, and is approximately 18 km long and 9.5 km wide. It consists of two shallow lagoons with multiple coral areas, many of which are dry (DEC, 2007). The basin opens to the sea via a shallow and very narrow passage that is not navigable by large vessels. A small unvegetated sandy cay, Cunningham Island, is located near the northern edge of the reef. In common with the atolls that make up the Rowley Shoals, Imperieuse Reef is characterised by intertidal and subtidal coral communities, while the small sandy cay (Cunningham Island) provides resting areas for migratory birds, as well as nesting areas for green and hawksbill turtles during the summer months (DEC, 2007).

Clerke Reef is approximately 15 km long and 6 km wide. Bedwell island is a bare sand cay that lies at the northern edge of the reef. Two additional sand banks just to the north of the island become exposed at low tide, along with an extensive sand bank at the southern end of the reef (DEC, 2007). Three narrow passages connect the main basin to the sea and are navigable by larger vessels, including some live-aboard vessels. In addition to the ecological sensitivities described above for Imperieuse Reef, the small sandy cay on Clerke Reef (Bedwell Island) is home to a colony of red-tailed tropic birds (DEC, 2007),

Both Imperieuse Reef and Clerke Reef are exposed to large tidal ranges, experiencing a semi-diurnal tidal cycle with an unusually high tidal range of around 5 meters (DEC, 2007). They are also exposed to oceanic swell, resulting in a high energy environment (DEC, 2007). Access via vessels is limited by weather conditions and the large semi-diurnal tidal ranges poses challenges for personnel and equipment access to the sandy cays located on both reefs.

There is possible anchorage for larger live-aboard vessels in the lagoon of Clerke Reef, with approval required from DBCA prior to any mooring in the lagoon. There are also suitable anchorages to the north-east of both reefs, subject to suitable weather conditions. Given the remote offshore location of Imperieuse and Clerke Reefs, any shoreline clean-up response would require a suitable accommodation vessel capable of accommodating SCAT, protection and deflection, OWR and shoreline clean-up personnel and equipment. Other support vessels would also be required, potentially including shallow draft vessels, beach access support vessels, landing barges and sector command/staging area vessels. Santos can source these vessels from existing contracted vessel providers in the first instance, and if required will source vessels from vendors that Santos already has a MSA with, or spot hiring vessels as needed. The Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) contains the specifications for the types of vessels described above to support shoreline clean-up.

Given the safety constraints and ecological sensitivities of these shorelines, shoreline clean-up operations should be conducted by smaller teams for a longer period of time. Methods such as intermittent manual treatment (<20 visits/month) and use of passive recovery booms are likely to be more effective and more practical 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 minimising ecological impacts on the shorelines and their sensitive species.

The number of shoreline clean-up teams recommended to treat these shorelines is not based on extensive, intrusive and contiguous removal of oil and waste along all shorelines, but rather use of smaller teams and at lower frequency of visits. Where shoreline based manual removal is safe and deemed advantageous by SCAT teams and the Operational NEBA, this should be conducted via suitable vessels. However, it should be noted that it is generally not feasible to deploy shoreline clean-up teams on remote offshore intertidal reefs. Santos has considered the access limitations, safety issues and number of clean-up teams that may be able to operate in each of these environments.

In such environments as remote offshore intertidal reefs, natural recovery through wave washing is considered the least damaging and most effective technique for removing stranded oil (IPIECA-IOGP, 2016c; NOAA, 2010). Secondary techniques include booming and skimming floating oil before it strands on the reef and low pressure flushing from vessels using seawater. Santos has arrangements in place to access the equipment required to undertake these techniques (Table 15-3).

Although it may not be practicable to undertake manual shoreline clean-up, or deploy only a limited manual shoreline clean-up at these locations, the worst-case resourcing requirement for shoreline clean up personnel has been presented in Table 15-5, to show that Santos can access the required personnel if required.

15.4.1.2 Remote island deployment

For shoreline clean-up of remote islands, the following process could be implemented so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines. If shoreline contact is predicted with locations where TRPs exist, the TRP will be used to assist with planning the deployment. Where TRPs are unavailable for areas likely to be contacted, refer to other sources of information such as aerial photography, Oil Spill Response Atlas, and WAMOPRA.

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 four stages:

6. Drop off six person clean-up containers (contents list in Appendix J) to shoreline contact locations defined by the IMT through observation data; or if locations are too sensitive to be used as staging sites, then transfer equipment via landing barge for offsite staging.
7. Deploy 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.
8. Deploy clean-up teams in six person squads 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 storage areas lined with damp-proof coarse (DPC) grade HDPE sheeting above the high tide mark.
9. Deploy waste pickup landing barges to retrieve collected wastes from the temporary storage areas and to complete the shoreline clean-up and final polishing.

Multiple six person teams are to be used based on the actual volume of oil deposited, which will be determined via shoreline clean-up assessments (refer to the North West Shelf OSM-BIP [7715-650-ERP-0002]). These teams can be resourced through the existing Santos arrangements, using a combination of personnel from OSROs for trained shoreline clean-up team leader roles and labour hire companies for clean-up team member roles.

Table 15-5: Requirements for shoreline clean-up for Imperieuse Reef based on surface LOWC run 65 at the Ara operational area

Time (week)	Weekly change in mass of oil ashore (m^3)†	Oil on shoreline (m^3)	Potential max. waste generated (m^3) – bulking factor of 10	No. shoreline clean-up teams recommended (max 6 people/team)	Max. volume of oily waste collected (m^3/week by teams)
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	135	135	1,350	6	252
6	507	642	6,420	6	252
7	-42	600	6,000	6	252
8	-42	558	5,580	6	252
9	-36	522	5,220	6	252
10	-31	491	4,910	6	252
11	-29	462	4,620	6	252
Relief well drilled and well kill implemented					
12	-25	437	4,370	6	252
13	-24	413	4,130	6	252
14	-20	393	3,930	6	252
15	-19	374	3,740	6	252
16	-	-	-	6	252
17	-	-	-	6	252
18	-	-	-	6	252
19	-	-	-	6	252
20	-	-	-	6	252
21	-	-	-	6	252
				TOTAL	**4,284**

Source: RPS (2025)

† *Note: Positive number indicates shoreline loading, negative number indicates shoreline oil weathering.*

15.5 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.

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.

The WA DTMI Incident Management Plan (2023) also provides guidance on shoreline clean-up techniques.

15.6 Environmental performance

Table 15-6 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 15-6: 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 priority areas and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and personnel	[EPS-SCU-001] Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan, OSRL and TRG throughout activity.	Access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
			TRG Arrangements
	Access to Santos shoreline clean-up personnel	[EPS-SCU-002] Santos personnel available as per Table 15-3	Santos oil spill response team database
	Access to vessels suitable for remote island transfers of equipment, personnel and waste	[EPS-SCU-005] MSAs with multiple vessel providers maintained throughout activity	MSAs with multiple vessel providers; Vessel details show suitability.
	Vessel requirements for offshore island shoreline clean-up operations are identified	[EPS-SCU-006] Maintenance of vessel specification for remote island shoreline clean-up operations.	Vessel specifications within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Access to shoreline clean-up labour hire personnel	[EPS-SCU-003] Maintenance of contract with labour hire provider.	Labour hire contract
	Onboarding procedure to access shoreline clean-up labour hire personnel	[EPS-SCU-004] Maintenance of an onboarding procedure for oil spill response labour hire	Onboarding procedure
	Response Implementation		
	First strike capability mobilised	[EPS-SCU-007] First strike is mobilised in accordance with details and timings as specified in Table 15-4 unless directed otherwise by the Control Agency.	Incident log
	IMT and Control Agency to agree protection priorities	[EPS-SCU-012] Santos IMT to confirm protection priorities in consultation with the control agency.	IAP; Incident log,
	Prepare operational NEBA to determine if shoreline clean-up activities are likely to	[EPS-SCU-013] Records indicate operational NEBA completed prior to shoreline activities commencing. Operational NEBA to be undertaken	Operational NEBA; Incident Log; IAP.

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priority areas and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	result in a net environmental benefit	each operational period. Ensure NEBA considers waste management and the possibility of secondary contamination	
	IAP Shoreline Clean-up Sub-plan is developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-015] IAP Shoreline Clean-up Sub-plan including waste management is developed to provide oversight and management of shoreline clean-up operation	Incident Log; IAP Shoreline Protection and Deflection Sub-plan.
	Shoreline clean-up operations will be implemented under the direction of the Control Agency to ensure effective and coordinated execution	[EPS-SCU-008] Clean-up strategies will be implemented under the direction of the Control Agency. Santos will make resources available to the Control Agency.	Incident log
	Santos AMOSC core group responders available to the Control Agency for shoreline clean-up positions.	[EPS-SCU-016] Santos will make available AMOSC Core Group responders, or other appropriately trained responders, for shoreline clean-up team positions to the Control Agency.	Incident log
	Equipment for shoreline clean-up made available to the Control Agency from Santos, AMOSC and OSRL stockpiles	[EPS-SCU-017] Santos will make available to the Control Agency equipment from AMOSC and OSRL stockpiles.	Incident log
	Response requirements for extended operations	[EPS-SCU-010] If required, mobilisation of the required number of shoreline teams throughout the release to meet the need specified in Section 15.4.	Incident log
	NEBA included in development of following operational period IAP	[EPS-SCU-014] Effectiveness of shoreline clean-up to be evaluated by Team Leaders and reported to IMT for inclusion in NEBA. 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.
	Access plans are developed to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-018] Access plans for shoreline operations will be developed. Unless directed otherwise by the Control Agency, Access plans will prioritise use of existing roads and tracks, establish demarcation zones to protect sensitive areas and select vehicles appropriate to conditions	IAP demonstrates requirement is met
	Soil profile assessment is undertaken prior to earthworks to ensure effective execution and minimise environmental impacts from response	[EPS-SCU-020] Unless directed otherwise by the designated Control Agency, a soil profile assessment is conducted prior to earthworks.	Soil Profile Assessment; IAP; Incident log.
	Pre-cleaning and inspection of equipment (quarantine) is undertaken to minimise environmental impacts	[EPS-SCU-021] Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands.	Quarantine documentation; IAP; Incident log.

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priority areas and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards [EPS-ID]**	**Measurement Criteria**
	from response on offshore islands		
	If spill response activities overlap with potential areas of cultural significance, a Heritage Advisor will be engaged	[EPS-SCU-022] In consultation with the Control Agency, engage a Heritage Advisor to provide advice on any sites of cultural significance that may be affected directly by the spill, or indirectly through implementation of spill response measures.	Documented in IAP; Incident log.
	Select forward staging areas in consultation with the Control Agency	[EPS-SCU-023] Any establishment of forward staging areas at shorelines is done under the direction or in consultation with the Control Agency.	Incident log; IAP.
	Establish demarcation zones in sensitive areas	[EPS-SCU-024] Unless directed otherwise by the designated Control Agency, demarcation zones are mapped out in sensitive habitat areas for vehicle and personnel movement, considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat.	IAP demonstrates requirement is met
	Operational restrictions of vehicle and personnel movement are established to limit erosion and compaction	[EPS-SCU-019] Unless directed otherwise by the designated Control Agency, operational restrictions on movement of personnel and vehicles, including vehicle types and traffic volumes, are established to minimise impacts from erosion and compaction	IAP demonstrates requirement is met
	Stakeholder consultation for deployments in coastal areas	[EPS-SCU-025] Consultation is undertaken with relevant stakeholders prior to deployment of resources to townships and marine/coastal areas.	Consultation records

16. Oiled wildlife

The WA DTMI is the Control Agency and DBCA is the Jurisdictional Authority and lead agency for oiled wildlife response within WA State waters. Santos and AMSA are the Control Agencies for oiled wildlife response within Commonwealth waters from facility and vessel spills respectively. Table 16-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 16-1: Oiled wildlife response – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Implement tactics in accordance with Santos Oiled Wildlife Response Framework Plan (7700-650-ERP-0017) to prevent or reduce impacts, and to humanely treat, house, release or euthanise wildlife.	
Initiation criteria	Monitor and evaluate information and/or operational monitoring data shows that wildlife are contacted, or are predicted to be contacted, by a spill.	
Applicable hydrocarbons	**MDO**	**Caley Crude**
	✓1	✓1
Termination criteria	• Oiling of wildlife has not been observed over a 48-hour period. • Oiled wildlife has been successfully rehabilitated. • Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the response.	

16.1 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. 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 are found in the vicinity of an oil spill or are reasonable suspected of have succumbed to the effects of oiling.

Long-term effects of a spill on wildlife may be associated with loss/degradation of habitat and impacts to food sources and reproduction. An assessment of such impacts is covered in Section 7.2 and Section 7.3 of the EP and post-spill via scientific monitoring (Section 17).

Table 16-2 provides guidance on the designated Control Agency and Jurisdictional Authority for OWR in Commonwealth and State waters. For a petroleum activity spill in Commonwealth waters, Santos acts as the Control Agency and will be responsible for the wildlife response. The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) will be referred to for guidance in coordinating an OWR when Santos is the Control Agency and for the OWR first-strike response; otherwise, the relevant State OWR Plan will be referred to, as described below.

The key plan for OWR in WA is the WAOWRP (DBCA, 2022a). The WAOWRP establishes the framework for preparing and responding to potential or actual wildlife impacts during a spill and sets out the management arrangements for implementing an OWR in conjunction with the SHP-MEE. It is the responsibility of DBCA to administer the WAOWRP under the direction of the DTMI (Table 16-2). The Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) is consistent with and interfaces the WAOWRP and the WA Oiled Wildlife Response Manual (WA OWR Manual) (DBCA, 2022b).

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

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

Table 16-2: 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 (3 - 200 nautical miles from territorial/state sea baseline)	Vessel	DCCEEW	AMSA		WAOWRP WA OWR Manual Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017)
	Petroleum activities		Titleholder		
WA State waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	DBCA	WA DTMI[44]		
	Petroleum activities		Titleholder	WA DTMI	
International waters	Vessel	Relevant foreign authority	Santos will liaise with DFAT in the event that an oil spill may enter international waters. Santos will work with DFAT and the respective governments to support response operations.		
	Petroleum activities				

16.2 Wildlife priority protection areas

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

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

The wildlife PPAs for Bedout Multi Well drilling activities are outlined in Table 16-3 and align with the PPAs for spill response described in Section 6.3. Further detail on the conservation status of relevant species is outlined in the EP. Also refer to Appendix B of the North West Shelf OSM-BIP for background information on species at these locations, including any known key locations and seasonality.

Depending on the timing of a potential hydrocarbon spill, certain species could be more impacted because of key seasonal biological activities such as breeding, mating, nesting, hatching or migrating. Table 16-4 provides further detail of key wildlife activities in the Pilbara/Kimberley regions and the corresponding time of year.

Table 16-3: Wildlife PPAs

Wildlife priority protection area	Key locations / fauna type
Clerke Reef	• Bedwell Island (Clerke Reef)
Imperieuse Reef	• Cunningham Island (Imperieuse Reef) • Bedwell Island is home to one of only two nesting colonies of Red-tailed Tropic Birds (*Phaethon rubricauda*) in WA • Other seabirds are known to nest and rest on Bedwell Island • Green turtle and hawksbill turtle frequent these reefs, however little nesting activity has been observed on Cunningham or Bedwell Island • Migratory pathway for humpback whales (*Megaptera novaeangliae*) and calves • Oceanic cetacean species including spinner and bottlenose dolphins (*Stenella longirostris*; *Tursiops truncatus*) as well as pilot and false killer whale (*Globicephala melaena*; *Pseudorca crassidens*)

[44] *If an OWR is required in WA State waters, the DBCA is responsible for the administration of the WAOWRP under the direction of the DTMI.*

Table 16-4: Key wildlife activities in the Pilbara and Kimberley regions and corresponding time of year

Wildlife Type	Activity	Period
Humpback whales	Migration pathway to and from Kimberley calving grounds.	Peak between June and August
Marine turtles	Foraging	September to December January to April
Shorebirds	Migratory pathway stopover	September to April

16.3 Magnitude of wildlife impact

Given the distribution and behaviour of wildlife in the marine environment, a spill which only impacts Commonwealth offshore waters is likely to result in limited opportunities to rescue wildlife. In such instances, continued wildlife reconnaissance, carcass recovery, sampling of carcasses that cannot be retrieved and scientific monitoring are more likely to be the focus of response efforts. In contrast, a spill which results in shoreline accumulation is likely to result in far greater wildlife impacts and opportunities to rescue wildlife.

The stochastic modelling for the worst-case LOWC spill scenario for the Bedout Multi Well drilling activities predicts that the greatest accumulation of oil will occur at Imperieuse Reef. There is also a potentially large area of floating oil ≥50 g/m^2 that is predicted to weather predominantly offshore (refer to section 6.3.1) (RPS, 2025). Using the WAOWRP (DBCA, 2022a) Guide for Rating the Wildlife Impact of an Oil Spill (Table 16-5), and stochastic modelling for the worst-case spill scenarios (Section 6.3), it is predicted that high wildlife impacts have the potential to occur as a result of a worst-case spill scenario associated with this activity.

Table 16-5: WAOWRP Guide for rating the wildlife impact of an oil spill

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

Source: DBCA (2022)

16.4 Implementation guidance

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

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

The OWR first strike plan will focus on notifications, wildlife reconnaissance and response preparation (refer to Section 6.1 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]). Refer to Table 16-6 for an indicative timeframe and Appendix P for resource capability. Preventative actions, such as hazing, along with capture, intake and treatment require a higher degree of planning, approval (licences) and skills and will be planned for and carried out under the wildlife portion of the IAP (refer to Section 6.2 of the Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017]).

Due to the remote offshore reef locations potentially impacted in the event of a worst-case LOWC event (i.e. Imperieuse Reef and Clerke Reef), there are additional logistical constraints that may need to be considered for implementing an OWR in these areas; these are presented in Table P-2 of Appendix P. The Santos Marine Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) also highlights the potential need for sourcing of vessels to serve as an OWR field station and provides the broad specification of such vessels. This information assists the IMT in the sourcing of appropriate vessels through the existing MSAs that Santos has with various vessel providers.

Table 16-6: 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 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. First strike resources: • Reconnaissance platforms (refer to Santos Oiled Wildlife Response Framework Plan [7700-650-PLA-0017] and Appendix P). • 6x trained industry OWR Team personnel (AMOSC staff and contractors/AMOSC Industry OWR Group). Additional resources: • Refer to Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017). • Refer to Appendix P for information on OWR capability and equipment.	

16.5 Environmental performance

Table 16-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 16-7: Environmental performance – oiled wildlife response

<table>
<tr><th>Environmental performance outcome</th><td colspan="3">Implement tactics in accordance with Santos Oil Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.</td></tr>
<tr><th>Response strategy</th><th>Control measures</th><th>Performance standards [EPS-ID]</th><th>Measurement criteria</th></tr>
<tr><td rowspan="6">Oiled wildlife response</td><td colspan="3">Response preparedness</td></tr>
<tr><td rowspan="3">Access to oiled wildlife response equipment and personnel.</td><td rowspan="3">[EPS-OWR-001] Access to oiled wildlife response equipment and personnel through Santos, AMOSC, AMSA National Plan and OSRL maintained throughout activity.</td><td>Access to National Plan resources through AMSA</td></tr>
<tr><td>AMOSC Participating Member Contract</td></tr>
<tr><td>OSRL Associate Member Contract</td></tr>
<tr><td>Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) in place</td><td>[EPS-OWR-005] Santos Oiled Wildlife Response Framework Plan provides guidance for coordinating an OWR when Santos is the Control Agency and outlines Santos response arrangements.</td><td>Santos Oiled Wildlife Response Framework Plan;
Revision records.</td></tr>
<tr><td>Access to labour hire personnel</td><td>[EPS-OWR-003] Maintenance of contract with labour hire provider.</td><td>Labour hire contract</td></tr>
</table>

Environmental performance outcome	Implement tactics in accordance with Santos Oil Wildlife Response Framework Plan (7700-650-PLA-0017) to prevent or reduce impacts, and to humanely treat, house, and release or euthanise wildlife.		
Response strategy	**Control measures**	**Performance standards [EPS-ID]**	**Measurement criteria**
	Labour hire onboarding procedure to access labour hire personnel	[EPS-OWR-004] Maintenance of an onboarding procedure for oil spill response labour hire.	Onboarding procedure
	Access to Santos trained oiled wildlife response personnel	[EPS-OWR-002] Maintain Santos personnel trained on OWR and positioned at Perth and VI	Training records
	Vessel specifications for an OWR field station in place	[EPS-OWR-014] Vessel specifications for an OWR field station included within planning documentation.	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response implementation		
	First strike capability mobilised	[EPS-OWR-006] First strike is mobilised in accordance with details and timings as specified in Table 16-6 unless directed otherwise by relevant Control Agency.	Incident log
	OWR Management	[EPS-OWR-007] OWR managed in accordance with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017)	Incident log
	Prepare operational NEBA prior to operations commencing	[EPS-OWR-008] Prepare operational NEBA to determine magnitude of wildlife impact and determine if OWR activities are likely to result in a net environmental benefit (particularly in relation to hazing and pre-emptive capture). Operational NEBA to be undertaken each operational period.	IAP; Incident log
	IAP Oiled Wildlife Response Sub-plan developed, including waste management, to provide oversight and management of OWR operations	[EPS-OWR-009] IAP Oiled Wildlife Response Sub-plan is developed to ensure effective, coordinated execution with the Santos Oiled Wildlife Framework Plan (7700-650-PLA-0017) and minimise environmental impacts from response.	Incident log indicates IAP Oiled Wildlife Response Sub-plan prepared prior to oiled wildlife response operations commencing
	Oiled Wildlife Sample Collection Protocol	[EPS-OWR-010] Oiled wildlife sample collection carried out in accordance with the Santos Oiled Wildlife Sample Collection Protocol.	Incident log

17. Operational and Scientific monitoring

OSM is a key component of the environmental management document framework for offshore petroleum activities, which includes activity EPs and OPEPs. Operational monitoring is instrumental in providing situational awareness of a hydrocarbon spill, enabling the IMT to mount a timely and effective spill response and continually monitor the effectiveness of the response. Scientific monitoring is also the principal tool for determining the extent, severity and persistence of environmental impacts from a hydrocarbon spill and for informing resultant remediation activities.

Santos has developed a North West Shelf Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0002) which describes a program of monitoring oil pollution that will be adopted in the event of a hydrocarbon spill incident (Level 2–3) to marine waters. It aligns with the Joint Industry Operational and Scientific Monitoring Framework (APPEA, 2021) and describes how this Framework applies to Santos activities and spill risks for the geographic extent of North West Shelf OSM-BIP (7715-650-ERP-0002). The relationship between the Joint Industry OSM Framework and Santos environmental management framework is illustrated in Figure 17-1.

The Santos OSM-BIPs can be found on the Santos ER SharePoint site.

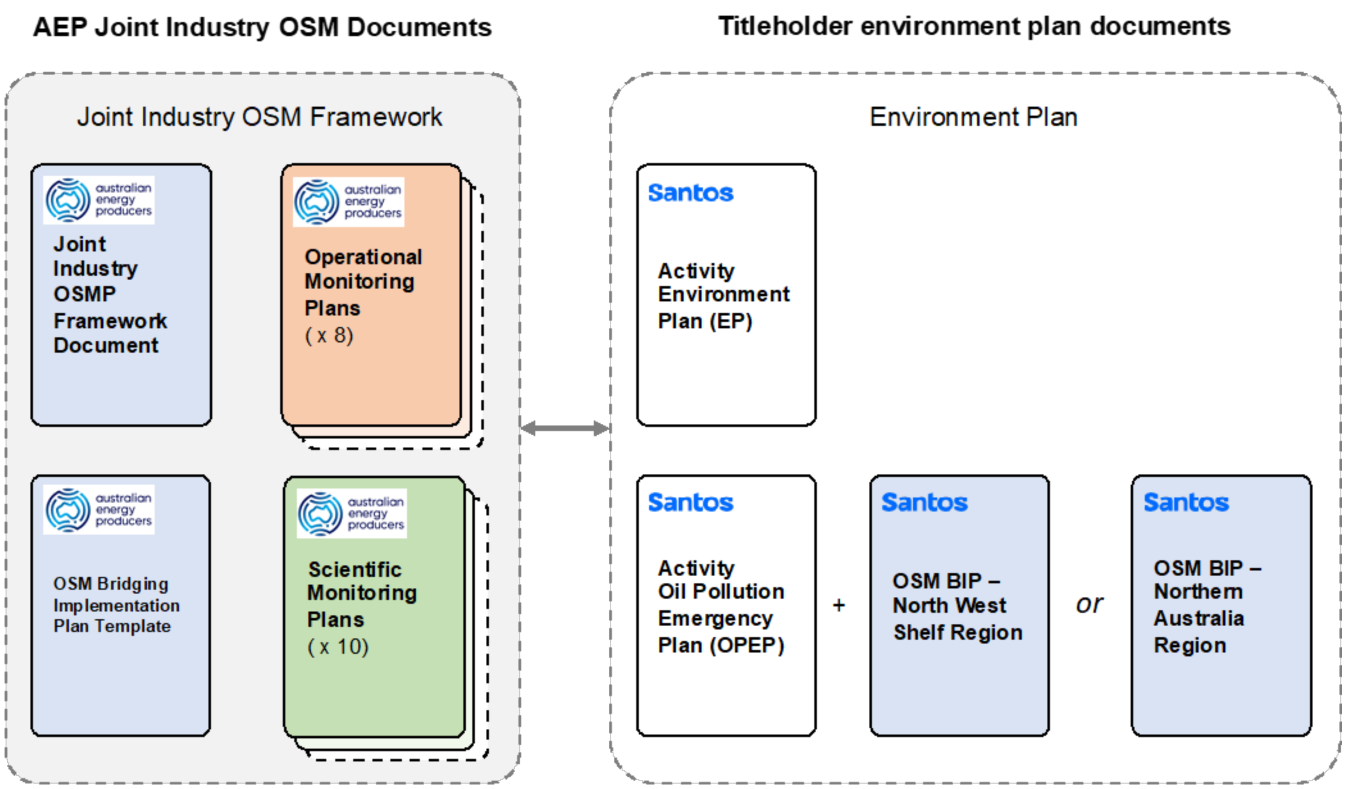

Figure 17-1: Relationship of Joint Industry and Titleholder OSM Documentation

The North West Shelf OSM-BIP is structured so that it can provide a flexible framework that can be adapted to individual spill incidents. A series of Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs) form part of the Joint Industry OSM Framework and provide detail on monitoring design, standard operating procedures, data management, quality assurance and quality control and reporting.

There are two types of monitoring that would occur following a Level 2–3 spill event:

- **Operational Monitoring** – which is undertaken during the course of the spill and includes any physical, chemical and biological assessments that may guide operational decisions such as selecting the appropriate response and mitigation methods and / or to determine when to terminate a response activity. This monitoring is additional to the activities (aerial/vessel surveillance, tracking buoys, oil spill trajectory modelling and satellite tracking) performed as part of the Monitor and Evaluate Strategy (Section 10). The design of operational monitoring requires judgements to be made about scope, methods, data inputs and outputs that are specific to the individual spill incident, balancing the operational needs of the response with the logistical and time constraints of gathering and processing information. Information needs to be collected and processed rapidly to suit response needs, with a lower level of sampling and accuracy needed than for scientific purposes. For details on initiation and termination criteria for OMPs refer to the North West Shelf OSM-BIP (7715-650-ERP-0002).

- **Scientific Monitoring** – which can extend beyond the termination of response operations. Scientific monitoring has objectives relating to attributing cause-effect interactions of the spill or associated response with changes to the surrounding environment. SM will be conducted on a wider study area, extending beyond the spill footprint, will be more systematic and quantitative, and aim to account for natural or sampling variation. For further details on the SMPs refer to the North West Shelf OSM-BIP (7715-650-ERP-0002).

Table 17-1 lists the Joint Industry OMPs and SMPs that are relevant to Santos' Bedout Multi Well Drilling activities. Santos confirms that it has reviewed the aims and objectives of these relevant OMPs and SMPs, and determined that they are appropriate to meet the monitoring requirements of this activity, addressing potential impacts, risks and response activities.

The North West Shelf OSM-BIP (7715-650-ERP-0002) is tailored to Santos' activities on the north west shelf. It includes details on priority locations for monitoring, resourcing requirements; and operational guidance including logistics, mobilisation and permitting; with the exception of capability requirements for OM6: Shoreline Clean-up Assessment; these are typically assessed for each activity, according to deterministic modelling for the worst-case scenario that shows the simulation with the longest length of shoreline contacted, as this criterion influences the number of assessment teams required. The capability assessment for the remaining OMPs and SMPs is assessed against different deterministic modelling criteria, as described in the North West Shelf OSM-BIP (7715-650-ERP-0002). Resourcing requirements for OM6: Shoreline Clean-up Assessment for the Bedout Multi Well drilling activity are provided in Appendix M.

In summary, Santos assessed the worst-case spill scenario for OSM capability as the scenario predicted to contact the greatest number of receptors at the low hydrocarbon thresholds for floating, shoreline or dissolved hydrocarbon contact within 7 days; followed by the greatest number of receptors contacted within 7-14 days; and at the highest contact probabilities. If a receptor is only contacted by low concentrations of entrained hydrocarbons and not by any other hydrocarbon phase, it will be considered a lower priority during the initial monitoring response as outlined in Section 2.2 of the North West Shelf OSM-BIP (7715-650-ERP-0002). Santos confirms that all of the Bedout Multi Well Drilling spill scenarios (refer to Section 6.1) fit within the OSM combined Scientific Monitoring Planning Area and assessment criteria defined within Appendix B of the North West Shelf OSM-BIP (7715-650-ERP-0002). This assessment is detailed in Appendix N.

Santos will review the initiation criteria for OMPs and SMPs (Provided in Table 9-1 (OMPs) and Table 9-2 (SMPs) of the Joint Industry Operational and Scientific Monitoring Framework [APPEA, 2021]) when preparing the initial IAPs, and subsequent IAPs. If any initiation criteria are met, then that relevant OMP and/or SMP will be activated via the OSM Services Provider.

Table 17-1: Joint Industry OSM Plans relevant to Bedout Multi Well Drilling

Operational monitoring	Relevant for Bedout Drilling	Scientific Monitoring	Relevant for Bedout Drilling
OM1: Hydrocarbon Characterisation	✓	SM1: Water Quality Impact Assessment	✓
OM2: Hydrocarbon in water assessment	✓	SM2: Sediment Quality Impact Assessment	✓
OM3: Hydrocarbon in sediment assessment	✓	SM3: Intertidal and Coastal Habitat Assessment	✓
OM4a: Surface dispersant effectiveness monitoring	✓	SM4: Seabirds and Shorebirds Assessment	✓
OM4b: Subsea dispersant injection effectiveness monitoring	✓	SM5: Marine Mega-fauna Assessment	✓
OM5: Rapid Marine Fauna Surveillance	✓	SM6: Benthic Habitat Assessment	✓
OM6: Shoreline Clean-up Assessment	✓	SM7: Marine fish and elasmobranch assemblages assessment	✓
OM7: Air Quality Modelling	✓	SM8: Fisheries Impact Assessment	✓
		SM9: Heritage Features Assessment	✓
		SM10: Social Impact Assessment	✓

17.1 Environmental performance

Table 17-2 indicates the environmental performance outcome, control measures, performance standards and measurement criteria for operational and scientific monitoring.

Table 17-2: Environmental performance – operational and scientific monitoring

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Operational and Scientific monitoring - Preparedness	**Response preparedness**		
	Maintenance of OSM Services Provider (MSP) contract	[EPS-OSM-002] Maintain contracts with third-party provider/s to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of monitoring in accordance with the capability and resourcing requirements described in Sections 8-10 of the North West Shelf OSM-BIP (7715-650-ERP-0002)	Contract with OSM services provider
	OSM Services Provider capability verified through regular capability reporting	[EPS-OSM-003] Obtain monthly capability reports from OSM services provider to demonstrate that the capability outlined in Section 10 of the North West Shelf OSM-BIP (7715-650-ERP-0002) is available throughout the activity	Monthly capability reports from OSM Services Provider
	Adequacy of existing baseline data sources across the Santos combined EMBA reviewed periodically	[EPS-OSM-004] Regular review of existing baseline data	Baseline data review report
	Water quality monitoring vessels requirements identified	[EPS-OSM-006] Maintenance of vessel specification for water quality monitoring vessels within Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Vessel specification
	Pre-completed risk assessment for operational and scientific monitoring activities	[EPS-OSM-016] Pre completed and approved risk assessment is in place with the OSM Services Provider for operational and scientific monitoring activities	OSM Services Provider pre-completed and approved risk assessment
	Access to Santos oil sampling kits	[EPS-OSM-001] Oil sampling kits pre-positioned at Exmouth, Dampier and Varanus Island. Equipment contents as per Appendix C of the Santos Oil and Water Sampling Procedures (7710-650-PRO-0008).	Evidence of deployment to site
	OSM Services Provider testing and exercising	[EPS-OSM-005] Annual testing of OSM Services Provider arrangements and capability	Exercise and testing records
	OSM-BIP reviewed annually	[EPS-OSM-030] Annual review of OSM-BIP will be conducted in accordance with Section 11 of the North West Shelf OSM-BIP (7715-650-ERP-0002)	Record of revision
Response implementation			
	Activate Operational and Scientific Monitoring Plans	[EPS-OSM-010] OMPs and SMPs will be activated in accordance with the initiation	Incident Action Plan and Incident Log confirm OMPs and SMPs are

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Operational and Scientific monitoring – Activation and Mobilisation		criteria provided in Table 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)	activated in accordance with the initiation criteria provided in Table 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)
	Activation of operational and scientific monitoring plans according to OMPs and SMPs initiation criteria	[EPS-OSM-009] Initiation criteria of OMPs and SMPs will be reviewed during the preparation of the initial IAP and subsequent IAPs; and if any criteria are met, relevant OMPs and SMPs will be activated	IAP/s Incident log
	Mobilisation and implementation of OMPs and SMPs	[EPS-OSM-031] Mobilisation and implementation of OMPs and SMPs will be undertaken in accordance with the indicative timeframes and sequencing described in Part B of the North West Shelf OSM-BIP (7715-650-ERP-0002)	Incident log; Monitoring records.
	OSM-BIP	[EPS-OSM-025] Monitoring to be conducted in accordance with the Santos North West Shelf OSM-BIP (7715-650-ERP-0002).	Incident log; Monitoring records.
	OSM implementation Minimum Standards	[EPS-OSM-026] Implementation of operational and scientific monitoring will comply with the Minimum Standards listed in Appendix A of the Joint Industry OSM Framework (APPEA, 2021)	Incident log; Monitoring records.
	OSM Services Provider to commence activation within specified time from initial notification	[EPS-OSM-011] OSM services provider shall commence activation process within 30 mins of initial Call-off Order form being received from Santos	OSM services provider records
	Scalable OSM capability	[EPS-OSM-032] If the OSM Implementation Lead identifies that additional monitoring capability is required beyond that described in Section 10 of the North West Shelf OSM-BIP (7715-650-ERP-0002), the need for these resources will be identified as soon as practicable and mobilised through Santos resources including the OSM Services Provider Contract	Incident log; OSM services provider records.
	Co-mobilised monitoring teams	[EPS-OSM-033] Decisions regarding co-mobilisation of monitoring teams will be determined following a spill event, as part of the Incident Action Planning process. These decisions will be made by the IMT in consultation with the	Incident log; OSM services provider records.

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
		OSM Services Provider and relevant stakeholders, with due consideration given to safety, access to sensitive receptors, timing, and data quality requirements	
	Santos to provide support to OSM Services Provider	[EPS-OSM-012] Santos personnel to support OSM services provider through the provision of monitor and evaluate information and relative location of sensitive receptors to the spill	Incident log; OSM services provider records.
	Mobilisation of appropriately specified monitoring vessels	[EPS-OSM-017] Source monitoring vessel(s) with specifications in accordance with Section 5.2 of Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)	Incident log
Operational and Scientific monitoring – Water quality and dispersant amenability	Ecotoxicity testing of oil samples to take place	[EPS-OSM-007] Oil samples collected to be sent for laboratory ecotoxicity testing of oil	Incident log
	Ecotoxicity testing to derive species protection triggers	[EPS-OSM-008] 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
	Dispersant amenability analysis of oil samples to take place	[EPS-OSM-029] If applicable (not MDO), oil samples sent to laboratory for dispersant amenability	Incident Log
Operational and Scientific monitoring – Shoreline assessment and nearshore operations	Use of shallow draft vessels for shoreline and nearshore operations	[EPS-OSM-020] Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the relevant Control Agency	Vessel specification documentation contained in IAP
	Shoreline clean-up assessment direction and leadership	[EPS-OSM-018] OM6: Shoreline Clean-up Assessment will be implemented under the direction of the relevant Control Agency	Incident log
	SCAT Specialist/Coordinator assessment/selection of vehicle appropriate to shoreline conditions	[EPS-OSM-021] SCAT Specialist/Coordinator assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/ nearshore habitat/ bathymetry assessment	[EPS-OSM-022] Unless directed otherwise by the designated Control Agency, a rapid shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities	IAP records; Assessment records

Environmental performance outcome	Implement monitoring programs to monitor the effectiveness of control measures and inform response activities; and assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/ roosting areas and turtle nesting habitat	[EPS-OSM-023] Unless directed otherwise by the designated Control Agency, 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	[EPS-OSM-024] Unless directed otherwise by the designated Control Agency, action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met
	Daily SCAT reports issued during SCAT operations	[EPS-OSM-019] Reports from OM6: Shoreline Clean-up Assessment will be provided to the IMT daily, detailing the assessed areas to maximise effective utilisation of resources	Incident log
Operational and Scientific monitoring – Stand-down and termination	Stand-down, termination and post-spill activities	[EPS-OSM-027] Once post-spill SMP monitoring reports are drafted they will be peer reviewed by an expert panel	Monitoring records
	Stand-down, termination and post-spill activities	[EPS-OSM-028] OMPs and SMPs will be terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)	Incident Action Plan and Incident Log confirm OMPs and SMPs are terminated in accordance with the termination criteria provided in Tables 9-1 and 9-2 of the Joint Industry OSM Framework (APPEA, 2021)

18. Waste management

Table 18-1 lists the environmental performance outcome, initiation and termination criteria for this strategy.

Table 18-1: Waste management – environmental performance outcome, initiation criteria and termination criteria

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using and recycling waste where possible.
Initiation criteria	Response activities that will be generating waste have been initiated.
Termination criteria	All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements. Agreement is reached with Jurisdictional Authorities to terminate the response.

18.1 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. All transport will be undertaken via controlled-waste-licensed vehicles and in accordance with the Environmental Protection (Controlled Waste) Regulations 2004. Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001) provides detailed guidance to the WSP in the event of a spill.

Where DTMI is the Control Agency, Santos will provide the Deputy Waste Management Coordinator to the DTMI IMT Logistics Unit to support the DTMI IMT in coordinating waste management services (refer to Table 5-4).

18.2 Implementation guidance

Table 18-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. The OSC and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Santos

Table 18-2: Implementation guidance – waste management

Action		Consideration	Responsibility	Complete
Initial actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager.	Refer to Incident Response Telephone Directory (7700-670-PLA-0016.20) for contact details.	Logistics Section Chief	☐
	Based on operational modelling and applicable response strategies, communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations.	It is better to overestimate volumes and scale back resources then to underestimate waste volumes.	Logistics Section Chief Planning Section Chief	☐
	Using most recent monitor and evaluate data and any existing and future response activities, determine the most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established.	Shoreline waste collection points (temporary storage site) will be determined by DTMI and will depend upon the location of shoreline clean-up activities and staging areas and the availability of vehicle access routes. Consideration should 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 is given through DWER.	Logistics Section Chief Planning Section Chief Environmental Unit Leader	☐
	For each receival location, indicate the anticipated: • Material types. • Material generation rates. • Material generation quantities. • Commencement date/time. • Anticipated clean-up duration. • Receptacle types required. • Logistical support requirements. • Approvals required from ports, local governments, landowners, state government agencies (refer to Oil Pollution Waste Management Plan 7715-650-ERP-0001]).	Consider facilities for waste segregation at source.	Logistics Section Chief Planning Section Chief	☐
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP.	Waste management should be done in accordance with Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001) and where relevant, the DTMI Waste Management Guidelines (WA), and the respective port, port operator and/or ship owner's waste management plan.	Logistics Section Chief Planning Section Chief Deputy Waste Management Coordinator (DTMI IMT) WSP Operations Supervisor	☐
	Mobilise waste management resources and services to agreed priority locations.	-	WSP Operations Supervisor Logistics Section Chief Deputy Waste Management Coordinator (DTMI IMT)	☐

Action		Consideration	Responsibility	Complete
Ongoing actions	Provide ongoing point of contact between IMT and WSP.	If DTMI is the Control Agency, the Deputy Waste Management Coordinator shall be the point of contact between DTMI and the WSP.	Logistics Section Chief	☐
	Ensure all waste handling, transport and disposal practices comply with legislative requirements.	Alert Logistics Section Chief (or delegate) if any non-compliance is anticipated or detected. Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001), and where relevant, the DTMI Waste Management Guidelines (WA) and the respective port, port operator and/or ship owner's waste management plan.	WSP Operations Supervisor Deputy Waste Management Coordinator (DTMI IMT)	☐
	Ensure records are maintained for all waste management activities, including but not limited to: • Waste movements (e.g. types of receptacles, receival points, temporary storage points, final disposal locations). • Volumes generated at each site (including total volume and generation rates). • Types of waste generated at each site. • Approvals obtained (as required).	-	WSP Operations Supervisor Deputy Waste Management Coordinator (DTMI IMT)	☐

18.3 Waste approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Oil Pollution Waste Management Plan (7715-650-ERP-0001), and where relevant, the DTMI 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 authority for waste management in WA. If required, DTMI may establish an Operational Area Support Group, as defined in the 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 (7715-650-ERP-0001) 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.

18.4 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 (7715-650-ERP-0001).

Key responsibilities of the WSP include the following.

- Maintain ER standby preparedness arrangements:
  - 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.
  - Access to 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 and liaison with relevant field-based spill responders).

18.5 Waste management resources

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

Table 18-3 provides WSP capability for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP. The weekly removal capacity is 8,778 m^3.

The maximum oily waste collected from shoreline clean-up , including bulking factor (Section 15.4) over 21 weeks is 252 m^3 per week (Table 15-5), which is exceeded by the WSP weekly total removal capacity specified in Table 18-3.

Liquid waste from containment and recovery operations (if used) can also be handled by the WSP weekly liquid waste removal capacity of 5,250 m^3 at the port of reception. As per Table 12-6, the maximum weekly volume of oily waste predicted is 1,223 m^3 (week 2), with a total predicted oily waste of 4,980 m^3 over the 11 weeks of the response.

Table 18-3: North West Alliance vehicle and equipment availability

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Waste stored/shifted per week (m^3)
Waste removal					
Oily waste					
Skip lift truck	14	Lift up to 10 t, 4.3 m^3 per service	Servicing of skip bins	7	420
Front lift trucks	10	28 m^3 body, 11.2 m^3 per service	Servicing of front lift bins	7	784
Side loading truck	10	18 m^3 body, 7.2 m^3 per service	Servicing of MGBs	7	504
Hook lift truck	8	Lift up to 15 t, 17.5 m^3 per service	Servicing of hook lift bins	7	980
Flat bed truck	16	15 pallet spaces, 17.5 m^3 per service	Servicing of bins	7	840
Liquid oil					
Liquid waste tankers (triple 'road-train' configuration)	10	75 m^3	Collection of liquid waste at the port of reception (Dampier)	7	5,250
Waste storage					
Oily waste					
ISO-tainers	15	22 m^3	Various waste streams	2	660
MGBs	500	240 L	Mobile bins	2	240
Offshore 8 pack lifting cradle (MGBs)	2	16 x 240 L MGBs	Able to remove 16 x 240 L MGBs simultaneously	Continuous	
Lidded bins	6	1,100 L	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, assumed 8 m^3 per service	Various waste streams	2	960
Hook lift bins	12	15–30 m^3, assumed 23 m^3 per service	Various waste streams	25	6,900
Forklift	4	4 t forklift	All areas	Continuous	
				Weekly waste storage capacity	**10,528**
				Weekly total waste removal capacity	**8,778**
				Weekly liquid oil removal capacity	**5,250**

Source: As per Oil Pollution Waste Management Plan (7715-650-ERP-0001)

18.6 Environmental performance

Table 18-4 indicates the environmental performance outcomes, control measures and performance standards for this response strategy.

Table 18-4: Environmental performance – waste management

Environmental performance outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, re-using and recycling waste where possible.		
Response strategy	**Control measures**	**Performance standards**	**Measurement criteria**
Waste management	**Response preparedness**		
	Access to waste management equipment, personnel, transport and disposal facilities.	[EPS-WM-001] Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained throughout activity.	Contract with WSP for ER services; Annual desktop assurance report.
	Access to vessels for waste transport	[EPS-WM-002] MSAs with multiple vessel providers maintained throughout activity.	MSAs with vessel providers
	Vessels requirements for containment and recovery waste transport are identified	[EPS-WM-003] Maintenance of vessel specification for waste storage and transport vessels for containment and recovery	Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)
	Response implementation		
	Santos Oil Pollution Waste Management Plan (7715-650-ERP-0001) implemented	[EPS-WM-004] WSP shall: • Appoint a Project Manager within 24 hours of activation; • Track all wastes from point of generation to final destination; • Provide monthly waste management reports and more regular situation reports during the response until termination criteria are met.	Incident log; Waste tracking records
	Santos Oil Pollution Waste Management Plan (7715-650-ERP-0001) implemented to ensure effective execution and minimise environmental impacts from response	[EPS-WM-006] WSP to provide liquid oil waste tanks for containment and recovery operations to deployment port, if requested, within 24 hours.	Incident log
		[EPS-WM-007] WSP to provide waste bins for oil and oily waste (shoreline clean-up operations) to clean-up site or deployment port within 24 hours.	Incident log

19. Response termination

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

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

An Operational NEBA will be conducted to inform the decision-making process. Termination criteria are defined within each section of response activities within this 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 activity that was mobilised.
- Undertake an inventory of consumables and prepare accounts.
- Arrange for the return of equipment.
- Arrange for the refurbishment of consumed equipment.
- Investigate the cause of the incident and report to relevant authorities.
- Assess long-term scientific monitoring requirements.

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Appendix A Hydrocarbon characteristics and behaviour

Marine diesel oil

ITOPF (2023) and RPS (2025) categorise MDO as a Group II light persistent oil. The physical characteristics of MDO are summarised in Table A-1.

Generally, about 4.0% of the MDO mass should evaporate within the first 12 hours (boiling point (BP) < 180°C), a further 32.0% should evaporate within the first 24 hours (180°C < BP < 265°C), an additional 54.0% should evaporate over several days (265°C < BP < 380°C) and an additional 54.0% should evaporate over several days (265°C < BP < 380°C). Approximately 10% (by mass) of MDO will not evaporate, though will decay slowly over time (RPS, 2025).

In the marine environment, MDO will behave as follows:

- Spread rapidly in the direction of the prevailing wind and waves.
- In calm conditions, evaporation is the dominant process contributing to the fate of spilled MDO from the sea surface and will account for 60–80% reduction of the net hydrocarbon balance.
- Strong tendency to entrain into the upper water column (0–10 m) (and consequently reduce evaporative loss) in the presence of moderate winds (>10 knots) and breaking waves; however, it can re-surface under calm conditions.
- The evaporation rate of MDO will increase in warmer air and sea temperatures such as those present around the area.
- Approximately 10% (by mass) of MDO will not evaporate, though will decay slowly over time.

Table A-1: Properties of MDO

Hydrocarbon type	Density (kg/m3)	Dynamic viscosity at 25 °C (cP)	API	Wax content (%)	Pour point °C	Asphaltene (%)
MDO	890.0 at 15ºC	14.0	27.5	1	−9.0	-

Source: RPS (2025)

Caley crude

ITOPF (2023) and RPS (2025) categorise Caley crude as a Group II light persistent oil. The physical characteristics of Caley crude are summarised in Table A-2.

Due to its low viscosity, if spilt on the sea surface, the crude would rapidly spread and thin out. Based on its boiling point distributions, approximately 48% of the product (which are the volatile components) is expected to evaporate within the first 12 hours (BP < 180°C), a further 19% (the semi-volatiles) should evaporate within the first 24 hours (180°C < BP < 265°C) and the low volatile portion (18%) should evaporate over a longer period (265°C < BP < 380°C). Additionally, 15% of the crude is shown to persist in the marine environment for much longer periods and would be subject to a relatively slow degradation. Hence, due to the percentage of persistent components (15%) with a boiling point above 370ºC, Caley crude is considered a Group II light persistent oil as presented in the AMSA (2023) categorisation. However, it should be noted that Caley crude also has properties that align it with a Group I oil as per the ITOPF (2023) classifications (RPS, 2025).

In the marine environment Caley crude will behave as follows:

- Spread rapidly in the direction of the prevailing wind and waves.
- In calm conditions (winds <5 knots), evaporation is the dominant process contributing to the fate of spilled Caley crude from the sea surface and will account for a 48% reduction of the net hydrocarbon balance within 12 hours. Evaporation of the residual compounds will slow considerably, and they will then be subject to more gradual decay through biological and photochemical processes.

- 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 can re-surface under calm conditions.
- The increased level of entrainment in the variable wind speed case (2-23 knots) will result in a higher percentage of biological and photochemical degradation.
- Given the proportion of entrained crude oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay over time scales of several weeks.

Table A-2: Properties of Caley crude

Hydrocarbon type	Density (kg/m3)	Dynamic viscosity at 25 °C (cP)	API	Wax content (%)	Pour point °C	Asphaltene (%)
Caley crude	773 at 15 °C	1.45	51.4	9.2	−15	<0.5

Source: RPS (2025)

Appendix B Oil spill response ALARP framework & assessment

ALARP assessment framework

Rationale

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

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

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

Guidance documents

Guidance documents used in the preparation of this framework include:

- Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003).
- NOPSEMA Guidance Note ALARP (N-04300-GN0166, August 2022).
- NOPSEMA Guidance Note Control Measures and Performance Standards (N04300-GN0271, June 2020).
- NOPSEMA Guideline Environment Plan Decision Making (N-04750-GL1721, January 2024).
- NOPSEMA Guidance Note Risk Assessment (GN0165, June 2020).
- NOPSEMA Oil Pollution Risk Management (GN1488, October 2024).

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 of 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. **PPAs**: The 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. PPAs are locations of high ecological value within the EMBA that would be targeted in response. Selection of PPAs is detailed in the Oil Spill Risk Assessment and Response Planning Procedure (SO-91-II-20003).
4. **NEBA**: NEBA is used to select the most effective response strategies to protect the PPAs 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. Implementation Guidance is then developed to detail what arrangements and actions are required to be initiated by the IMT to meet the incident requirements up to a worst-case incident.

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

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

- 6a. Record Control Measures In Effect: The spill response control measures currently in place for Santos 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 and 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 the 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 Santos' current response arrangements to determine if synergies or resource conflicts might occur.

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

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

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

1. Finalised Control Measure Selection: Outputs from the ALARP Assessment shown in Step 6 comprise of the finalised control measures (in BLUE).
2. 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 following measures of effectiveness; functionality, availability, reliability, survivability, dependency and compatibility. Parameters set in the performance standard should be 'SMART'; specific, measurable, appropriate, realistic and timely.

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

Criteria and definitions

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

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

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated. Description of the control measure that is In Effect or description of the potential control measure.
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N 04750-GL1721, January 2024.
Control Measure Category	A range of different types of controls generally provide effective protection as they offer independence and multiple layers of protection. The OPGGS (Safety) Regulations 2024 refer to technical and ‘other’ controls where technical control measures involve hardware like shutdown valves and alarms. ‘Other’ control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: • People – personnel. • System – organisation, information/communications, support facilities, training/competency. • Equipment – equipment. • Procedures – doctrine. Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using the following six criteria. Functionality • The functional performance of a control measure is what it is required to do. How does the control perform in order to achieve the required risk reduction? Availability • Probability that the Control Measure will be available when required and has not failed or is undergoing a maintenance or repair. Reliability • The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do with the probability that the system will function correctly and is usually measured by the mean time between failure. Survivability • Whether or not a control measure is able to survive a potentially damaging event such as fire or explosion is relevant for all control measures that are required to function after an incident has occurred. • To achieve their purpose, oil spill response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. Dependency • The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the failure of others, then the control measures are not independent, and it may not be appropriate to count such measures as separate.

Column	Description
	• Several control measures are reliant on equipment, people and vessels, hence have high dependency. Compatibility • Whether or not a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 June 2020.
Feasibility	Feasibility describes the time, cost and/or effort required to implement the Control Measure.
Accept/Reject	Outcome of assessment and key reasons for the decision.

ALARP assessment summaries

ALARP assessment summary

Source Control – Semi-sub MODU wells

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 release during the drilling activities. 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 a MODU will be on site for relief well drilling by day 44 from the start of a well release. Relief well drilling can be completed within 77 days (11 weeks) using MODUs, equipment and specialist personnel that Santos has arrangements to gain access to.

Seventeen additional, alternative or improved control measures were identified and assessed, but none were adopted as they were assessed as grossly disproportionate to the potential reduction in environmental risk. The rejected control measures were:

- Access to additional source control emergency response personnel;
- Schedule drilling campaign to avoid cyclone season;
- Pre-drill riser-less intervals for a potential relief well before drilling the main well;
- Install a mudline closure device;
- WWCI on standby in Perth during drilling operations in order to respond immediately to a LOWC;
- 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;
- Dedicated BOP Intervention vessel equipped with ROV tooling package in field;
- Alternative BOP design (additional sealing rams installed);
- Alternative BOP design (Pyrotechnic subsea isolation device);
- Santos to purchase and maintain its own capping stack in Dampier;
- Incentivise a vendor to set up a capping stack in Dampier;
- Purchase and maintain own capping stack and have suitable deployment vessel/crew on standby with pre - approved Safety Case to deploy capping stack;
- Transport WWCI capping stack via air;
- Use of lightweight Rapid Cap to be mobilised via air from Houston, USA;
- Deploy Offset Installation Equipment (OIE) to cap well when direct vertical access is not possible - to allow the installation of a cap directly onto a subsea wellhead;
- A contract & Australian Safety Case is obtained with very large crane reach (boom-out and load capacity) vessels suitable of installing capping stacks on wells with large diameter gas boils;
- Preposition WWCI Capping Stack standby crew in Perth.

Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Table 9-9. 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.

Source Control – jack-up MODU wells

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 release during the drilling campaign. 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 a MODU will be on site for relief well drilling by day 43 from the start of a well

ALARP assessment summary
release. Relief well drilling can be completed within 77 days using MODUs, equipment and specialist personnel that Santos has arrangements to gain access to. Nine additional, alternative or improved potential Control Measures were identified and assessed, but none were adopted as they were assessed as grossly disproportionate to the potential reduction in environmental risk. The rejected control measures were: • Contract source control personnel through a provider in addition to existing arrangements • WWCI on standby in Perth during drilling operations in order to respond immediately to a LOWC; • MODU on standby at activity location during drilling campaign; • Having a dedicated relief well MODU on contract during the drilling campaign; • Use of two drilling rigs during the activity that drill simultaneously so that one rig could act as a relief well drilling rig for the other; • Schedule drilling campaign to avoid cyclone season; • Pre-drill riser-less intervals for a potential relief well before drilling the main well; • Use of semi-submersible MODU to drill the jack up MODU wells; • Alternative BOP design (additional sealing rams installed). Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Table 9-9. 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.
Monitor and evaluate
For the monitor and evaluate strategy, various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture (COP) during the incident. Three additional / alternative control measures were identified and all were assessed and rejected as being grossly disproportionate to the potential reduction in environmental risk: • Purchase of oil spill modelling system and internal personnel trained to use the system; • Purchase additional satellite tracking buoys; • Ensure trained aerial observers based at strategic locations such as Exmouth, Port Hedland and/or Karratha. Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Table 10-21. The key areas of effectiveness for the identified control measures, during times of maintaining 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 and satellite imagery providers.
Mechanical dispersion
Mechanical dispersion is a secondary strategy that could be conducted by vessels undertaking primary response strategies without the requirement for additional equipment. The use of mechanical dispersion as a response strategy would be assessed as part of an Operational NEBA. No potential additional, alternative or improved control measures were identified and assessed. Performance standards and measurement criteria that have been developed for the in-effect control measures are shown in Table 11-4. The key areas of effectiveness for the identified control measures during a response relate to the development of an Operational NEBA to confirm suitability and environmental benefit of mechanical dispersion and the mobilisation of vessels. These key areas of effectiveness are reflected in the Performance Standards.
Offshore Containment and Recovery
Containment and recovery has been selected as a primary strategy for the surface and subsea LOWC scenarios as the deterministic oil spill modelling predicts areas of surface oil ≥50 g/m^2 thickness that may be amenable to containment and recovery. Santos, AMOSC, AMSA and OSRL have provisions for spill response personnel and equipment for the worst-case scenario and equipment is available in the northwest region and within WA (including stockpiles in Karratha and Exmouth) which includes offshore rated boom and skimmers suitable for application in response to a potential crude oil spill. Containment and recovery equipment availability is not considered a limiting factor to containment and recovery operations; the quantity of equipment available to Santos through contractual arrangements and the positioning of equipment in first strike locations is considered adequate for the scale of worst-case containment and recovery operations identified in the OPEP. The timely mobilisation of suitable vessels and personnel required for containment and recovery operations are considered to be the key constraints for this strategy. A review of Control Measures associated with personnel identified that no improvements could be made to the availability of personnel or vessels (above current arrangements) without the cost/effort being disproportional to the potential reduction in environmental risk. Five additional or alternative Control Measures were identified and assessed. One alternative Control Measure was identified and accepted: • Arrangements for staff from an additional oil spill personnel provider (TRG).

Santos

ALARP assessment summary
Four additional/alternative Control Measures were rejected. Rejected control measures were: • Purchase additional booms and ancillary equipment to be owned by Santos; • Access to additional vessels by contracting vessels to remain on standby for containment and recovery; • Train additional Santos personnel for spill response teams; • Just-In-Time training to train personnel for containment and recovery operations. Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in Table 12-8. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to suitable vessels, equipment and personnel through contractual arrangements and the tracking of suitable vessels. During response, a key area for increasing effectiveness is the rapid mobilisation of first strike resources so that operations can be undertaken when oil thickness is at its highest. Given effectiveness of this strategy increases with oil concentration and decreases under high wind/sea state conditions, the consideration of these factors within an operational NEBA (SIMA) is considered a key control for maintaining effectiveness as well as the use of aerial surveillance to direct operations to areas of highest oil concentration. Waste storage may be a limiting factor for ongoing containment and recovery operations, so a key area for increasing effectiveness will be the application for approval for decanting wastewater from liquid oil waste storage tanks onboard vessels. These key areas of effectiveness have been represented in the Performance Standards for containment and recovery operations.
Chemical Dispersant Application - surface
Surface dispersant application is a primary response strategy for Caley crude, to be assessed at the time of a spill where deemed environmentally beneficial by an operational NEBA. Following planning for aerial dispersant application, where 4 FWADC dispersant aircraft and the C-130 system from OSRL are used from day 3, planning for the worst case resourcing requirements for vessel based dispersant indicates that 9 vessels per week are required after the first week. During the first week, as aerial and vessel dispersant activities ramp up, 1 vessel will be available from day 4 as per first strike mobilisation. It is expected that vessel dispersant units could then be effectively ramped up to the required number over the first week; for the purposes of estimating dispersant volumes it is assumed that 1 dispersant spray vessel will be in-field by day 4, 4 vessels by day 5, 6 vessels by day 7, and 9 vessels by day 8, then maintaining 9 vessels per week for the remainder of the vessel based dispersant response. The response needs calculator indicates a total dispersant use of 3,225 m^3 from vessel application, and 5,625 m^3 from aerial application, throughout the duration of the response (a total of 8,850 m^3). The total volume needed indicates that manufacture of 2,240 m^3 of dispersant will be required, which will need to start arriving on site at the start of week 9. Vessel based dispersant spray systems are available from Santos, AMOSC and AMSA in the region (including stockpiles at Exmouth) and within WA. These spray systems are not considered a limiting factor to surface dispersant operations; the quantity of equipment available to WA through contractual arrangements and the positioning of equipment in first strike locations is considered adequate for the scale of worst-case surface dispersant operations identified in the OPEP. The timely mobilisation of suitable vessels and personnel required for surface dispersant operations, as well as additional dispersant manufacture to support extended operations, are considered to be the key constraints for this strategy. A review of control measures associated with personnel and vessels identified that no further improvement could be made with respect to the identification of suitable surface dispersant vessels or to the availability of personnel without the cost/effort being disproportional to the risk. Aerial based dispersant application is available to Santos through national and international resources via contractual arrangements. Mobilisation times for these resources are considered to be in line with industry best practice. No additional potential Control Measures were identified that could improve mobilisation times for aerial dispersant application. The response needs calculator estimates a total dispersant use of 8,850 m^3 throughout the duration of the response, which will exceed the dispersant volumes available within WA, Australia and internationally. Hence, dispersant availability is a limiting factor for this strategy. Therefore, the timely manufacture of additional dispersant stocks is a key control measure to ensure an effective ongoing response for this strategy. Nine alternate, additional or improved potential Control Measures were identified and assessed. Two improved control measure was accepted as reasonably practicable: • Develop and maintain dispersant supply and logistics plan to ensure worst case LOWC surface dispersant application requirements can be met; • If surface dispersant is selected as a response strategy, Santos to initiate dispersant manufacture on week 1 of the response to ensure a build-up of dispersant supply. Seven alternative, additional or improved Control Measures identified were rejected as grossly disproportionate. Rejected Control Measures were: • Access to additional spray systems stored in Karratha, Exmouth or Dampier; • Access to additional spray systems with dispersant stored on vessels; • Access to additional vessels by contracting vessels to remain on standby for chemical dispersion; • Faster access to response personnel via Santos employment of local personnel in locations such as Karratha or Exmouth; • Santos to contract personnel from Exmouth freight and logistics to deploy and operate vessel spray systems; • Access to aircraft via additional service provider;

ALARP assessment summary
• Access to additional dispersant stockpiles owned by Santos. Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in Table 13-17. The key areas of effectiveness for the identified Control Measures during times of preparedness, are around the maintenance of contracts for the vessel based and aerial dispersant application resources, dispersants and deployment personnel and the tracking of suitable vessels. In the event of a response, the key areas for ensuring effectiveness are the mobilisation of requirements to commence surface dispersant operations, evaluating dispersant efficacy using test sprays and operational monitoring, and ensuring dispersant supply for extended operations through early initiation of dispersant manufacture. These key areas of effectiveness are reflected in the performance standards.
Chemical Dispersant Application - subsea
SSDI would be employed as a secondary strategy for a subsea LOWC and only if it was determined to have an overall environmental benefit in consideration of enhancing safety for source control personnel and environmental benefits associated with a reduction in the surface oil versus potential detrimental environmental impacts. The response needs calculator estimates a total dispersant use of 3,564 m^3 throughout the duration of the SSDI response, which can be met by the existing industry dispersant stockpile, initially from stocks held within Australia, and then with stocks held in international stockpiles accessed via OSRL. Hence, dispersant availability is not a limiting factor for the SSDI strategy. Control measures are in place for a rapid mobilisation of the SFRT, personnel and dispersants to Dampier, however the key limiting factor for deployment is suitable SFRT capable vessels which may take longer to mobilise (~9 days). A Control Measure involving the positioning of SFRT vessels on standby at a regional port in order to reduce deployment time was assessed but was found to be disproportionate in terms of costs to the reduction in risk gained. Dispersant available with the AMOSC SFRT package would be supplemented with national and global dispersant stockpiles to meet dispersant requirements during the course of operations. A total of seven additional/ alternative/ improved Control Measures were identified and assessed. One additional/improved control measure were accepted as reasonably practicable: • Develop and maintain dispersant supply and logistics plan to ensure worst case LOWC SSDI requirements can be met. Six Control Measures were rejected as grossly disproportionate. Rejected control measures were: • Purchase of Santos SFRT to be located in Exmouth or Dampier; • Relocate AMOSC SFRT to Dampier; • Subsea bladder dispersant system positioned next to well site; • Enable improved vessel access by contracting a suitable, dedicated vessel on standby; • Rent dispersant stockpiles and place in Dampier; • Access to additional dispersant stockpile owned by Santos. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in Table 13-17. The key areas of effectiveness for the identified Control Measures during times of preparedness, are around the maintenance of contracts for SSDI resources, dispersants and deployment personnel and the tracking of suitable vessels. In the event of a response, the key areas for ensuring effectiveness are the mobilisation of requirements to commence SSDI operations, evaluating dispersant efficacy using operational monitoring, and ensuring dispersant supply for extended operations through the dispersant supply and logistics plan. These key areas of effectiveness are reflected in the performance standards.
Shoreline protection and deflection
Santos has access to the indicative resource requirements for the worst-case scenario in the OPEP, including mobilisation of shoreline and nearshore booms and ancillary equipment from Exmouth, Karratha, Varanus Island and Fremantle as well as spill response personnel from Santos, AMOSC, AMSA and OSRL. Trained regional Santos personnel can be quickly mobilised to appropriate locations, followed by 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. Santos also has Master Services Agreements in place with multiple vessel providers to enable access to shallow draft vessels as well as a list of small vessel providers. Potential Control Measures around providing additional equipment, vessels and personnel, pre-deployment of equipment in remote locations (i.e. Clerke and Imperieuse Reefs), and the placing of a vessel on standby for protection and deflection operations support during the activity were investigated, but were considered grossly disproportionate to the risk and the potential environmental benefits. Five potential additional/ improved control measures were identified and evaluated, however were rejected as grossly disproportionate: • Santos to purchase additional shoreline and nearshore booms and ancillary equipment; • Pre-deployment of protection and deflection resources in remote locations; • Access to additional shallow draft boom-tow vessels owned by Santos; • Dedicated vessel placed on stand-by for protection and deflection operations support in remote locations; • Ensure trained personnel based at strategic locations such as Dampier, Port Hedland, Karratha, Exmouth or Broome. Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in Table 14-6. The key areas of effectiveness for the identified Control Measures, during times of

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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 the Performance Standards for protection and deflection operations.
Shoreline clean-up
Santos has access to the indicative resource requirements for the worst case scenario in the OPEP, including manual clean-up and flushing equipment, decontamination/staging equipment from Exmouth, Karratha, Varanus Island and Fremantle and temporary storage as well as shoreline clean-up personnel from a combination of Santos, AMOSC, AMSA and OSRL. Trained Santos personnel located in regional areas can be quickly mobilised to appropriate locations, 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. Santos also has Master Services Agreements in place with multiple vessel providers to allow access to shallow draft vessels. Various shoreline clean-up response Control Measures were also identified. Potential Control Measures around providing faster access to clean-up plant, equipment, vessels and personnel, pre-deployment of equipment in remote locations (i.e. Clerke and Imperieuse Reefs), and the placing of a vessel on standby for shoreline clean-up operations support during the activity were investigated but were either not feasible or were considered grossly disproportionate to the risk and the potential environmental benefits. Nine potential additional or improved Control Measures were identified and evaluated but none were accepted, rejected on the basis of being grossly disproportionate: • Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations (e.g. Karratha, Dampier or Port Hedland); • Pre-purchase and storage of equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations (e.g. Karratha, Dampier or Port Hedland); • Pre-deployment of shoreline clean-up resources in remote locations; • Access to additional shallow draft vessels owned by Santos to transport personnel to key sensitive areas on offshore islands; • Dedicated vessel placed on stand-by for shoreline clean-up operations support in remote locations. • Access to additional team leaders that are locally based at strategic locations or can be mobilised within short timeframes; • 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. Performance standards and measurement criteria that have been developed for the in-effect and accepted control measures are shown in Table 15-6. 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 Sub-plan and operational 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.
Oiled wildlife
Oiled wildlife equipment including first strike kits and containers can be mobilised from regional locations and Perth. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst-case oiled wildlife operations identified in the OPEP. 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 Varanus Island 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. Control measures around the pre-positioning of equipment in strategic locations, and the pre-positioning of an OWR field station vessel, were considered but were found to be grossly disproportionate to the potential reduction in environmental risk. A control measure around developing a specification for an OWR field station vessel was accepted. Four additional/ alternative potential control measures were identified and assessed. One was accepted as reasonably practicable: • Vessel specifications for an OWR field station included within planning documentation (Santos Marine Vessel Requirements for Oil Spill Response [7710-650-ERP-0001]). Three control measures were rejected as grossly disproportionate to the potential reduction in environmental risk. Rejected control measures were: • Pre-positioning of an OWR field station vessel to enable rapid response in remote locations; • Pre-hire and/or prepositioning of staging areas and responders; • Direct contracts with service providers. Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in Table 16-7. 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

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response, the mobilisation of requirements for initial oiled wildlife response operations and the management of the oiled wildlife response in accordance with the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) are both key elements for achieving this strategy and they are represented as a Performance Standard.
Operational and Scientific monitoring
Oil spill operational and scientific monitoring will be conducted on behalf of Santos by contracted OSM Service Provider, via the OSM Supplementary Services Agreement, as detailed in the North West Shelf OSM-BIP (7715-650-ERP-0002). Four additional potential Control Measures were identified but all were rejected as grossly disproportionate to the potential reduction in environmental risk: • Monitoring personnel and equipment on standby in Dampier; • Contract additional OSM Service Providers to increase availability of monitoring personnel in the first 2 weeks of the spill; • Ensure trained monitoring specialists are available 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 17-2. 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 OSM service provider capability and reviews of existing baseline data. During response, a key area for effectiveness is the mobilisation requirements to commence operational and scientific monitoring, and ensuring that relevant operational and scientific monitoring plans are followed.
Waste Management
The Santos contract with a waste service provider has provisions for waste management operations of the scale estimated to be required in worst case scenarios detailed in the OPEP. Further detail is captured in the Waste Management Plan - Oil Spill Response Support (7715-650-ERP-0001). The waste service provider can mobilise waste receptacles from Karratha within 24 hours. Given the waste service provider arrangements and pre-planning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. Areas of improvement were identified regarding the availability of vessels required for waste transport at sea and additional storage tanks. Four potential additional Control Measures were identified and assessed to reduce these risks, one of which was accepted and the other three rejected due to the cost being grossly disproportionate to the potential reduction in environmental risk. The accepted control measure was: • Monitoring and hire of additional vessels located in the region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal), and contracted at the time of incident. The three rejected control measures were: • Maintain contracts with multiple service providers; • Procure temporary waste storage for Santos' stockpile; • Contract additional vessels on standby for waste transport. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in Table 18-4. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are regarding 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 worksheets

ALARP Assessment							
Relief Well Drilling	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract / MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Facilitate planning and execution of relief well in 77 day period to minimise environmental impacts	This primary source control measure provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintenance of contracts / MOUs	**In effect**
	Access to additional source control emergency response personnel	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	**Not Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** No environmental benefit in having access to personnel surplus to requirements. Sufficient reliable resourcing available within current contractual arrangements.
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process to 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	**Feasible** Cost associated with maintaining document	**In effect**
	MODU Capability Register is monitored monthly prior to and throughout the activity	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 as well as maintaining awareness of any changes in the available local rig fleet and determining if this will impact suitability to execute relief well operations. This could reduce MODU mobilisation times thus reducing volume of hydrocarbons released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with monitoring MODU availability	**In effect**
	Available MODU(s) confirmed to be suitable prior to drilling	In effect	Procedure	Identification of a suitable MODU prior to drilling would decrease the time spent searching for a suitable MODU in the event of a spill, reducing mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	**In effect**
	Relief well drilling supplies readily available in Western Australia	In effect	Equipment	Relief well drilling supplies such as casings and well head equipment could potentially reduce relief well drilling times	Shorten lead time for availability	Cost of purchase, maintenance and storage of supplies	**In effect**
	Relief well design assessment to identify and screen relief well spud locations	In effect	Procedure	Reduce time taken to plan and execute relief well and reduce environmental impacts	Improved availability and reliability	**Feasible** Cost associated with conducting a relief well design assessment	**In effect**
	Schedule drilling campaign to avoid cyclone season	Alternative	Procedure	Drilling the well in cyclone season does not increase the likelihood of a loss of containment. This will be verified by NOPSEMA in the accepted WOMP, where the plan to suspend the well during a cyclone will be assessed.	Does not alter the effectiveness of the response strategy.	**Not Feasible** Having to mob and de-mob a MODU to guarantee the well could be drilled outside of cyclone season would be a >$20MM 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 completing the drilling activities for 6 months of the year, and as a result would delay decommissioning activities. Repeat rig mobilisation would incur additional cost of >$20MM USD.
	Pre-drill riserless intervals for a potential relief well before drilling the main well	Additional	Equipment Procedure	Could potentially 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 riserless 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 10-15MM USD. Once the main well was completed, the partially completed relief well would need to be abandoned, at a further cost of 7MM USD.	**Reject** This option may result in a sub-optimal relief well location being used. There is minimal environmental benefit gained for the grossly disproportionate environmental impact and costs associated with this option.
	Install a mudline closure device (MCD)	Improved	Equipment	May provide a pre-installed safety barrier at the seabed	MCD augments the existing BOP safety system, located below the BOP and above the wellhead, and provides two additional sets of rams with an independent control system. Provides an additional level of safety, in addition to the subsea BOP.	Feasible, however BOP has sufficient functionality for a conventional pressure moored semi submersible MODU. There are no known hazards to consider where mudline closure device has been used to prevent/mitigate specific hazards.	**Reject** - cost is grossly disproportionate to the negligible environmental benefit that may be gained. There is a lack of run history within the industry to support the effectiveness and reliability of this control measure.
	WWCI 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
	Well / campaign specific SCP developed prior to drilling.	In effect	Procedure	Provides well specific planning information to allow drilling of relief well within 77 day timeframe.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintaining document	**In effect**

	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	Additional	Equipment	Provides for rapid mobilisation of relief well rig to location, reducing duration of spill by approximately 20-30 days. However, there would be an increase in operational environmental impacts from having an additional MODU drilling, i.e. light, noise, discharges etc.	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.	**Not Feasible** 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 implement this. - Existing MOU gives Santos sufficient access to relief well MODUs within Australia. - Response time modelling and worst-case hydrocarbon spill modelling includes additional time required to source a MODU internationally (e.g. Singapore) if required**.**
Blowout Preventer - Emergency Activation	BOP function testing	In effect	People	BOP E pressure/function tested as per API Standard 53 -ensures timely activation of the BOP.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Effort required to conduct BOP function test	**In effect**
	Access to ROV capability for BOP hot- stab intervention maintained with MODU ROV contractor throughout the activity	In effect	Equipment	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts. If ROV can access the BOP, BOP closed within 4-5 days.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of contract	**In effect**
	Dedicated BOP Intervention vessel equipped with ROV tooling package in field	Alternative	Equipment	If ROV can access the BOP, BOP closed within 1-2 days (depending upon daylight hours available) reducing release of hydrocarbons by 2-3 days.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Costs associated with having an additional dedicated BOP intervention vessel on contract $50-60K USD/day.	**Reject** Removes limitation of having to wait 2-3 days for a suitable vessel. However, the cost of having a vessel on standby is a fixed cost, regardless of whether a spill were to occur or not. The potential time saving of 2-3 days is not proportionate to the expense incurred.
	Alternative BOP design (additional sealing rams installed)	Improved	Equipment	May reduce severity of a LOWC event	Adds another layer of redundancy in BOP	Requires modifications to MODU, BOP and BOP control system to implement. Expected cost excess of 10MM 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 SCP and the WOMP. Additional cost doesn't significantly reduce risk and BOP equipment will be fully compliant with industry standards.
	Alternative BOP design (Pyrotechnic subsea isolation device)	Improved	Equipment	May reduce severity of a LOWC event	A new technology utilising pyrotechnic energy that can be used as a supplementary tubular shearing device together with a traditional hydraulic-mechanical BOP. The device is marketed in two configurations, either retrofitted to a rig BOP by modifying the device and BOP to replace a traditional BSR/CSR or deployed as a standalone device fitted within a dedicated 'spool' with appropriate connector below and wellhead hub enabling installation between the wellhead and BOP stack. Benefits of such a device include reportedly being able to shear traditionally "unshearable" tubulars such as drill collars, heavy walled casing, and heavy landing strings (including those with slip proof sections), seal the wellbore following a shear, with no requirement to discharge control fluid to the marine environment. In the event of a LOWC following failure of all existing rig BOP elements to isolate the well (BSRs, pipe rams and annular preventors), the activation of the device that successfully shears any tubulars and then achieves a seal could provide an	Santos has performed an ALARP assessment of cost and feasibility vs. potential benefits of deploying a pyrotechnic subsea isolation device as an additional control measure, considering the following for either the BOP retrofit or standalone configuration deployment options. The MODU's subsea BOP stack will be installed on the wellhead and tested prior to drilling through any subsurface zones that may have the potential to flow. Utilisation of subsea BOPs are broadly accepted by regulators worldwide as capable systems with sufficient redundancy in the context of ability to seal (via multiple annulars and pipe rams), shear (via multiple blind/shear rams) and be controlled via multiple systems (surface and subsea accumulators for power fluid, surface hydraulic or electric pilot signals, or subsea ROV hot-stab panels at the LMRP). For any given well control situation encountered, the MODU BOP is described, validated and accepted by NOPSEMA within the MODU Safety Case to meet ALARP for control of formation hydrocarbons entering the wellbore, and BOP equipment and control systems are qualified against API Standard 53. At the time of the development of this EP, pyrotechnic shearing and isolation devices have not been deployed in Australia for either surface or subsea well applications. Santos is aware of a limited number of international subsea deployments, with all known subsea applications utilising a retrofitted configuration where the device has replaced a BOP blind/shear ram (BSR) or casing shear ram (CSR). Although it has been reported that a DNV validation process to qualify the device as a blind shear BOP has been undertaken, Santos is not aware of any known activations in an active subsea LOWC and cannot consider it to be field proven. Currently, source control measures widely adopted by industry and accepted by international regulators such as BOPs, relief well drilling / dynamic well kills, and installation / closure of a subsea capping stack have all been utilised in actual LOWC scenarios to successfully halt an uncontrolled flowing wellbore via sealing or hydrodynamic overbalance. The experience of the pyrotechnic subsea isolation device technology to seal off a flowing subsea well (following a successful shear) is currently based on testing, modelling, and/or simulation under controlled and/or optimal conditions. Despite anticipated significant costs for adoption of the device (further described below), it would only potentially be used during a very unlikely worst case LOWC scenario (as a last line of defense if all other barriers fail) to shear any obstructing tubulars and attempt to seal the flowing well. The device would offer no additional preventative safeguard utility during more routine well control operations (managing influxes) or other operational well integrity challenges as current BOP BSRs routinely provide. This device is a mitigative safeguard to stop a LOWC already having occurred and does not reduce the likelihood of occurrence of the LOWC.	**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 SCP and the WOMP. Additional cost doesn't significantly reduce risk and BOP equipment will be fully compliant with industry standards.

					additional means to isolate the well and thus reduce the response time taken to control the LOWC, in turn reducing the volume of hydrocarbon released.	As the device is only able to be utilised for a single activation, an evaluation of the readiness state (functionality) of the technology during operations is unconventional and can only be indirectly inferred via diagnostics of its electrical control system and/or monitoring the device body for leaks. It is reasoned by the vendor that these methods are comparable (given the design of the device) to traditional BOP BSR or pipe ram function and pressure testing governed by API Standard 53 Revision 5, which positively demonstrate the ability to seal on a wellbore after closure. However, the inability to traditionally test the device's capability to positively seal on a well during operations renders its ultimate effectiveness as uncertain. When drilling exploration and appraisal wells, many of the unshearable tubulars that the subsea isolation device is primarily intended for will not be utilised. For example, the well will not run: •Any landing strings with slip-proof sections, •Unshearable landing strings across the BOP, •Unshearable casing strings with reservoir sections open, •Any completions with control lines or screens, •Subsea test trees for the programmed activities. Running of unshearable bottom-hole assembly (BHA) tubular components across the BOP when hydrocarbon reservoir sections are open would be typically limited in duration to several hours and efforts made to minimise time of exposure. The control measures described within the rig contractor procedures, the drilling program, Joint Operations Manual and the MODU Safety Case to manage this risk are well established and accepted as ALARP. The MDOU BOP is planned to contain two Blind Shear Rams (BSRs) that will be assessed to ensure they are appropriate for shearing and/or sealing planned tubulars to be run on the well and that they have available or calculated shear test data to verify effectiveness of these rams at the anticipated wellbore pressures and temperature. Further ALARP consideration specific to the device retrofit configuration option (as part of the MODU BOP) is discussed in the points below: •The MODU type anticipated to be utilised is expected to have a BOP containing five ram cavities to enable installation of two BSRs (or a combination of BSR and CSR) typically installed in one 'double' ram spool, and three pipe rams (for installation of a combination of fixed size pipe rams and/or variable bore rams). This configuration is typical for 5th or 6th generation semi-submersible MODUs available in Australia, although, it is also possible that there may also be MODUs in the region with only four ram stacks. These are typically utilised to minimise BOP weight to reduce wellhead fatigue; in this case, the replacement of a ram is not possible as this would preclude compliance with API Standard 53. Replacement of a ram to accommodate the inclusion of the pyrotechnic device retrofit is further complicated by the inability to remove a single ram given the common use of a double ram spool; therefore, the entire spool consisting of two rams would be removed rather than a single ram. •Further to the above, the BOP control system is utilised to control the functions of the BOP equipment subsea. Retrofit of such a device as a replacement of a ram spool would involve significant integration testing as this is not in alignment with the original intended function of the BOP's control system. There would also be flow on effects requiring integration with emergency shut down systems, auto dead man functionality and emergency disconnect functionality. •As far as Santos is aware, the device retrofit configuration has only been deployed to date on subsea BOPs containing 6 ram cavities, whereby an existing ram (typically BSR or CSR) is required to be removed and substituted with the device. It is noted that in general, only newer generation MODUs (operating in deep water and/or drilling HPHT wells) will have BOP stacks containing 6 rams where the substitution of a ram (providing it is a 'single' ram spool), may be arguably less compromising to the overall BOP system effectiveness as a well control safeguard. •Removal of the MODUs existing BOP 'double' ram spool to accommodate the retrofit installation of the device (which would only be used in an unlikely LOWC scenario) is an unacceptable compromise to the existing BOP system redundancy which has been validated and accepted as part of the MODU Safety Case to meet ALARP for management of formation hydrocarbons entering the well. •In addition to the above considerations, retro-fitting this device into the MODU BOP stack is assessed to require ~12+ months lead time for device fabrication, assembly and commissioning with a custom build body and connectors to interface with the MODU's BOP. •Following fabrication and device delivery, a BOP modification scope would be required in shipyard, the rig contractor would take additional time for integration of the modified BOP stack into an updated Base Safety Case. •Santos estimates a retrofit option would ultimately take ~18-24 months and a substantial cost increase (estimated at US$30 – 40MM) when accounting for device shipping and rental costs, BOP modification and device install costs, control system integration works, associated engineering works, acceptance testing and regulatory approval and permitting costs. Considerations specific to the standalone device configuration (below the rig BOP) are noted below: •Adding the device as a dedicated 'spool' between the wellhead and MODU BOP would result in extending the height and weight of equipment attached to the wellhead and conductor system by approximately 3.5m and 35 metric tons respectively. •Assessment of the stability / fatigue life of the already procured wellhead, conductor and surface casing equipment does not consider the additional loads (bending and fatigue) that would be applied as a result of installation of the device between the wellhead and BOP stack. Further analysis would be required and additional engineering controls may be required to accommodate the device, such as tethering of the BOP or equipment replacement.. •The execution of the drilling campaign using the standalone device configuration would require running and recovery of the device independent of the rig BOP and on critical path of operations. It is assessed this would add ~3-4 rig days to the campaign leading to increase costs per well of ~$3-4 million. •Use of the device in a standalone configuration spool to potentially shear and seal in an actual LOWC event may further complicate planning / executing a well kill and subsequent P&A operations as pumping access does not appear to be available below the device based on current design. Application of existing controls and barriers captured in the MODU Safety Case, Santos' Drilling & Completions Management Process, and Safety Management Systems provide a resulting low LOWC risk level that meets ALARP without the deployment of this additional control measure.	
Capping Stack (semi-sub MODU subsea wells only)	Capping stack is applicable as a secondary strategy for subsea wells and BOPs to be used. Santos has access to two WWCI capping stacks (Singapore and Aberdeen). Singapore Capping Stack- Assembly and ready to mobilise will take approximately 6 days + 9 days to mobilise to incident (total= 15 days).	In effect	Equipment	If deployment is feasible, controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	Provides functionality, availability, reliability, survivability, compatibility and independence. Would only be used where there is suitable vertical access over the wellhead.	Cost of contract	**In effect** Note that for wells with high rate gas WCD (large surface boils), this control still provides the ability to install a capping stack in the event the WCD is lower (for example, a partially sealing BOP or an obstruction in the wellbore, pipe in the hole on the well with the blowout, or reservoir permeability less than assumed in the WCD).

	Santos to purchase and maintain its own capping stack in Dampier	Alternative	Equipment	This is unlikely to provide any reduction in timeframes due to vessel access being the key time driver. In order for this to be effective, a suitable vessel would need to be on standby (with personnel) to realise benefit of capping stack in Dampier.	A capping stack positioned in Dampier or Karratha would need to be disassembled and stored at a suitable location as there are no suitable locations to store a fully assembled capping stack. Unpacking the containers, assembly and testing of the capping stack is estimated to take 4-5 days, but the limiting factor will be the availability of a suitable vessel.	USD20 million to procure and USD 2.8 million per year to maintain	**Reject** Cost of purchasing and maintaining an additional capping stack system is grossly disproportionate to the reduction in environmental risk.
	Incentivise a vendor to set up a capping stack in Dampier	Alternative	Equipment	This is unlikely to provide any reduction in timeframes due to vessel access being the key time driver. In order for this to be effective, a suitable vessel would need to be on standby (with personnel) to realise benefit of capping stack in Dampier	This would result in needing to move an existing stack away from a shared logistics hub, such as Singapore. This could potentially affect other operators sharing this contracted resource. In addition, there is no local expertise available on standby in Dampier/Karratha to conduct maintenance or commence assembly operations if the capping stack was required.	Pay full time rental as a sole beneficiary.	**Reject** Critical time path will be sourcing and availability of a suitable vessel, which is most likely to be in SE Asia. Therefore, the additional cost in requesting a vendor to set up an existing capping stack in Singapore is unlikely to provide any significant environmental benefit.
	Purchase and maintain own capping stack and have suitable deployment vessel/crew on standby with pre - approved Safety Case to deploy capping stack	Alternative	Equipment People	Some debris removal may be required prior to Capping Stack installation. The SFRT would not be onsite until day 8-9 and then debris removal may take 1-2 days (depending on extent of damage). This option would therefore reduce Capping Stack deployment time by 4- 6 days and potentially reduce volume of oil contacting sensitive receptors.	A capping stack positioned in Dampier or Karratha would need to be disassembled and stored at a suitable location as there are no suitable locations to store a fully assembled capping stack. Unpacking the containers, assembly and testing of the capping stack is estimated to take 4-5 days, but the limiting factor will be the availability of a suitable vessel. Purchasing a capping stack would also require training of personnel to maintain and install the stack, if it was required to be used. However, these personnel may not have the depth of experience that existing specialist personnel have whom are available through WWC, reducing the reliability and compatibility of this alternative.	Costs in addition to Capping Stack: purchase/ maintenance costs are $80k USD per day for vessel/crew plus training costs for personnel.	**Reject** Based on an activity of ~50 days the costs of vessel/crew hire would be in the order of $4M additional to Capping Stack purchase/maintenance costs and not including for mobilisation costs. Capping Stack deployment is a secondary source control strategy, is contingent on safety and technical considerations, and may not be effective in controlling the source. Given the low likelihood of a blowout event, the significant upfront costs involved and the presence of a more effective primary control strategy (relief well drilling) the costs are considered disproportionate to the level of risk reduction.
	Transport WWCI capping stack via air	Alternative	Equipment	The mobilisation time of the capping stack intervention system via airfreight is unlikely to provide a reduction in mobilisation time. The capping stack would need to be mobilised and flown into Perth (3-5 days) as regional airports do not have the required unloading equipment for the containers. Following this the containers would need to be transported to Dampier via sea (preferred - 6-8 days) or road (8+ days). Therefore, this option is not expected to result in a significant environmental benefit.	Air transportation of the capping stack requires it to be disassembled, which may affect the functionality of the stack if any components are damaged. The process of disassembly, packing, transport, unpacking and reassembly introduces a risk of damage to equipment, especially the metal pressure sealing surfaces associated with the high pressure connections. While the metal sealing rings have the strength to withstand very high pressures, they require a very smooth sealing surface to form a pressure seal. Mechanical handling of sealing components during capping stack disassembly risks damage to the smooth sealing surfaces and could result in additional time necessary to prepare the capping stack for deployment. Individual pressure sealing equipment elements must be packed separately. Damage to sealing surfaces may render the capping stack unusable until repairs can be undertaken at a certified machine shop. Therefore, air transportation adds an element of risk to the reliability of this alternative.	Cost of contracting Boeing 747 or Antonov 124 to transport the containers to Perth.	**Reject** The risk associated with damaging equipment from airfreighting the capping stack and the minimal improvement in mobilisation time (13 days v's 15 days) is considered disproportionate to any potential incremental environmental benefit.
	Use of lightweight Rapid Cap to be mobilised via air from Houston, USA.	Additional	Equipment	The mobilisation time of the rapid cap would take approximately 10+ days, not resulting in any significant environmental benefit.	Airfreighting this cap in from Houston would not lead to any significant reduction in the estimated response time (10 days v's 15 days for preferred alternative of shipping Singapore stack). This is due to debris clearance taking 10+ days. Use of the Rapid Cap would only mitigate very specific cases (e.g. no debris) and industry experience indicates debris removal is likely for catastrophic failures. Although this lightweight cap only requires a lighter construction vessel with lesser specification on the crane and heave compensation, it is most likely this vessel will still need to be sourced from SE Asia.	Cost of having an additional contract for another capping stack. Lightweight cap likely not feasible to land on well due to the upwards velocity of hydrocarbons from the blowing well.	**Reject** The mobilisation time of the rapid cap would take approximately 10+ days as the critical time path is likely to be debris clearance. The cost of having another contract with another equipment provider is disproportionate to the minimal environmental benefit gained.

	Deploy Offset Installation Equipment (OIE) to cap well when direct vertical access is not possible - to allow the installation of a cap directly onto a subsea wellhead	Additional	Equipment	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	The OIE has not been deployed to control a flowing well, is reliant on multiple vendors providing the equipment, and is currently unproven technology, so for these reasons it provides no improvement to functionality, reliability, survivability or independence.	The OIE is located in Trieste (Italy) and would take 45 to 65 days to arrive in Dampier (influenced by weather, customs, quarantine, vessel availability, site conditions at field, and well configuration). Given the OIE is unproven technology, it is unknown if any attempts to use the OIE would affect the primary source control strategy of drilling a relief well.	**Reject.** Based on predicted timeframes, the OIE is only marginally quicker at controlling the well than drilling a relief well. OIE is also considered unlikely to work in these water depths. The risks associated with use of the OIE are not proportionate to the potential benefits gained.
	The location of suitable vessels (required vessel specs. and Safety Case approval) for capping stack deployment are monitored monthly.	In effect	Procedure	Timely access to a suitable vessel could reduce mobilisation times for the capping stack thus reducing volume of hydrocarbons released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	**In effect**
	Capping Stack deployment vessel availability is reviewed prior to the activity.	In effect	Procedure	Timely access to a suitable capping stack deployment vessel could reduce mobilisation times for the Capping Stack thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	**In effect**
	A screening exercise is conducted to identify very large crane reach (boom out and load capacity) vessels suitable of installing capping stacks on wells with large diameter gas boils. Vessels with Australian Safety cases to be identified as well as regionally possibly suitable vessels with crane capacity information (as reasonably available). A register is to be compiled with their current location as part of the pre-spud assurance review.	In effect	Equipment	Timely access to a suitable vessel could reduce mobilisation times for the Capping Stack thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	**In effect**
	A contract & Australian Safety Case is obtained with very large crane reach (boom-out and load capacity) vessels suitable for installing capping stacks on wells with large diameter gas boils.	Additional	Equipment	Timely access to a suitable vessel could reduce mobilisation times for the Capping Stack thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	These large vessels are typically transient in the global market. Getting commerical interest to develop a SC to operate in Australia without firm work is likely to be zero. A payment could be made expected to be in the order of several milllion dollars to motivate vessel owners to provide technical specifications of their vessels and develop a SC. This would need to be repeated with multiple vessels, requiring a lot of time and effort to support. Securing the vessel to overalap with the activity will require a mutli-million dollar commitment given the nature of these vessels in the market.	**Reject** The effort and cost to implement this control is disproportionate to the environmental benefit. It is important to note that in a WCD involving a very large gas boil, vessel owners or indeed NOPSEMA may not permit the activity to be performed (from a safety perspective). A relief well becomes the primary method of source control in this instance.
	Wild Well Control Inc. staff available via contract to assist with the mobilisation, deployment, and operation of the Capping Stack and well intervention equipment	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of contract	**In effect**
	Preposition WWCI Capping Stack standby crew in Perth	Additional	People	No environmental benefit as WWC personnel are available to provide support within 72 hours.	No change to effectiveness or reliability as WWC personnel available within a rapid timeframe under existing arrangements.	Significant additional costs in having WWC personnel on standby in Perth. Locating personnel with specialised expertise in Perth may also create issues for other operators, as WWC offer this service to multiple operators. Locating them in remote locations may increase travel times to other global locations if they are required.	**Reject** No environmental benefit in having access to personnel surplus to requirements
	Capping stack installation feasibility study	In effect	Equipment Procedure	Provides capping stack feasibility and deployment specific planning information to allow deployment of a capping stack within the nominated timeline if feasible.	Provides functionality, availability, reliability, survivability, compatibility and independence	Requires logistics and desktop preparation; achievable and important for effective response.	**In effect** Maintaining capping stack readiness enables rapid well shut-in, lowering spill magnitude and duration; benefits outweigh cost and logistical complexity.
Subsea First Response Toolkit (SFRT) (semi-sub MODU)	AMOSC SFRT stored at Oceaneering yard in Jandakot and can be transported to Dampier. It is estimated this would take 10 hours to arrange and up to 7 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 9 days of call-out. Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day 12 from call out.	In effect	Equipment	May improve capability to perform subsequent source control measures (e.g. capping stack). Equipment needed to clean the area around the wellhead, enable intervention and prepare for relief well drilling and safe installation of a well capping or containment device.	Provides functionality, availability, reliability, survivability, compatibility and independence. Availability - whilst the SFRT takes several days to mobilise to site and conduct initial surveys, this timeframe is considered reasonable given the technical nature of this equipment.	Cost of AMOSC membership for SFRT	**In effect**

	Oceaneering personnel contracted for the deployment of the SFRT.	In effect	People	Equipment needed to clear the area around the wellhead, enable intervention and prepare for relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Cost of Oceaneering contract for personnel	**In effect**
	Suitable vessel sourced through Santos contractors. Vessel requirements outlined in Santos Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	**In effect**
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.	Cost associated with due diligence checks on contractor procedure.	**In effect**

ALARP Assessment							
Relief Well Drilling	Santos Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract / MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Facilitate planning and execution of relief well in 77 day period to minimise environmental impacts	This primary source control measure provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintenance 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	**Not Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** - No environmental benefit in having access to personnel surplus to requirements
	WWCI on standby in Perth during drilling operations in order to respond immediately to a LOWC	Additional	People	No environmental benefit as WWCI 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.	**Not Feasible** 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. Positioning 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 to 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	**Feasible** Cost associated with maintaining document	**In effect**
	MODU Capability Register is monitored monthly prior to and throughout the activity	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 as well as maintaining awareness of any changes in the available local rig fleet and determining if this will impact suitability to execute relief well operations. This could reduce MODU mobilisation times thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with monitoring MODU availability	**In effect**
	Available MODU(s) confirmed to be suitable prior to drilling	In effect	Procedure	Identification of a suitable MODU prior to drilling would decrease the time spent searching for a suitable MODU in the event of a spill, reducing MODU mobilisation times thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with monitoring MODU availability	**In effect**
	Relief well drilling supplies readily available in Western Australia	In effect	Equipment	Long lead equipment for relief well drilling will be readily available such as casings and well head equipment, which could potentially reduce relief well drilling times	Shorten lead time for availability	**Feasible** Cost of purchase, maintenance and storage of supplies	**In effect**
	Relief well design assessment to identify and screen relief well spud locations prior to drill campaign	In effect	Procedure	Reduce time taken to plan and execute relief well and reduce environmental impacts	Improved availability and reliability	**Feasible** Cost associated with conducting a relief well assessment	**In effect**

	MODU on standby at activity location during drilling campaign	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 34 days (77 days less the 43 days required for MODU to be ready to spud/commence relief well operations).	Reduction in spill duration by 43 days, resulting in less hydrocarbon exposure and reduced shoreline loading volumes.	**Not Feasible** The cost of having a MODU contracted, crewed and holding a valid NOPSEMA Safety Case and WOMP to be on standby would cost ~300k USD per day for a minimum negotiated contract term, plus a cost associated for MODU mob. and de-mob. ($20MM USD or more). This cost would be paid regardless of whether there is a loss of containment or not.	**Reject** - Likelihood of LOWC is considered unlikely and the cost of having a second MODU on standby at location is considered grossly disproportionate to the potential environmental benefit. - It is anticipated a MODU would need to be brought in from overseas to guarantee availability of this MODU in the event a relief well was required when the event occurred. The cost of a standby MODU is estimated at an additional $18MM USD, plus $20MM USD or more for mob/de mob, depending on where the MODU were mobilised from/to and the market at the time.
	Having a dedicated relief well MODU on contract during drilling campaign.	Improved	Equipment	Provides for rapid mobilisation of relief well MODU 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.	**Not Feasible** 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 NOPSMEA Safety Case. This could cost ~300k 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 MODU in the event a relief well was required when the event occurred. The cost of a standby MODU is estimated at an additional $18MM USD, depending on where the MODU were mobilised from/to and the market at the time. - This option was rejected as the reduction in risk is grossly disproportionate to the cost and effort required to perform it.
	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	Additional	Equipment	Provides for rapid mobilisation of relief well rig to location, reducing duration of spill by approximately 20-30 days. However, there would be an increase in operational environmental impacts from having an additional MODU drilling, i.e. light, noise, discharges etc.	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.	**Not Feasible** 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 implement this. - Existing MOU gives Santos sufficient access to relief well MODUs within Australia. - Response time modelling and worst-case hydrocarbon spill modelling includes additional time required to source a MODU internationally (e.g. Singapore) if required**.**
	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 WMP, where the plan to suspend the well during a cyclone will be assessed.	Does not alter the effectiveness of the response strategy.	**Not Feasible** Having to mob and de-mob a MODU to guarantee the well could be drilled outside of cyclone season would be a >$20MM 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 completing the drilling activities for 6 months of the year, and as a result would delay decommissioning activities. Repeat rig mobilisation would incur additional cost of >$20MM USD.
	Pre-drill riser-less intervals for a potential relief well before drilling the main well	Additional	Equipment / Procedure	Could potentially reduce relief well drill duration by 10 days. However, this activity would result in drill cuttings/discharges being released to the marine environment and the associated MODU noise and atmospheric emissions and operational discharges regardless of whether 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 as such a pre-drilled riserless interval may adversely affect functionality and reliability of this response strategy.	**Not Feasible** The pre-drilling activity itself would require approximately 10 days and a complete rig move to perform, costing approximately ~$7MM USD. Once the main well was completed, the partially completed relief well would need to be abandoned, at a further cost of $6-7MM USD.	**Reject** - This option may result in a sub-optimal relief well location being used, which may put the success of a relief well programme at unnecessary risk. - As a result there is minimal environmental benefit gained for the grossly disproportionate environmental impact and costs associated with this option.

	Use of semi-submersible MODU to drill the jack-up MODU wells	Alternative	Equipment	Use of a semi-submersible drill rig would mean additional source control methods could potentially be employed to control the flow of hydrocarbons. This would include use of a capping stack.	Possibly results in reduced time to stop the flow from the well. A capping stack could potentially be installed in 17-43 days vs a relief well at 77 days.	**Not Feasible** It is possible that in some of the operational areas a semi-submersible or a jack-up MODU may be used (in approx 100m of water depth). Typically in shallow water areas (<110m) for high rate gas wells, capping stack deployment is highly challenging and often infeasible so capping stack installation may not be possible even if a semi-submersble MODU was able to be utilised. Where possible a JU rig is preferred given the lower cost. Typically spread rates for the jack-up rig operation vs a semi-submersible operation are in the order of 200-250k USD/day lower (rig cost, vessels costs and fuel usage). Over a 40 day well this is an incremental cost of 8-10MM USD.	**Reject** The incremental cost to allow the possibility of using another source control method is not ALARP. Additionally, surface BOP and wellhead equipment tends to have a higher reliability and availability vs. subsea BOP equipment, reducing the risk of an event occuring in the first place.
	Well / campaign specific SCP developed prior to drilling.	In effect	Procedure	Provides well specific planning information to allow drilling of relief well within 77 day timeframe.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with maintaining document	**In effect**
Surface Well Kill	Direct Surface Intervention Via Well Control Experts	In effect	Procedure	Reduce time taken to control source and reduce environmental impacts	- Effectiveness of intervention of this type needs to be assessed at the time given that personnel safety considerations may preclude this control measure. - Mobilisation procedure for personnel as per Source Control Planning and Response Guideline (DR-00-OZ-20001) - Contracts and MoUs for well control personnel (WWC)	**Feasible** Ability to implement and effectiveness of this control can only be determined at the time of an incident.	**In effect** - Santos has a standing agreement with Wild Well Control for call-out of well control experts. - Arrangements already in place to access resources (Source Control Planning and Response Guideline (DR-00-OZ-20001), Contracts) but this control will be applied opportunistically and will be dependent upon safety constraints.
Blowout Preventer - Emergency Activation	BOP function testing	In effect	People / Equipment / Procedure	BOP E pressure/function tested as per API Standard 53 on deployment ensures timely activation of the BOP.	Provides functionality, availability, reliability, survivability, compatibility and independence	**Feasible** Cost associated with conducting BOP function test	**In effect**
	Alternative BOP design (additional sealing rams installed)	Improved	Equipment	May reduce severity of a LOWC event	Adds another layer of redundancy in BOP	**Feasible** Requires modifications to MODU, BOP and BOP control system to implement. Expected cost in excess of $10MM 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 SCP and the WMP. Additional cost doesn't significantly reduce risk and BOP equipment will be fully compliant with industry standards.
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.	**Feasible** Cost associated with due diligence checks on contractor procedure.	**In effect**

ALARP Assessment							
Oil Spill Trajectory Modelling	Maintain contract with Oil Spill Trajectory Modelling service provider. The service provider will be contacted within 2 hours from IMT call-out. 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	**Feasible** 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 or additional capability is needed. There is also the possibility of increased functionality associated with improved certainty of the modelling results if both service providers are activated.	**Feasible** Cost of membership	**In effect**
	Purchase of oil spill modelling system and internal Santos 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	**Feasible** Purchase of system, training of personnel, and on-call roster	**Reject** The cost of purchasing the system, training and having personnel on-call is disproportionate to any potential gains from potentially being able to deliver initial results quicker than the 2 hour turn-around currently guaranteed by the service provider.
Tracking Buoys	Level 1: Two tracking buoys located on the MODU ready for deployment 24/7. Tracking buoys deployed within 2 hrs.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment and maintenance of tracking subscription	**In effect**
	Level 2: 2 tracking buoys available from Dampier Supply Base during the activity. Tracking buoys deployed within 24-48 hrs (pending vessel availbility)	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**In effect**
	Level 2: Santos owns and maintains a total of 12 x tracking buoys across its NW facilities.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of equipment	**In effect**
	Level 2: Tracking buoys available from AMOSC and through AMOSC Mutual Aid. Equipment logistics varies according to stockpile location - Mobilisation timeframe estimated 48-72 hrs.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**

	Level 3: Tracking buoys available from OSRL. Transit times (air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Tracking buoys provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance)	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of membership	**In effect**
	Santos 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 accross Santos NW facilities ready for deployment 24/7 and any additional needs can be provided by these 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	**Feasible** 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 Santos 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	**Feasible** Cost of contract	**In effect**
Aerial Surveillance (observers)	Level 1: Trained Santos aerial 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	**Feasible** 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. Available from Day 2 of the incident.	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	**Feasible** Cost of AMOSC membership	**In effect**
	Level 3 : Access to additional aerial observers 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	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	**Feasible** Cost of OSRL membership	**In effect**
	Ensure trained aerial observers based at strategic locations such as Exmouth, Port Hedland and Karratha	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 helicopter 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	**Feasible** 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 (UAVs) for aerial surveillance available through AMOSC. UAVs and pilots can be accessed through AMOSC. Equipment mobilisation times vary according to stockpile location - mobilisation time estimated <48 hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given their ability to assess more difficult areas.	Provides functionality and availability Area of improvement; none identified	**Feasible** 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 their ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	**Feasible** Cost of membership with OSRL	**In effect**
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	**Feasible** Cost of maintaining and implementing procedure	**In effect**
	Level 1: Vessels already on hire and in use in WA and located at (or in transit to) Exmouth, Dampier or Varanus Island could be used for surveillance purposes in the event of a spill. The Santos IMT begins sourcing Santos contracted vessel or VOO for on-water surveillance within 90 minutes from IMT call-out. WA Vessel Monitoring System (IHS Maritime Portal) has access to automatic identification system (AIS) live-vessel tracking portal to establish vessel availability. Vessel of opportunity on site for surveillance within 48 hours (daylight dependent).	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 provides localised close-up observation.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Monitoring and hire of additional vessels located in the region tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through the existing Master Service Agreements.	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 provides localised close-up observation.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**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 provides localised close-up observation.	Improves availability and reliability Area of improvement; none identified	**Feasible** Cost of contracts at the time of requirement.	**In effect**
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	**Feasible** Cost of membership with AMOSC	**In effect**
	Maintain membership with OSRL provider 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	**Feasible** Cost of membership with OSRL	**In effect**

Mechanical Dispersion

ALARP Assessment							
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. 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 and macroalgae).	Provides availability, reliability, survivability, compatibility and independence. Limited functionality as mechanical dispersion is a secondary response strategy limited by weather conditions, hydrocarbon type and hydrocarbon volume.	**Feasible** - Cost associated with vessel hire - Safety is a key factor and slicks with potential for high volatile organic compound (VOC) emission are not suitable.	**In effect**
	No alternate, additional or improved control measures identified						N/A

ALARP Assessment							
Containment and recovery - booms, ancillary equipment	Level 2: Offshore booms and skimmers. Equipment supplied from a combination of Santos, AMOSC and AMSA stockpiles.	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Reliability is attained through OSRO contracts. Area of improvement: none identified.	**Feasible** Cost of OSRO membership contracts for AMOSC. Access to National Plan Resources through AMSA.	**In effect**
	Level 3: Offshore Booms and skimmers to supply additional capability . Equipment supplied from a combination of AMOSC, OSRL, AMSA and Industry Mutual Aid stockpiles.	In effect	Equipment	Potentially reducing the volume of surface hydrocarbons to reduce contact with protection priorities. Greater capacity for containment and recovery operations. Potentially increased volume of oil collected.	Provides functionality, availability, reliability, survivability, compatibility and independence. Reliability is attained through OSRO membership contracts. Area of improvement: none identified.	**Feasible** Cost of OSRO membership contracts for AMOSC and OSRL, MOUs in place for Industry Mutual Aid, access to National Plan Resources through AMSA.	**In effect**
	Purchase additional booms and ancillary equipment to be owned by Santos	Additional	Equipment	Greater capacity for containment and recovery in the initial 2-5 days of response	Improved availability and reliability	**Feasible** Cost of equipment purchase and maintenance	**Reject** Santos has the capability to scale up containment and recovery operations through existing arrangements. Furthermore, as an OSRL member, Santos can also gain access to offshore containment and recovery units of OSRL's global capability (made available on a case-by-case basis).
Containment and recovery - liquid oil waste tanks	Level 2: Liquid waste storage capacity available to support temporary waste storage on board deployment vessels. Supplied through a combination of AMOSC, AMSA and contract with Santos contracted container provider.	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Reliability is attained through OSRO membership contracts and terms of engagement conditions with OEG. Area of improvement; increasing the functionality of liquid waste storage tanks through decanting operations approved by DTMI or AMSA.	**Feasible** Cost of contract with OEG, cost of OSRO membership contracts, MOUs in place for AMOSC, access to National Plan Resources through AMSA.	**In effect**
Containment and recovery- vessels	Level 1/2: Vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Is. Suitable towing/deployment vessels mobilised to deployment port within 24 hrs.	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement: none identified.	**Feasible** Cost of variation to existing contracts with vessel providers.	**In effect**
	Level 2/3: Vessels sourced through Master Service Agreements, located in region and tracked by Santos Vessel Monitoring System (IHS Maritime Portal).	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.	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription). Cost of contracts at the time of requirement/appointment.	**In effect**
	Level 2/3: Vessels sourced without existing contracts from any location and tracked via the Santos Vessel Monitoring System (IHS Maritime Portal)	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement: none identified	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription), cost of brokers fees. Cost of contracts at the time of requirement/ appointment.	**In effect**
	Access to additional vessels by contracting vessels to remain on standby for containment and recovery	Additional	Equipment	Greater capacity for containment and recovery in the initial stages of response	Improved availability and reliability	**Feasible** Cost of vessel to be on standby when not required for oil spill operations	**Reject** Santos monitors vessel availability through Santos Vessel Monitoring System. Regularly contracted vessels could be supplemented with vessels of opportunity

	Determine required containment and recovery vessel specifications, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001), and source vessels through Master Service Agreement, located in region, tracked via the IHS Maritime Portal and contracted through a Master Service Agreement.	In effect	System	More accurate vessel tracking may lead to faster mobilisation times, potential for response operations at more locations	Improved availability and reliability.	**Feasible** Cost and effort to gather and input data	**In effect** Cost of control measure is proportionate to benefit.
Containment and recovery- personnel	Level 2: Spill responders from Varanus Is., Perth (Santos), Fremantle (AMOSC staff), Perth (AMOSC Core Group). Containment and recovery trained personnel mobilised to deployment port within 24-48 hrs.	In effect	People	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality attained through training and exercises. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible** Employment and training of Santos staff. Cost of contracts in place for AMOSC staff	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international if needed (OSRL). 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	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement: availability - rapid mobilisation of personnel.	**Feasible** Employment and training of Santos staff. Cost of contracts, MOUs in place for AMOSC Core Group and OSRL	**In effect**
	Train additional Santos personnel for containment and recovery operations	Additional	Personnel	Greater capacity for containment and recovery in the initial stages of response	Improved availability and reliability	**Feasible** Cost of training and staff hours	**Reject** AMSA, AMOSC and AMOSC Core Group and OSRL have sufficient numbers of personnel with the appropriate skill set
	Contract for staff from an alternative oil spill personnel provider	Alternative	Personnel	Greater capacity for containment and recovery in the later stages of response	Improved availability and reliability	**Feasible** Time and cost of contractual management	**Adopt** Additional staff to meet the response needs availble through TRG
	Just-In Time training to train personnel for containment and recovery operations	Additional	People	Greater capacity for containment and recovery in the later stages of response	Improved availability and reliability, lower dependence	**Feasible** Difficulty in identifying trainees with appropriate prior skill sets such as maritime experience. Concerns around adequacy of training. Supervisors of complex operations require long term experience.	**Reject** Not required to address any gap, and not feasible due to adequacy and safety concerns.

ALARP Assessment							
Vessel based surface chemical dispersant application- spray systems	Level 2: Vessel spray systems from Exmouth (WA, 3*Afedo; AMOSC, 1*Afedo, 1*Vikospray), Dampier/ Karratha (WA, 3*Afedo; AMSA, 2*Ayles Fernie), Fremantle (AMOSC, 5*Afedo, 1*Global) Vessel spray system equipment mobilised to deployment port within 48 hrs of IMT call out Vessel based dispersant commenced within 72 hours of IMT call out.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Cost of equipment purchase and maintenance Costs of membership and MOUs with AMOSC, AMSA	**In effect**
	Level 3: Vessel spray systems from Karratha (AMSA) Fremantle, Geelong (AMOSC, 3*Afedo, 3*Vikospray), Singapore (OSRL, 10*systems, additional systems stored at global stockpiles) Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs of membership with AMOSC, OSRL	**In effect**
	Access to additional spray systems stored in Exmouth or Dampier/Karratha	Additional	Equipment	Additional spray systems could increase encounter rate with fresh hydrocarbons	Improved availability and reliability	Additional cost for purchase and maintenance of vessel spray systems	**Reject** Spray systems are already available at these locations. Additional spray systems can be mobilised from Femantle.
	Access to additional spray systems with dispersant stored on vessels	Additional	Equipment	Additional spray systems could increase encounter rate with fresh hydrocarbons	Improved availability and reliability	Additional cost for purchase and maintenance of vessel spray systems. Cost and maintenance of dispersant stock. Storage of equipment on vessels may impede vessel functionality. Storage of equipment on vessels may prevent vessels from being used by other clients. Training for vessel crew.	**Reject** Spray systems could be rapidly mobilised from Dampier/Karratha and Exmouth. Vessels are commonly multi tasked, hence there is no guarantee that the vessel with spray storage would be in the right place at the right time.
Vessel based surface chemical dispersant application- vessels	Level 2: vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Is. Suitable Dispersant Vessels mobilised to nearest deployment port (Dampier or Exmouth) within 48 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	Cost of existing contracts with vessel providers	**In effect**
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Vessel Monitoring System (IHS Maritime Portal)	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	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	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; vessel availability	Cost of contracts at the time of requirement.	**In effect**

	Access to additional vessels by contracting vessels to remain on standby for chemical dispersion	Additional	Equipment	Additional vessels with spray systems could increase encounter rate with fresh hydrocarbons	Improved functionality, availability and reliability	Cost of vessel purchase or cost of contract to engage vessel on standby	**Reject** Cost is disproportionate to benefit. Multiple vessels in the region are tracked and could be contracted at short notice.
	Define spray vessel specifications and keep a record of this information (within Santos Vessel Requirements for Oil Spill Response [7710-650-ERP-0001]) to improve vessel tracking.	In effect	System	More accurate vessel tracking may lead to faster mobilisation times and could improve effectvieness of the strategy.	Improved functionality, availability and reliability	Cost and effort to gather and input data	**In effect**
Vessel based surface chemical dispersant application-personnel	Level 2: Santos AMOSC Core Group Spill responders from Varanus Is., Perth (WA, 16 people), Spill responders from Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Offshore Core Group mobilised to deployment port (Exmouth and/or Dampier) >48 hrs.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - WA access to helo. services ensures that regional personnel can be quickly mobilised to the appropriate port. Area of improvement; none identified	Cost of employing and training Santos Core Group Costs of membership, MOUs with AMOSC staff and AMOSC core group personnel	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international (OSRL). 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	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Costs of membership with OSRL	**In effect**
	Faster access to response personnel via Santos employment of local personnel in locations such as Karratha or Exmouth	Improved	People	Improve mobilisation time	Improved availability and reliability	Costs associated with personnel employment and training	**Reject** Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial 24 hours following incident. Personnel from regional facilities can be quickly transported by helicopter.
	Santos to contract personnel from Exmouth freight and logistics to deploy and operate vessel spray systems	Additional	People	Improve mobilisation time	Improved availability and reliability. Skills required to mount and operate equipment and perform preliminary checks of dispersant effectiveness could be obtained through basic training.	Costs associated with increasing scope of existing contract with Exmouth Freight and Logistics. Personnel training.	**Reject** Cost is disproportionate to benefit.
Aerial based surface chemical dispersant application- aircraft	Level 2: Access to Fixed Wing Aerial Dispersant Aircraft equipment and personnel through AMOSC under FWAD contract conditions. AMOSC to mobilise Fixed Wing aircraft to nominated airbase within 12 hrs. First FWADC test spray within 48 hrs.	In effect	Equipment, people, system	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement: none identified	Costs of membership with AMOSC	In effect
	Level 3: Access to aircraft (C130 or B727) for aerial application system through OSRL. C130 available from Singapore in Karratha or Learmonth within 20 hrs.	In effect	Equipment, people, system	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement: none identified	Costs of membership with OSRL	In effect
	Access to aircraft via additional service provider	Alternative	Equipment, people, system	Increased volume of hydrocarbons treated with chemical dispersant	Improved availability and reliability	Cost for contract with additional service provider. Potential challenges in managing safety interactions of two different service providers	**Reject** The current contracts with AMOSC and OSRL meet requirements for aerial dispersant application and are industry standard

Aerial based surface chemical dispersant application-personnel	Level 2: FWADC operational personnel incl. Air Attack Supervisor and Dispersant Operations Coordinator from AMOSC under FWADC. AMOSC to mobilise all FWADC capability personnel to nominated airbase within 48 hours.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Costs of membership with AMOSC and aerial service provider	**In effect**
	Level 3: Pilots, crew and spill specialists sourced through OSRL. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Costs of membership with OSRL	**In effect**
	No alternate, additional or improved control measures identified						
Dispersant stocks	Level 2: Dispersant stocks from Exmouth (AMOSC, 75m^3 Slickgone NS); Dampier (AMSA, 10m^3 Slickgone NS, 10m^3 Slickgone EW); Fremantle (AMOSC, 27m^3 Corexit 9500, 258m^3 Slickgone NS; AMSA, 48m^3 Slickgone NS, 52 m^3 Slickgone EW). Dispersants mobilised to deployment port within 48 hrs for vessel-based application, within 24 hours for aerial application.	In effect	Equipment		Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of membership, MOUs with AMOSC, AMSA.	**In effect**
	Level 3: Dispersant stocks from national stockpiles (AMOSC, 137m^3) (AMSA, 255m^3) and Singapore (OSRL, up to 750m^3 from SLA and 5,000m^3 as a subscriber to the Global Dispersant Stockpile). Transit time (road/ air) Altona North or Singapore to Exmouth or Karratha = 3–5 days UK or other OSRL bases to Exmouth or Karratha = 7-10 days.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to potential harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified. Availability exceeds requirements	Costs of memberships, MOUs with AMOSC, AMSA, OSRL	**In effect**
	Access to additional dispersant stockpiles owned by Santos	Additional	Equipment	No additional environmental benefit if surplus to requirements - dispersant manufacture will cover the required dispersant volumes.	Improved availability and reliability	Additional cost for purchase and maintenance of stockpiles	**Reject** Availble dispersant stocks, supplemented by the initiation of dispersant manufacture in week 1, are sufficent to meet the response need.
	Initiation of dispersant manufacture on week 1 of the response to ensure a build up of dispersant supply	Additional	Equipment	Ensure capacity to meet worst case requirements	Improved availability and reliability	Additional cost for commissioning of dispersant manufacture and delivery to site	**Accept** Additonal dispersant is required to be manufactured during the response to meet the worst case needs.
	Develop and maintain dispersant supply and logistics plan to ensure worst case LOWC SDA requirements can be met	Improved	Equipment	Ensure capacity to meet worst case requirements	Allows Santos to meet worst case requirement	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Cost of maitaining updated supply and logistics plan	**Accept**
Dispersant effectiveness monitoring	To assess the effectiveness of dispersant application, Santos will use the Joint Industry Operational Monitoring Plan "Surface chemical dispersant effectiveness and fate assessment" to determine the efficacy of subsea dispersant application.	In effect	Procedure	The Joint Industry Operational Monitoring Plan "Surface chemical dispersant effectiveness and fate assessment" to assist in characterising the nature and extent of subsea or near surface dispersed oil, aid in the validation and accuracy of plume trajectory models and allow for rapid quantification of data to enable the IMT to make decisions about continuation of dispersant application. The IMT assesses the effectiveness of continued dispersant use against an operational NEBA assessment	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of contracts to provide monitoring capability	**In effect**

ALARP Assessment							
ROV survey	ROV Survey conducted at the release point to determine the nature of the release. This information will inform the applicability of SSDI and initial choice of dispersant injection methods (e.g., number of nozzles, nozzle sizes) and DOR.	In effect	Procedure, equipment	SSDI can break-up oil droplets forcing greater entrainment of the oil into the water column below the sea surface. Has ability to reduce volatile organic compounds in the vicinity of a spill, making the area safer for responders. It typically requires smaller volumes of dispersant to be used when compared to surface application, as it has a higher encounter rate with the hydrocarbons.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Costs associated with vessel contract	**In effect**
Subsea First Response Toolkit (SFRT) [The SFRT includes debris clearance equipment and subsea dispersant equipment, including a dedicated dispersant stockpile (500 m³ of Dasic Slickgone NS) and ancillary equipment (e.g., pumps, flying leads, coiled tubing head, dispersant wands)].	AMOSC SFRT stored at Oceaneering yard in Jandakot and can be transported to Dampier. It is estimated this would take 10 hours to arrange and 4-5 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 ~9 days of call-out. Once the equipment is loaded, the vessel will mobilise to site and be ready to commence operations by day 12 from call out.	In effect	Equipment	SSDI can break-up oil droplets forcing greater entrainment of the oil into the water column below the sea surface. Has ability to reduce volatile organic compounds in the vicinity of a spill, making the area safer for responders. It typically requires smaller volumes of dispersant to be used when compared to surface application, as it has a higher encounter rate with the hydrocarbons.	Provides functionality, availability, reliability, survivability, compatibility and independence. Availability - whilst the SFRT takes several days to mobilise to site and conduct initial surveys, this timeframe is considered reasonable given the technical nature of this equipment.	Cost of AMOSC membership for SFRT	**In effect**
	Purchase of Santos SFRT to be located at Exmouth or Dampier	Improved	Equipment	Reduces mobilisation time between storage and port of deployment (Dampier) by approx. 48 hrs	Improved availability however limited by vessel availability to deploy	Cost of SFRT purchase, storage and maintenance	**Reject** SFRT is estimated to arrive in Dampier only 2-3 days before vessel. Taking into account the significant costs of purchasing and maintaining a Santos-owned SFRT, an improvement of 2-3 days mobilisation time is not considered to provide a proportionate benefit.
	Relocate AMOSC SFRT to Dampier	Improved	Equipment	Reduces mobilisation time between storage and port of deployment (Dampier) by approx. 48 hrs	Improved availability however limited by vessel and personnel availability to deploy	AMOSC is unable to alter storage location of SFRT as this could negatively impact other members	**Reject** Positioning of SFRT in Dampier in order to reduce deployment time was assessed but was found to be disproportionate in terms of costs to the reduction in risk gained and may adversely affect other SFRT members and their committed deployment times.
	Subsea bladder dispersant system positioned next to well site	Alternative	Equipment	Subsea dispersant bladder system can be prepositioned and operate remotely if SSDI is determined a suitable strategy via an operational NEBA. Bladder systems are positioned in framed housings next to the well site. Autonomous application could commence by Day 1-2, reducing application times by 7-8 days.	Possible improved availability and independence, however technical development and procurement would be required as existing components in the market would need to be combined to develop this system. Placing bladders adjacent to the well site exposes them to risk of damage from debris in the event of a loss of well control. Additionally, bladder systems require extensive equipment and fluid deployment/recovery operations at each wellsite, exposing personnel to significant additional HSE risks. Therefore, the design and development of this technology includes a high degree of uncertainty. Subsea bladders also have limited volume capacity, meaning this alternative would offer a short term application option until SSDI arrives via the SFRT.	Purchase of bladder system on top of SFRT membership as both systems would still be required.	**Reject** Subsea bladder systems are a unproven technology and bring additional risks to the environment and personnel. In addition, the cost of having a subsea bladder system in place is a fixed cost, regardless of if a spill were to occur or not.

Subsea dispersant injection - planning	Source Control Planning and Response Guideline (DR-00-ZF-20001).	In effect	Procedure	Provides a set process to follow for the mobilisation of SFRT and suitable vessel by Santos Source Control Team thereby reducing the timeframe and increasing the effectiveness of SFRT.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	**In effect**
Subsea dispersant injection - vessels	Level 2: Suitable vessel sourced through Santos contractors. Vessel requirements outlined in Santos Source Control Planning and Response Guideline (DR-00-ZF-1001).	In effect	Equipment	Enhances subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	**In effect**
	Level 2/3: Suitable vessel sourced through any regional contractors and monitored through WA Vessel Tracking System.	In effect	Equipment	Enhances subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	**In effect**
	Level 3: Suitable vessel sourced as Vessels of Opportunity.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of contracts at the time of requirement.	**In effect**
	Enable improved vessel access by contracting a suitable, dedicated vessel on standby	Improved	Equipment	This alternative would result in SSDI commencing on Day 8-9, instead of Day 11-12 as vessel would be in Dampier on standby. Although this would treat released hydrocarbons for an additional 3 days, this would have a negligible reduction in shoreline accumulation volumes at protection priorities.	Improved availability and reliability	Costs associated with having a suitable vessel on contract and standby in Dampier - $50-60K USD/day.	**Reject** Removes bottleneck of having to wait 3 days for a suitable vessel. However, the cost of having a vessel on standby is a fixed cost, regardless of if a spill were to occur or not. The time saving of 3 days is not proportionate to the expense incurred, especially as SSDI is not anticipated to significantly reduce shoreline accumulation volumes if it were applied for an additional 3 days.
Subsea dispersant injection - personnel	Oceaneering personnel for the deployment of the SFRT	In effect	People	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of Oceaneering contract for personnel	**In effect**
Subsea dispersant injection - dispersant stocks	Level 2: Dedicated SFRT dispersant stockpile stored with SFRT at Jandakot (AMOSC, 500m^3 Dasic Slickgone NS). Additional dispersant stocks stored at Exmouth, Dampier, Broome, Fremantle. Available within 24 hours.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contract with AMOSC, AMSA through NatPlan	**In effect**
	Level 3: Dispersant stocks stored at other national stockpile locations (AMOSC, AMSA). OSRL dispersant stocks available in Singapore and worldwide (50% of SLA and 5,000m^3 as a subscriber to the Global Dispersant Stockpile) Mobilisation times depend on location.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contracts, MOUs with AMOSC and OSRL, access to National Plan resources through AMSA	**In effect**
	Access to additional dispersant stockpiles owned by Santos	Additional	Equipment	No additional environmental benefit if surplus to requirements - arrangements for dispersant manufacture will cover the required dispersant volumes.	Improved availability and reliability	Additional cost for purchase and maintenance of stockpiles	**Reject** Availble dispersant stocks, supplemented by the initiation of dispersant manufacture in week 1, are sufficent to meet the response need.

	Develop and maintain dispersant supply and logistics plan to ensure worst case LOWC SSDI requirements can be met	Improved	Equipment	Ensure capacity to meet worst case requirements	Allows Santos to meet worst case requirement	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Cost of maitaining updated supply and logistics plan	**Accept**
	Rent dispersant stockpiles and place in Dampier	Additional	Equipment	No additional environmental benefit as existing dispersant stockpiles can be relocated to Dampier and dispersant manufacture can commence in a timeframe where dispersant demand does not exceed supply.	Availability already meets requirements	Additional cost for renting dispersant stockpiles	**Reject** Analysis indicates that timeframes for mobilising, relocating and manufacturing dispersant supplies are sufficient.
Dispersant effectiveness monitoring	To assess the effectiveness of dispersant application, Santos will use the Joint Industry Operational Monitoring Plan "Subsea chemical dispersant effectiveness and fate assessment" to determine the efficacy of subsea dispersant application.	In effect	Procedure	The Joint Industry Operational Monitoring Plan "Subsea chemical dispersant effectiveness and fate assessment" to assist in characterising the nature and extent of subsea or near surface dispersed oil, aid in the validation and accuracy of plume trajectory models and allow for rapid quantification of data to enable the IMT to make decisions about continuation of dispersant application. The IMT assesses the effectiveness of continued dispersant use against an operational NEBA assessment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of contracts to provide monitoring capability	**In effect**

ALARP Assessment							
Protection and Deflection (booms and ancillary equipment)	Level 2/3: Shoreline and nearshore booms plus ancillary equipment from Varanus Island, Exmouth, Dampier, Fremantle and Broome (refer to OPEP Table 14-3 for equipment lists). Vehicles sourced from local hire companies. Transit times (vessel): Varanus Island to Dampier = 7 hrs Varanus Island to Exmouth = 18 hrs Transit times (road) Fremantle to Exmouth = ~24 hrs Fremantle to Karratha/Dampier = ~24 hours Exmouth to Dampier/ Karratha= 7 hrs Protection booming equipment mobilised to FOB location within 24 hrs. Protection/deflection operation deployed to the protection location in 60-72	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of booms, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	**Feasible** Costs associated with equipment purchase and maintenance Costs of contracts, AMOSC membership, access to National Plan resources through 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	**Feasible** Costs associated with equipment purchase and maintenance Costs of contracts, 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	**Feasible** Costs associated with equipment purchase and maintenance	**Reject** Existing arrangments exceed the worst case resource requirments.
	Pre-deployment of protection & deflection resources in remote locations	Additional	Equipment	Protection and deflection resources for key sensitive offshore locations (i.e. Clerke and Imperieuse Reefs) deployed prior to activities taking place, in anticipation of reducing potential impacts from oil ashore in the event of a worst-case LOWC event.	Improved availability	**Feasible** Potentially feasible, however access permit requirements, environmental impacts, and monitoring of deployed equipment are limiting factors	**Reject** Hiring, pre-deploying and maintaining protection and deflection resources at remote offshore locations (i.e. Clarke and Imperieuse Reefs) for the duration of the activity is cost-prohibitive. Hire of a single OSV which would likely be needed to support response in a remote location and remaining in-situ to provide an offshore base for responders is ~$75k per day; oil spill response specialist is ~$1.2k per day; booms and ancilliaries hire rates is likley to be in the region of $7.5k per day; total cost ~84k per day. Placing these resources on stand-by during the on-risk reservoir section work (estimated at 3-4 weeks) would cost between $1.7MM - $2.3MM. This cost is considered grossly disproportionate to the risk, when access to protection & deflection equipment is already facilitated by existing contracts (i.e. AMOSC Membership, access to AMSA equipment via National Plan arrangements, OSRL Associate Membership). Due to the remoteness of offshore reef locations, it is considered that the benefit of pre-deploying resources is highly limited, as this would create unecessary environmental disturbance to these sensitive habitats (both during placement and during monitoring/maintenance) and would also create unecessary safety risks to personnel. In addition, there is no guarantee that pre-placement will be effective, as it will depend on the circumstances and trajectory of a real spill incident as to what shoreline is at risk of oil ashore and in need of protection. Given the drilling activities are short-term, and that oil spill modelling has been conducted and utilised to assess and plan for the potential risks in the event of an unplanned release, pre-deployment is considered disproportionate to the environmental risk and potential benefit. The current resources that Santos has access to meet the response need and are considered proportionate to the environmental risk. They also allow flexibility for incident response planning based on real-time monitoring data. Based on the worst-case oil ashore prediction from a LOWC at the Ara OA, the minimum potential time to shore at Clerke and Imperieuse Reefs is 3 days 22 hours, and 3 days 5 hours (respectively); Santos has the ability to deploy protection and deflection resources within 60–72 hours (weather/daylight dependent) from time of shoreline contact (either predicted or observed) - this is reflected in the first-strike commitments.
Protection and Deflection (vessels)	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Island. Boom deployment vessel / remote island transfer vessel mobilised to FOB location / port within 24 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	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	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	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription)	**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	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Maintain a list of small vessel providers that could be used 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	**Feasible** Cost of maintaining a list of small vessel providers	**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	**Feasible** Costs of vessel purchase and maintenance	**Reject** Existing arrangments exceed the worst case resource requirments. High numbers of shallow draft vessels located in the region. One vessel can help to set boom at multiple locations.
	Dedicated vessel placed on stand-by for protection & deflection operations support in remote locations.	Additional	Equipment	Vessel placed on standby to support protection and deflection operations for key sensitive offshore locations (i.e. Clerke and Imperieuse Reefs), in anticipation of reducing potential impacts from oil ashore in the event of a worst-case LOWC event by providing a faster response.	Improved availability and functionality	**Feasible** Cost of vessel and crew hire, and standby rates.	**Reject** The placement of a dedicated vessel and crew on stand-by to support protection and deflection operations in remote locations (i.e. Clerke and Imperieuse Reefs), for the duration of the activity is cost-prohibitive. Hire of a single OSV which would likely be needed to support response in a remote location and remaining in-situ to provide an offshore base for responders is ~$75k per day. Placing this resource on stand-by during the on-risk reservoir section work (estimated at 3-4 weeks) would cost between $1.5MM - $2.1MM. This cost is considered grossly disproportionate to the risk. Access to vessels for spill response is already facilitated by the multiple existing MSAs that Santos has in place with vessel suppliers. The Santos Marine Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) includes considerations for supporting oil spill responses in offshore remote locations, including beach access support vessels, sector command/staging area vessels, landing barges and accomodation vessels. This information assists the IMT in the rapid resourcing of the appropriate vessels to support deployment of protection and deflection oil spill response equipment, facilitated through the existing MSAs that Santos has in place with various vessel providers, along with the IHS Maritime Portal to assist in the rapid search and selection of suitable available vessels.
Protection and Deflection (personnel)	Level 2: Spill responders from Varanus Island, Perth (Santos), Fremantle (AMOSC), Perth (AMOSC Core Group). Santos Offshore Core Group mobilised to deployment port within 24 hrs. AMOSC Staff and Industry Core Group mobilised to deployment port location within 24-48 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	**Feasible** Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	**In effect**
	Level 3: Spill responders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA National Response Team) 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	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	**Feasible** Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	**In effect**
	Ensure trained personnel based at strategic locations such as Dampier, Port Hedland, Karratha, Exmouth or Broome.	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** No Santos personnel currently based at Karratha or Exmouth so employment costs would be significant and would need to include new office space commissioning. Such costs are not justified given that helicopters enable rapid transportation of Santos staff within the region.
Protection and Deflection (planning)	Regional shoreline sensitivity and access data/maps and TRPs for key locations	In effect	Procedures	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	**Feasible** Cost of document preparation and maintenance	**In effect** Santos has TRPs in place for the protection priority areas identified for the Bedout Multi-well drilling activity - Clerke Reef and Imperieuse Reef. In addition, Santos also has access to the INPEX Browse Regional OPEP – Area Response Planning Guideline (X060-AH-GLN-70005) via collaboration, which provides additional guidance for response at Clerke Reef and Imperieuse Reef within its Rowley Shoals Area Response Plan (Appendix A.6).

ALARP Assessment							
Shoreline Clean-up (equipment)	Level 2: Manual clean-up and flushing equipment from: Varanus Island (Santos WA, 1*container) Fremantle (AMOSC, 1*shoreline support kit and 1*flushing kit) State hardware outlets. Decontamination/staging equipment from: Karratha (AMSA; 2*decon stations) Fremantle (AMOSC, 1*decon kit; AMSA, 2* decon stations). Mobile plant from state hire companies. PPE from: Exmouth and Varanus Island (Santos WA, 2*containers) Fremantle (AMOSC, 1*decon kit, 2*gas detectors). Transit times (vessel): Varanus Island to Dampier = 7 hrs Varanus Island to Exmouth = 18 hrs Transit times (road) Fremantle to Exmouth/Dampier = ~24 hrs Exmouth to Dampier/Karratha = 7 hrs Resources in place to commence shoreline clean-up within 1–3 days Clean-up equipment mobilised to deployment port location <48 hours	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	**Feasible** Cost of membership with AMOSC Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**
	Level 3: Manual clean-up and flushing equipment from: Geelong (AMOSC, 1*shoreline support kit, 2* flushing kits, 1*shoreline impact lance kit) Singapore (OSRL) and national hardware outlets. Decontamination/ staging equipment from: Geelong (AMOSC, 1*decon kit). Mobile plant sourced from national hire companies. PPE from Geelong (AMOSC, 1*container, 4*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	**Feasible** Cost of membership with AMOSC and OSRL Cost of equipment purchase/ hire and maintenance at the time of incident	**In effect**
	Mechanical mobile plant equipment for clean-up pre-purchased and positioned at strategic locations (Exmouth)	Additional	Equipment	Environmental benefits and impacts are dependent on hydrocarbon fate and local ecology. Reduced mobilisation times and improved access would assist, should mobile plant be deemed advantageous.	Improved availability and reliability	**Feasible** 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. Cannot pre-position equipment at Clerke and Imperiuse Reef. Modelling predicts accumualtion >100 g/m^2 after 11 days at Bedout Island. Current capability meets this need.
	Pre-purchase and storage of equipment (decontamination/staging equipment, clean-up and flushing, PPE) at strategic locations (e.g. Exmouth, Dampier)	Additional	Equipment	Improve mobilisation time, potential for more response locations	Improved availability and reliability	**Feasible** Cost in purchase and maintenance of equipment	**Reject** Equipment for first strike available at Exmouth. Additional equipment can be mobilised from Dampier.

	Pre-deployment of shoreline clean-up resources in remote locations	Additional	Equipment	Shoreline clean-up resources for key sensitive offshore locations (i.e. Clerke and Imperieuse Reefs) deployed prior to activities taking place, in anticipation of reducing potential impacts from oil ashore in the event of a worst-case LOWC event.	Improved availability	**Feasible** Potentially feasible, however locations are unlikley to be suitable for long term storage of equipment. Access permit requirements, environmental impacts, and monitoring of stored equipment are also limiting factors.	**Reject** Hiring, pre-deploying and maintaining shoreline clean-up resources at remote offshore locations (i.e. Clarke and Imperieuse Reefs) for the duration of the activity is cost-prohibitive. Hire of a single OSV which would likely be needed to support response in a remote location and remaining in-situ to provide an offshore base for responders is ~$75k per day; oil spill response specialist is ~$1.2k per day; booms and ancilliaries hire rates is likley to be in the region of $7.5k per day; total cost ~84k per day. Placing these resources on stand-by during the on-risk reservoir section work (estimated at 3-4 weeks) would cost between $1.7MM - $2.3MM. This cost is considered grossly disproportionate to the risk, when access to shoreline clean-up equipment is already facilitated by existing contracts (i.e. AMOSC Membership, access to AMSA equipment via National Plan arrangements, OSRL Associate Membership). Due to the remoteness of offshore reef locations, it is considered that the benefit of pre-deploying resources is highly limited, as this would create unecessary environmental disturbance to these sensitive habitats (both during placement and during monitoring/maintenance) and would also create unecessary safety risks to personnel. It is also likely that the shorelines at Clerke and Imperieuse Reef are unsuitable for long-term storage of equipment (e.g. placement of 10 ft/20 ft shipping containers) due to the tidal ranges and sensitivity of the habitat. In addition, there is no guarantee that pre-placement of shoreline clean-up equipment will be effective, as it will depend on the circumstances and trajectory of a real spill incident as to what shoreline is at risk of oil ashore and in need of clean-up effort. Given the drilling activities are short-term, and that oil spill modelling has been conducted and utilised to assess and plan for the potential risks in the event of an unplanned release, pre-deployment is considered disproportionate to the environmental risk and potential benefit. The current resources that Santos has access to meet the response need and are considered proportionate to the environmental risk. They also allow flexibility for incident response planning based on real-time monitoring data. Based on the worst-case oil ashore prediction from a LOWC at the Ara OA, the minimum potential time to shore at Clerke and Imperieuse Reefs is 3 days 22 hours, and 3 days 5 hours (respectively); Santos has the ability to deploy shoreline clean-up resources within 60–72 hours (weather/daylight dependent) from time of shoreline contact (either predicted or observed) - this is reflected in the first-strike commitments.
Shoreline Clean-up (vessels)	Level 1: Shallow draft vessels in use by Santos and located at (or in transit to) Exmouth, Dampier or Varanus Island. Remote island transfer vessel mobilised to deployment port location within 24 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	**Feasible** Cost of existing contracts with vessel providers	**In effect**
	Level 2: Shallow draft vessels sourced through Master Service Agreement, located in region, tracked (where possible, if fitted with AIS) via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	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	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**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	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas on offshore islands	Additional	Equipment	Faster response times to facilitate protection of key sensitive areas on offshore islands	Improved availability and reliability	**Feasible** 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.
	Dedicated vessel placed on stand-by for shoreline clean-up operations support in remote locations.	Additional	Equipment	Vessel placed on standby to support shoreline clean-up operations for key sensitive offshore locations (i.e. Clerke and Imperieuse Reefs), in anticipation of reducing potential impacts from oil ashore in the event of a worst-case LOWC event by providing a faster response.	Improved availability and functionality	**Feasible** Cost of vessel and crew hire, and standby rates.	**Reject** The placement of a dedicated vessel and crew on stand-by to support shoreline clean-up operations in remote locations (i.e. Clerke and Imperieuse Reefs), for the duration of the activity is cost-prohibitive. Hire of a single OSV which would likely be needed to support response in a remote location and remaining in-situ to provide an offshore base for responders is ~$75k per day. Placing this resource on stand-by during the on-risk reservoir section work (estimated at 3-4 weeks) would cost between $1.5MM - $2.1MM. This cost is considered grossly disproportionate to the risk. Access to vessels for spill response is already facilitated by the multiple existing MSAs that Santos has in place with vessel suppliers. The Santos Marine Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) includes considerations for supporting oil spill responses in offshore remote locations, including beach access support vessels, sector command/staging area vessels, landing barges and accomodation vessels. This information assists the IMT in the rapid resourcing of the appropriate vessels to support deployment of protection and deflection oil spill response equipment, facilitated through the existing MSAs that Santos has in place with various vessel providers, along with the IHS Maritime Portal to assist in the rapid search and selection of suitable available vessels.
Shoreline Clean-up (personnel)	Level 2: Clean-up team leaders from Varanus Island, Perth (Santos WA), Fremantle (AMOSC staff), Perth (AMOSC Core Group). Santos Core Group mobilised to deployment port location within 24 hrs. AMOSC Staff and Industry Core Group mobilised to site/deployment port location within 48 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	**Feasible** Costs associated with staff training. Costs of membership, MoU with AMOSC, AMSA through the National Plan.	**In effect**

	Level 3: Clean-up team leaders from Geelong (AMOSC staff), interstate (AMOSC Core Group; AMSA) and international (OSRL). Interstate staff available from 2 to 3 days. OSRL 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	**Feasible** Costs associated with staff training Costs of membership, MoUs with AMOSC, AMSA	**In effect**
	Access to additional team leaders that are locally based at strategic locations (e.g. Exmouth, Dampier) or can be mobilised within short time frames.	Additional	People	Improve mobilisation time, potential for more response locations.	Improved availability and reliability.	**Feasible** Cost of employment and training of staff Cost of being locally based or on a rapid mobilisation plan	**Reject** Santos WA already employs trained oil spill responders in the wider region that can be mobilised to key areas by helicopter
	Access to clean-up labour hire 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	**Feasible** Costs of labour hire through existing service provider	**In effect**
	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** Not feasible to mobilise labour hire personnel in less than 72 hours	**Reject** Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	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	**Not Feasible** No identified regional labour hire companies	**Reject** Would not result in access to clean-up personnel any faster than what can be provided via AMOSC Core Group and mutual aid.
	Faster access to clean-up personnel via Santos employment of local personnel	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	**Feasible** Costs associated with personnel employment and training	**Reject** Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial phase of response.
Shoreline Clean-up (planning)	Regional shoreline sensitivity and access data/maps and TRPs for key locations	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	**Feasible** Cost associated with development and maintenance of mapping and Tactical Response Plans	**In effect**
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**
	Soil profile assessment prior to earthworks	In effect	Procedures	Improved baseline information for shoreline condition			**In effect**
	Pre-cleaning and inspection of equipment (quarantine)	In effect	Procedures	Reduced potential for contaminating environment during response activities			**In effect**
	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 DTMI and DBCA	In effect	Procedures	Optimise response based on camp location, reduce environmental impact of camps			**In effect**
	Shoreline Response Group Supervisor 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**

ALARP Assessment							
Oiled Wildlife Response (planning)	Implementation of the Western Australian Oiled Wildlife Response Plan (WAOWRP) and WA OWR Manual	In effect	Procedure	Working within the guidelines of the WAOWRP and Pilbara OWRP 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	**Feasible** Effort and time involved in developing OWR implementation plan within OSCP based on guidance from WAOWRP and Pilbara OWRP	**In effect**
	Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017); 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 OWRP 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	**Feasible** Cost of document development and maintenance	**In effect**
	Vessel specifications for an OWR field station included within planning documentation (Santos Marine Vessel Requirements for Oil Spill Response [7710-650-ERP-0001]).	Additional	Procedure	This information assists the IMT in the rapid resourcing of appropriate vessels through the existing MSAs that Santos has with various vessel providers, potentially enabling a more efficient OWR.	Improved functionality and reliability	**Feasible** Cost of document development and maintenance	**Accept** Due to the remote offshore reef locations potentially impacted in the event of a worst-case LOWC event (i.e. Imperieuse Reef and Clerke Reef), there are additional logistical constraints that may need to be considered for implementing an OWR in these areas. The Santos Marine Vessel Requirements for Oil Spill Response document (7710-650-ERP-0001) has been updated with information for the sourcing of vessels to serve as an OWR field station and provides the broad specification of such vessels. This information assists the IMT in the rapid resourcing of appropriate vessels through the existing MSAs that Santos has with various vessel providers.
Oiled Wildlife Rsponse (equipment)	Level 2: OWR kits and containers available from AMOSC, AMSA, DBCA or DTMI in Exmouth, Darwin, Broome, Karratha, Fremantle or Kensington. WA equipment mobilised to Exmouth region forward staging area within 48 hrs from oiled wildlife contact (predicted or observed).	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.	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3: OWR equipment available from OSRL. Transit times (road/ air) Singapore to Dampier = 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.	**Feasible** Cost of membership with OSRL	**In effect**

	Pre-positioning of OWR field station vessels to enable rapid response in remote locations.	Additional	Equipment	Having an OWR field station vessel pre-positioned in the field at a strategic location would enable a rapid offshore OWR to be implemented, potentially reducing the OWR impact from a worst-case LOWC incident.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified.	**Feasible** Cost of sourcing and placing on standby an OWR field station vessel.	**Reject** The cost of sourcing, fitting out, crewing and placing on standby a vessel to serve as an OWR field station, and having a vessel crew and OWR responders on standby is considered grossly disproportionate to the potential environmental benefit (hire cost of a single OSV is ~$75k per day; placing this resource on stand-by during the on-risk reservoir section work (estimated at 3-4 weeks) would cost between $1.5MM - $2.1MM). The development of OWR field station vessel specifications and inclusion in the Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) assists the IMT in the rapid resourcing of appropriate vessels through the existing MSAs that Santos has with various vessel providers, should the need arise for an OWR field station. In addition, in the event of a worst-case LOWC, the shortest time to arrival at the remote locations of Clerke Reef and Imperieuse Reef (arising from a LOWC at the Ara OA), is 3 days, which allows sufficient time for an appropriate OWR response to be implemented with the existing resources that Santos has access to.
Oiled Wildlife Response (personnel)	Level 1/2 Santos personnel trained in OWR. OWR trained personnel mobilised to Exmouth region within 24 hrs from oiled wildlife contact (predicted or observed)	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	**Feasible** Cost of training and maintaining training	**In effect**
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractor 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	**Feasible** Cost of membership with AMOSC	**In effect**
	Level 3 OWR personnel available through OSRL. Technical advice from Sea Alarm which includes 2 Technical Advisors (one that can be mobilised to site and one via remote access). Access to GOWRS Oiled Wildlife Assessment Service which includes 4 wildlife expert personnel to provide an on-the-groud technical assessment of wildlife response needs.	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	**Feasible** Cost of membership with OSRL	**In effect**
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel to 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	**Feasible** Cost of labour hire at time of incident	**In effect**
	Additional Santos OWR trained personnel positioned at VI and Perth.	In effect	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.	Improved functionality, availability, reliability and independence.	**Feasible** Cost of training staff	**In effect**

	Pre-hire and/or pre-positioning 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, pre-positioned personnel and staging areas may result in negative impacts to the environment and wildlife. The common operating picture (COP) and operational NEBA will inform the best response strategies at the time of the spill event.	Improved functionality, availability, reliability and independence.	**Feasible** Additional wildlife resources could total $1,500 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, pre-positioned 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 compete for the same resources without providing a significant environmental benefit	Does not improve effectiveness	**Feasible** Cost of contract	**Reject** This option is not adopted as the existing capability / contractural arrangements meets the anticipated need.

ALARP Assessment						
Operational & Scientific Monitoring (OSM services provider and equipment)	Maintenance of contract for operational and scientific monitoring services (OSM) and annual review of OSM Bridging Implementaition Plans (BIPs). OSM Service Provider and monitoring equipment mobilised to site within 72 hrs from OSM Activation.	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	**Feasible** Cost of contract with Operaitonal and Scientific Monitoring (OSM) Service Provider	**In effect**
	Regular capability reports from OSM Services Provider shows personnel availability and annual reviews of OSM BIP	In effect	System	This ensures the OSM Services Provider has the capability to undertake scientific monitoring, including, post-spill pre-impact surveys within the EMBA of receptors with deficient baseline data.	Improves functionality, availability and reliability	**Feasible** Cost of contract with OSM 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	**Feasible** Cost of contract with OSM Service Provider	**In effect**
	Operational and scientific monitoring personnel, plant and equipment on standby at the operational location	Additional	People / Equipment	Improve mobilisation time	Improved availability and reliability	**Feasible** Cost would be in excess of $1M annually	**Reject** Cost of control measure is disproportionate to the environmental benefit
	Contract additional OSM Service Providers to increase availability of monitoring personnel in the first 2 weeks of the spill	Additional	People / Equipment	Improve response time and possibly increase the number of receptors that could be monitoried in the first few weeks of the spill	Provides availability, reliability, survivability and independence	**Feasible** Cost of contract with OSM Services Provider	**Reject** Cost of control measure is disproportionate to the environmental benefit. This option was considered but discounted, as deploying additional monitoring teams alongside response operations would elevate safety, environmental, and operational risks, particularly through increased simultaneous operations (SIMOPs) such as vessel interactions, collision risks, anchoring impacts, and waste discharges. Expanding the number of teams beyond the predicted resource estimates in Section 8 of the OSM-BIP would raise the overall risk profile. Instead, a staged and scalable resourcing approach has been adopted - from week three onwards, any additional capacity needs will be identified through ongoing review and addressed via Santos' existing OSM Services Provider contract, at which point response operations are expected to have stabilised, reducing SIMOPs risks. Efficiencies will also be achieved by reallocating existing teams to other receptors once termination criteria are met, ensuring monitoring resources are only expanded when necessary, thereby maintaining risks at ALARP while supporting safety and environmental performance.
	Maintain equipment list and list of suppliers for implementation of Operational and Scientific Monitoring Plans	In effect	Procedure	Improve response time	Improved functionality, availability and reliability	**Feasible** Cost of contract with OSM Service Provider	**In effect**
	Oil sampling kits for operational and scientific monitoring personnel to be positioned at Varanus Island, Exmouth and Dampier	In effect	Equipment	Improve response time	Improved availability and reliability	**Feasible** Cost associated with purchase of equipment and maintenance	**In effect**

Operational & Scientific Monitoring (vessels)	Level 2: Hire of vessels located in the region tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement. Santos to mobilise monitoring vessels to deployment location within 72 hrs from OSM Activiation	In effect	Equipment	Improve response time	Provides availability and reliability	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of spill event	**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.	**Feasible** Cost of contracts at the time of requirement.	**In effect**
	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Procedure	Improve mobilisation time	Increase in availability and reliability	**Feasible** Cost to determine vessel specifications	**In Effect**
Operational & Scientific Monitoring (Water Quality Monitoring)	Maintain water quality monitoring services through OSM Supplementary Services contract with OSRL. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hours of OSM activation.	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	**Feasible** Cost of contract with OSM Service Provider	**In effect**
	Access to additional guidance and in-field support for water quality monitoring through AMOSC.	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	**Feasible** Cost of OSRL membership	**In effect**
	Determine required vessel specifications according to the IAP, with the aid of the Santos Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) and source vessels through Master Service Agreement, located in region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal) and contracted through a Master Service Agreement.	In effect	Procedure	Improve mobilisation time	Improved availability and reliability	**Feasible** Cost to determine vessel specifications	In effect
	Purchase of first strike oil/water quality monitoring kits to be positioned at Exmouth and VI. Technical procedure for sample collection by untrained personnel developed (Santos Oil and Water Sampling Procedures - 7710-650-PRO-0008).	In effect	Equipment / Procedure	Will enable oil fingerprinting and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	**Feasible** Cost of purchasing equipment and developing procedure	**In effect**
	Trained monitoring specialists on standby at site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	**Feasible** Costs associated with staff employment	**Reject** This is not necessary as a procedure for sample collection is in place (Santos Oil and Water Sampling Procedures - 7710-650-PRO-0008)
Operational & Scientific Monitoring (Shoreline Assessment)	Level 2: WA-based AMOSC staff and core group operations personnel	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 of improvement; none identified	**Feasible** 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	**Feasible** Cost of OSRL membership	**In effect**
Operational & Scientific Monitoring (Wildlife Reconnaissance (aerial/vessel surveillance, shoreline and coastal habitat assessment)	Maintain contract with operational and scientific monitoring services provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys through OSM Supplementary Services contract with OSRL.	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	**Feasible** Cost of contract	**In effect**
	Maintain a list of providers that could assist with fauna aerial observations, e.g. whale shark spotting planes	In effect	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	**Feasible** Cost of developing and maintaining list	**In effect**
	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 marine mammal/fauna aerial observers available from Day 1	Improved availability and reliability	**Feasible** Costs associated with staff employment and training	**Reject** Maintaining trained fauna observers at location is considered grossly disproportionate as they can be mobilised from scientific monitoring provider.

ALARP Assessment							
Waste Management	Waste management sourced through contract with waste service provider. Contract with waste service provider maintained and periodically reviewed. Waste receptacles mobilised from Karratha within 24 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	**Feasible** Cost of contract	**In effect**
	Maintain contracts with multiple waste 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.	**Feasible** Significant additional cost in maintaining two contracts for the same service	**Reject** Existing arangments exceed the worst case resourcing requirments.
	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	**Feasible** Costs of contracts, MOU with waste service provider, AMOSC and OSRL, access to National Plan Resources through AMSA	**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	**Feasible** Additional cost in purchase and maintenance of tanks	**Reject** Existing arangments exceed the worst case resourcing requirments. Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA and 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 commencing.
	Vessels for waste transport through Santos contracted providers. To minimise vessel decontamination requirements, larger vessel will remain on station whilst smaller vessel will transport waste to Dampier or Exmouth.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	**Feasible** Cost of contract with vessel providers	**In effect**
	Monitoring and hire of additional vessels located in the region, tracked via the WA Vessel Monitoring System (IHS Maritime Portal), and contracted at the time of incident.	Additional	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility.	**Feasible** Cost of vessel monitoring system (IHS Maritime Portal subscription) Cost of contracts at the time of requirement.	**Accept**

	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of waste, particularly greater capacity for containment and recovery in the initial 2-5 days of response	Provides functionality, availability, reliability, survivability, compatibility and dependence	**Feasible** Cost in contracting vessels to remain on standby for incident waste requirements	**Reject** Existing arangments exceed the worst case resourcing requirments. Expense of maintaining vessels on standby that are surplus to day to day requirements is disproportionate to environmental benefit. Santos is accustomed to coordinating logistics for tasks around finite resources. Santos monitors vessel availability through Santos Vessel Tracking System. Regularly contracted vessels could be supplemented with vessels of opportunity.
	Vessel to vessel waste transfer plan developed in line with the waste transfer concept of operations (defined in 7710-650-ERP-0001). Vessel to vessel waste transfer plan gives details of waste storage requirements and procedures.	In effect	Procedure	Allows effective use of available vessels and minimises vessel decontamination requirements	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Cost of documentation development, implementation, maintenance and exercising	**In effect**
	Decanting oily water, by returning treated waste water into a boomed area, to be undertaken subject to necessary approvals from AMSA and/or DTMI.	In effect	System / Procedure	Allows more effective handling, transportation and disposal of concentrated wastes	Provides functionality, availability, reliability, survivability, compatibility and independence.	**Feasible** Effort to obtain and adhere to approvals	**In effect**

Appendix C Pollution report

Government of **Western Australia**
Department of **Transport**

Marine Pollution Report (POLREP)
MEER

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

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

INCIDENT DESCRIPTION

Incident Name: ______________________ Date and Time of Incident (24 hr format): ______________

Location name/description: ______________________

____

Incident Coordinates: Latitude of spill ______________ Longitude of spill ______________

Description of Incident: ______________________

____

____

Weather conditions at site: ______________________

____

OIL DETAILS

Pollutant source

Amount of fuel/pollutant on board: ______________________

☐ 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 spilt, if known (litres): ______________________

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

☐ Photos taken Details: ______________________ held by: ______________

☐ Video taken Details: ______________________ held by: ______________

☐ Samples taken Description: ______________________ held by: ______________

☐ Items retrieved Description: ______________________ held by: ______________

To attach photos, this form must be opened in acrobat, or alternatively, photos can be attached to the submission email before sending.

ADDITIONAL INFORMATION

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

Equipment used? ☐ AMSA ☐ State ☐ Industry

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

KEY CONTACT DETAILS

Name:______________________ Position: ______________________ Phone: ______________

Control Agency: Select the Control Agency Jurisdictional Authority: Select the Jurisdictional Authority

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 State Hazard Plan - Maritime Environmental Emergency.

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.

Pollution Report (POLREP)		
Reporter's Signature:		
Name:	Agency:	Role:

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

Government of **Western Australia**
Department of **Transport**

Maritime Environmental Emergency Situation Report (SITREP)
MEER

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

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

MARITIME ENVIRONMENTAL EMERGENCY 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 DESCRIPTION

Incident Name: ____________________ Ref. No. ____________________

Incident Controller: ____________________

Incident Declaration Level: Please select ____________________ Controlling Agency: Please select ____________________

Priority ☐ Urgent ☐ Immediate ☐ Standard

Final SITREP? ☐ Yes ☐ No

Next SITREP on: ____________________

Date and Time of Incident (24 hr format): ____________________

POLREP or AMSA Form 18 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:

Maritime Environmental Emergency Situation Report (SITREP)		
Reporter's Signature:		
Name:	**Agency:**	**Role:**

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 E Vessel surveillance observer log

Vessel Surveillance Observer Log – Oil Spill

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

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

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

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

Timeline of observations:

Time	Description

Appendix 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:

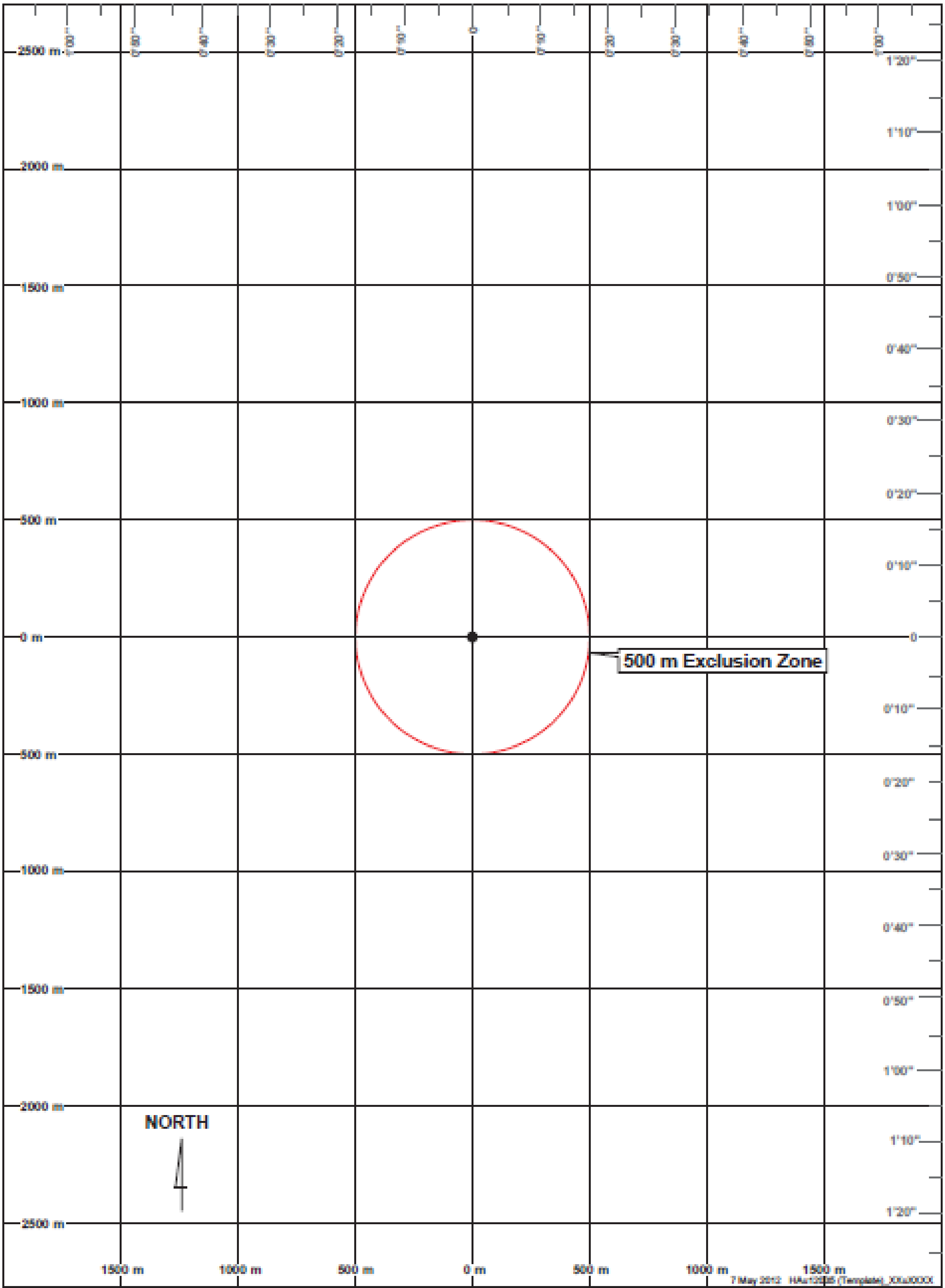
Weather Conditions	
Wind speed (knots)	Wind direction
Cloud base (feet)	Visibility
Time high water	Current direction
Time low water	Current speed (nM)

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

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.**	**<u>Behaviour / Comments.</u>** **Proximity to oil? Oiled?** **Milling? Feeding? Transiting?**
Cetaceans (Whales/ Dolphins)					
Turtles					
Birds					
Dugongs					
Sharks					
Other					

Other details for each observation location

WEATHER DETAILS
Sea State ◯ Mirror calm ◯ Small waves ◯ Slight ripples ◯ Large waves some whitecaps ◯ Large waves, many whitecaps
Visibility ◯ Excellent ◯ Good ◯ Moderate ◯ Poor ◯ Very Poor

OBSERVER DETAILS		
Observer Name	Observer signature	**Observer** ◯ Inexperienced ◯ Experienced

Appendix I Aerial surveillance shoreline observation log

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

Santos

Table J-1: Recommended equipment for an initial deployment of a 6-person shoreline clean-up team

Shore clean-up Tools	Quantity
Disposal Bag Labelled, 140 cm x50cm x 100µm	1,000
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	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	1,000
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 (assorted 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	6
Folding Table 1	1
Shelter open side 1	1
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6
Boxes, Bin and Lid Storage/transport assorted	-
Optional items	
Inflatable tent 9 square metres	1

Table J-2: Recommended equipment list for a decontamination unit for a shoreline 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	4
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 100µm	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
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	-

Table J-3: Recommended equipment list for deployment of a 6-person team for shoreline flushing or recovery

Flushing Equipment	Quantity
Diesel self prime semi trash pump, 25-35 psi, 4.8hp	1
Perforated 2" lay flat hose, 20 m 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	1
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section 2 (50m)	2 (50m)
Towing Bridle 2	2
Danforth Sand Anchor Kit, 30m lines, 15m trip lines 3	3
Diesel Powered pump with hose 1	1
Manta Ray skimmer 1	1
Personal Protection Equipment (PPE) – Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Respirator dust/mist/fume and valve	40
Disposable box light nitrile gloves (100 box)	2
Ear Plugs (200 box)	1
Safety Glasses	18
Gum Boots (assorted sizes)	18
Hyflex Oil Restraint Gloves (assorted sizes)	18
Day/Night Vest	6
Storage Equipment	
Collapsible Bund 1.6m x1.2m	1
Misc sizes of ground sheets/tarps	6
Collapsible Tank 5,000 litres	2
Absorbents	
Absorbent Boom 'oil and fuel only' 3 or 6m x 180,mm	200 m
Absorbent Roll 'oil and fuel only' 40m x 9m	10
Absorbent Pad "oil and fuel only" 45cm x 45cm	1,000
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

Table J-4: Recommended equipment list for a 6-person team for near shore clean-up

Absorbents	Quantity
Absorbent Roll 'oil and fuel only' 40m x 9m	20
Absorbent Pad "oil and fuel only" 45cm x 45cm	2,000
Absorbent Boom "oil and fuel only" 3or6m z 180mm	200 m
Poly Mops (snags)	150
Poly Absorbent Wipes	20
Recovery Equipment	
Tidal Boom (shoreline boom) 25m lengths	4 (100 m)
Tidal Boom Accessories pack	2
Versatech Zoom Curtin Boom 300mm chamber, 450mm skirt 25m section	8 (200 m)
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	
Disposal Bag large fit 205ltr drum, 100cm x 150cm x 100µm	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 Protective Equipment (PPE) Team of 6	
Spill Crew Hazguard water resistant coveralls (assorted sizes)	36
Disposable box light nitrile gloves (100 box)	2
Alpha Tec gloves (assorted sizes)	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 1.6 m x 1.2 m	2
Collapsible bund 4 m x 2.4 m	1
Collapsible Tank 5,000 litres	2
Alum box, Bin & lid Storage/transport cases	10
Misc. sizes of ground sheets/tarps	6
Additional Items	
6 Person first aid kit 1	1
Wide Brim Hat with cord 6	6
Sunburn Cream 1 litre pump bottle 1	1
Personal Eyewash bottle 500mls 6	6
Personal Drink bottle 750mls 6	6

Appendix K Shoreline response strategy guidance

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.
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	• 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.

Sensitive receptors	Strategy guidance
(Note: submerged coral reef communities are less susceptible to oiling)	• 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.

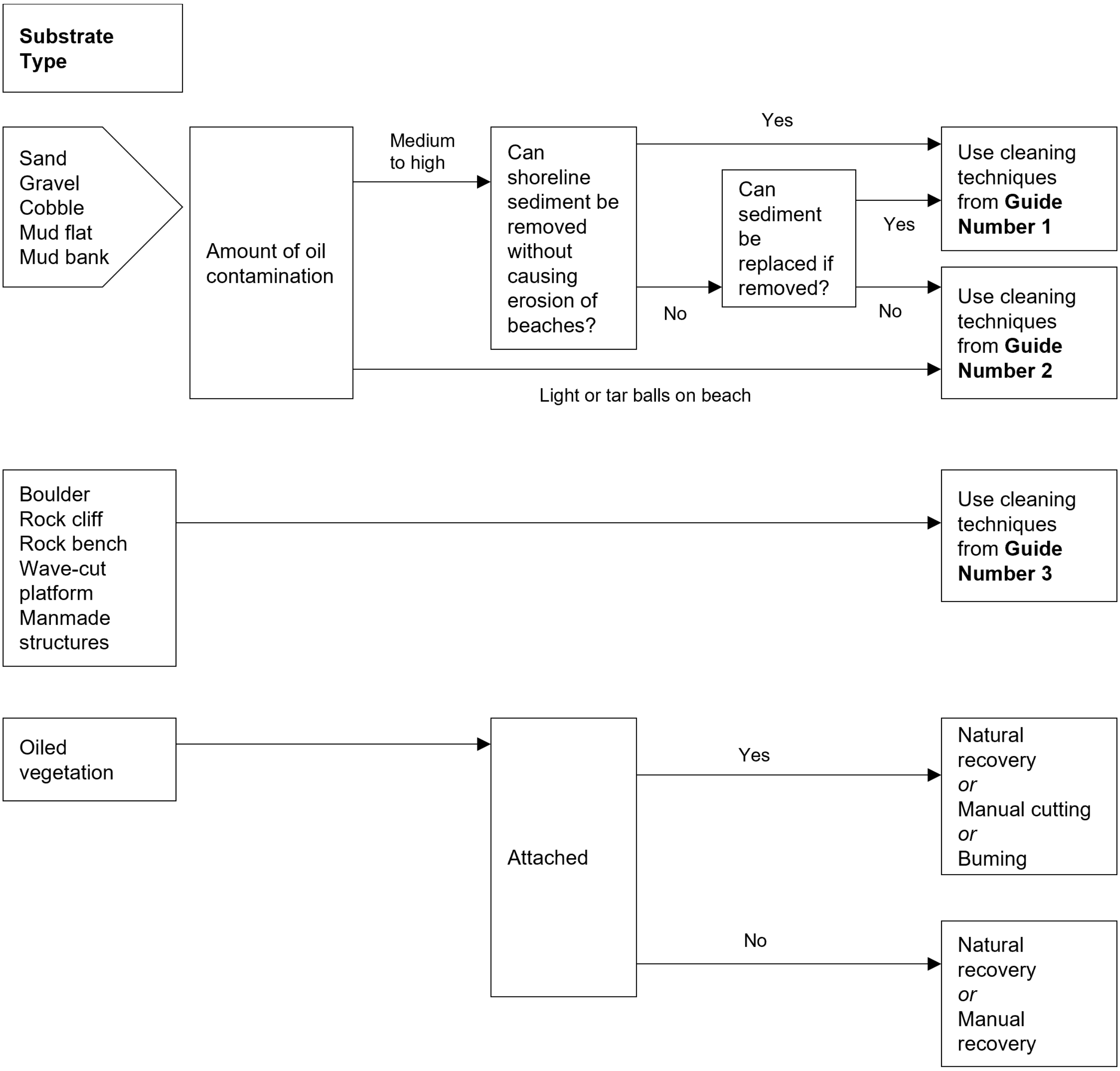


Figure K-1: Shoreline Clean-up Master Decision Guide

Trafficability		Substrate type	Depth of penetration	Clean-up techniques in order of preference	Access	
1. Can rubber-tyred equipment operate on beach?	➔ Yes	Sand, Gravel. Mud	Less than 3 cm	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?**	➔ Yes ↓
			Greater than 3 cm	Elevated Scraper. Front-end loader (Rubber-tyred). Bulldozer and Front-end loader (Rubber-tyred) combination.		Select most preferable technique
		Cobble	Less than 30 cm	Front-end loader (Rubber-tyred).		
			Greater than 30 cm	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 30 cm	Front-end loader (Tracked). Bulldozer and Front-end loader (Tracked) combination.		
			Greater than 30 cm	Bulldozer and Front-end loader (Tracked) combination. Front-end loader (Tracked).	↓ No	

↓ No

Use dragline or hydraulic grader or leave to natural recovery

↓ No (from Question 3)

Go to next Figure – Decision guide No. 2, Question 4.

Figure K-2: Shoreline Clean-Up Decision Guide 1

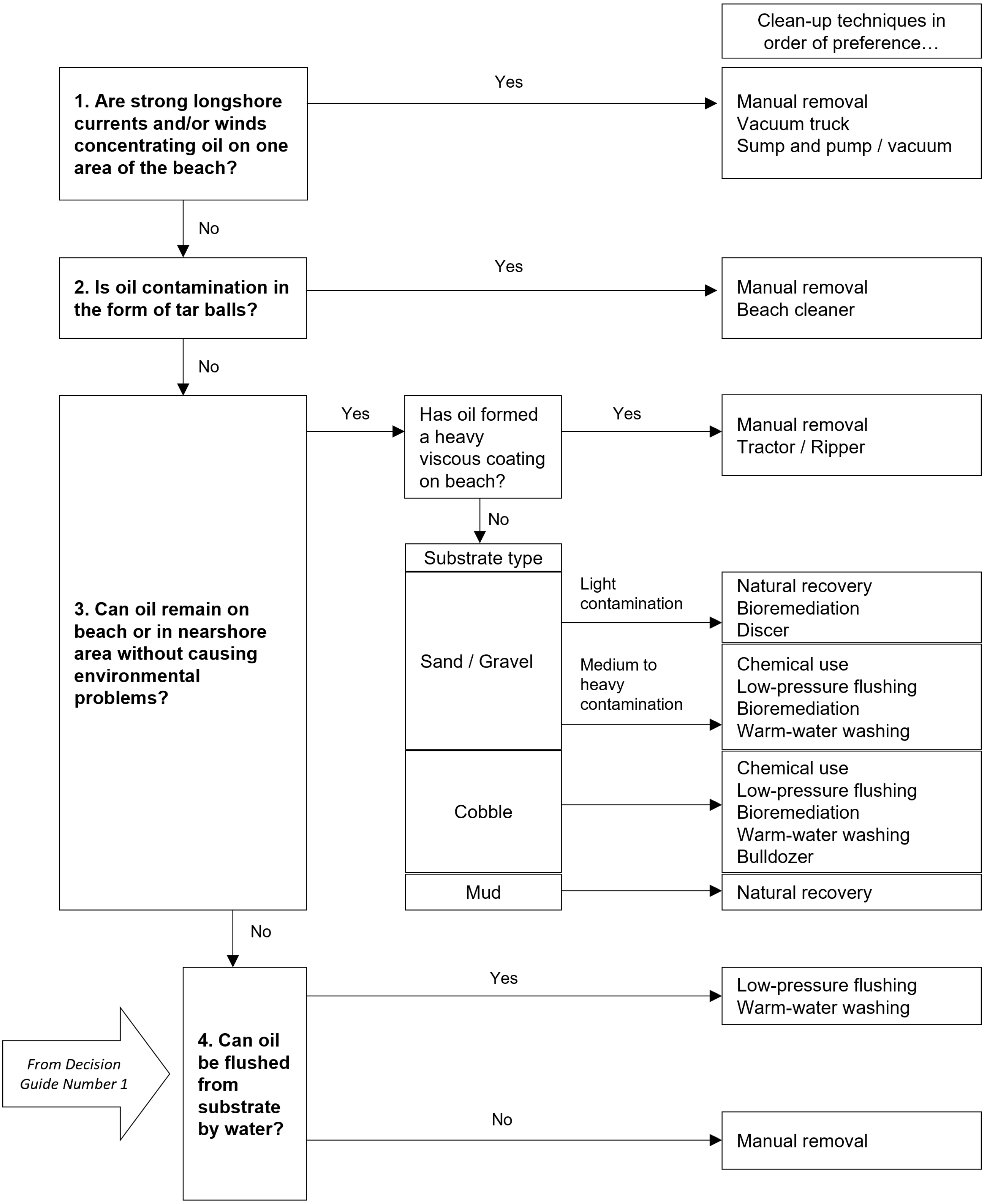


Figure K-3: Shoreline Clean-Up Decision Guide 2

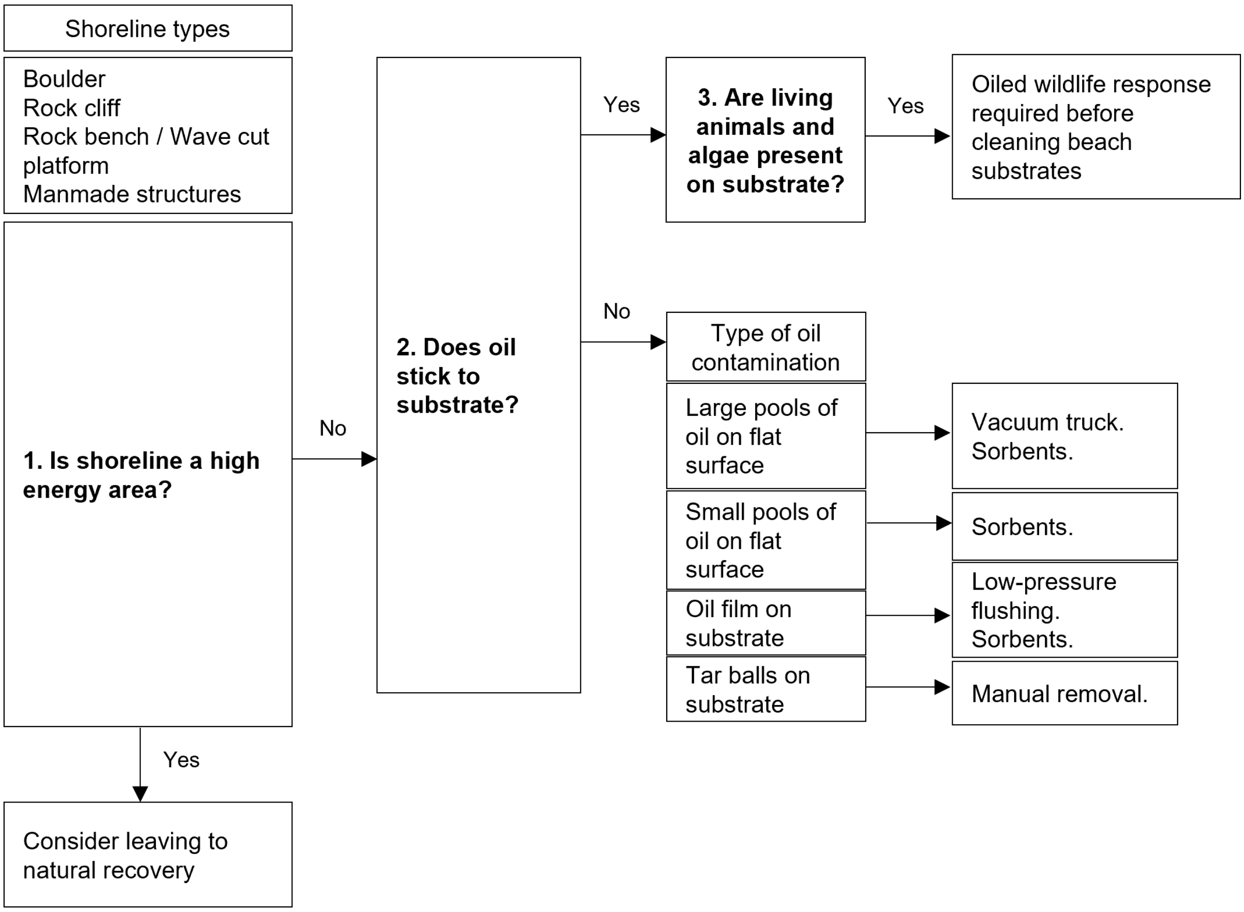


Figure K-4: Shoreline Clean-Up decision Guide 3

Appendix L Operational guidelines for shoreline response

L-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.

L-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:
  - Collection/scraping/gathering
  - Placing in bags/waste containers
  - 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.

L-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:
  - (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
  - (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

L-4 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. The Santos Offshore - Vessel Requirements for Oil Spill Response (7710-650-ERP-0001) describes the specifications for beach landing craft, and describes Santos vessel monitoring processes.

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 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 contamination 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-tide mark; and
4) Deployment of waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M Resourcing Requirements for OM6: Shoreline clean-up assessment

Shoreline clean-up assessment teams will comprise two to three members per team and are assumed to be able to cover 10 km per team per day. Teams may be able to exceed this distance, especially if remote sensing techniques (e.g. 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 to plan for the worst-case shoreline and habitat assessment personnel requirements. Table M-1 presents all receptors contacted at ≥100 g/m² using the stochastic modelling results for all three LOWC scenarios (note, the surface releases of MDO did not result in any predicted contact to shoreline receptors ≥100 g/m²) 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 M-1 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 models from each operational area. Santos will use initial monitor and evaluate 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 surveys and later confirmed via ground and/or vessel surveys.

Deterministic run 1 (LOWC of Caley crude from the Curie OA) was selected to further guide resourcing estimates for SCAT given this run resulted in one of the greatest volumes of oil ashore (Table M-2). Based on deterministic run 1 for the LOWC of Caley crude from the Curie OA the worst-case personnel requirements for SCAT for this activity are for 4-6 personnel based on 2 teams (1 Team Leader and 1–2 Team Members per team).

Table M-3 provides the resource capability available to Santos that may be used to implement SCAT.

Table M-1: Resource requirements for shoreline clean-up assessment for contacted receptors ≥100 g/m² based on stochastic modelling of all LOWC scenarios

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m² (hours / days)	Maximum length of shoreline oiled (km) ≥100 g/m²	Estimated No. of teams required
Ara operational area			
Imperieuse Reef MP	113 (4 days, 17 hours)	19	2
Clerke Reef MP	115 (4 days, 19 hours)	8	1
Dampier Archipelago	341 (14 days, 19 hours)	1	1
Scott Reef South	740 (30 days, 20 hours)	1	1
Mestrel/Bancroft operational area			
Dampier Archipelago	371 (15 days, 11 hours)	3	1
Lowendal Islands	1,514 (63 days, 2 hours)	1	1
Montebello Islands	531 (22 days, 3 hours)	2	1
Muiron Islands	1,705 (71 days, 1 hour)	1	1
Southern Islands Coast	506 (21 days, 2 hours)	2	1
Curie operational area			
Clerke Reef MP	255 (10 days, 15 hours)	3	1
Imperieuse Reef MP	213 (8 days, 21 hours)	11	2

Note: SCAT numbers not to be added up from this table 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: RPS (2025)

Table M-2: Resource requirements for shoreline clean-up assessment for contacted receptors ≥100 g/m^2 areas based on deterministic modelling – run 1 from the Curie LOWC scenario

Location	Minimum arrival time shoreline oil accumulation ≥100 g/m^2 (hours / days)	Maximum length of shoreline oiled (km) ≥100 g/m^2	Estimated No. of teams required
Curie operational area deterministic run 1			
Imperieuse Reef MP	531 (22 days, 3 hours)	11	2

Source: RPS (2025)

Table M-3: Shoreline clean-up assessment – resource capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Shoreline assessment team leaders	Santos	12	Perth, Varanus Island	24-72 hours from time of shoreline contact prediction (WA-based, Santos personnel, AMOSC staff and Core Group personnel)
	AMOSC Core Group	As per monthly availability	Perth, Dampier and other Australian locations	
	AMOSC staff	12 trained in SCAT	Perth and Geelong	
	OSRL	18	Perth and international	5 personnel available from 2–3 days, remaining personnel available from 4–5 days (subject to approvals/ clearances)
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	Drones available 24/7 through AMOSC sub-contract 1 x pilot	Fremantle	Response via duty officer within 15 minutes of first call – AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location (refer to Table 10-12)
	OSRL – Third Party UAV provider	2 x qualified remote pilots, however response is on best endeavours basis	Perth	Depending on the port of departure, 1–2 days if within Australia
	Local WA hire companies	10+	Perth and regional WA	<48 hours

Appendix N Operational and scientific monitoring assessment

The North West Shelf OSM Bridging Implementation Plan (OSM-BIP) (7715-650-ERP-0002) defines the 3-step process for ensuring that OSM priorities and capabilities of each activity are adequately covered by the existing information described within the North West Shelf OSM-BIP (Section 1.1 and Appendix B of the North West Shelf OSM-BIP).

Step 1: Determine if the new activity Scientific Monitoring Planning Area fits within the North West Shelf OSM-BIP consolidated Scientific Monitoring Planning Area

Comparison of the Scientific Monitoring Planning Area for the Bedout Multi Well Drilling activities (Figure N-1) shows that this fits within the North West Shelf OSM-BIP consolidated Scientific Monitoring Planning Area (Figure 2-1 in the North West Shelf OSM-BIP).

Step 2: Determine the monitoring priorities for the activity, by identifying receptors predicted to be contacted >5% probability within 7 days, determining whether these receptors are already noted as monitoring priorities in Section 2, and have been assessed for baseline data adequacy in Section 4 of the North West Shelf OSM-BIP

As per Section 2.2 of the North West Shelf OSM-BIP, monitoring prioritisation during a spill should focus on sensitive receptors (which Santos identifies through its Oil Spill Risk Assessment and Response Planning Procedure [SO-91-II-20003]) with the highest risk of adverse consequences and where oil spill modelling predicts high probability of rapid contact. Additionally, receptors that have little to no existing baseline are given a higher scientific monitoring priority.

The monitoring priorities for Bedout Multi Well Drilling activities include sensitive receptors contacted by hydrocarbons at either the low threshold for floating (≥1 g/m^2), shoreline contact (≥10 g/m^2), entrained (≥10 ppb), or dissolved (≥10 ppb) within 7.0 days at a probability >5%, as identified in Table N-1 to Table N-4. These receptors are all included in Table 2-1 of the North West Shelf OSM-BIP and have therefore been assessed for baseline data adequacy and also in the background information for key sensitivities (Appendix C of the North West Shelf OSM-BIP).

The results of the baseline data assessment for these monitoring priorities is provided in Table N-5, which is an excerpt of Table 4-3 in the North West Shelf OSM-BIP (but only includes monitoring priorities for Bedout Multi Well Drilling activities).

Note that stochastic modelling of the three MDO scenarios did not predict any receptors meeting the criteria of >5% probability of contact in <7 days for floating, shoreline or dissolved oil. However, the criteria were met for entrained oil for a limited number of receptors for the Ara and Curie operational areas (refer to Table N-4). The inclusion of entrained hydrocarbons at concentrations greater than 10 ppb is used to denote exposure to hydrocarbons, but does not necessarily imply toxicity. For entrained whole-oil droplets, the toxic fraction is small, as many hydrocarbon constituents remain sequestered and not bioavailable (French-McCay 2024). During the initial monitoring response, emphasis will be placed on receptors contacted by floating, shoreline, and dissolved hydrocarbon phases. If a receptor is only contacted by low concentrations of entrained hydrocarbons and not by any other hydrocarbon phase, it will be considered a lower priority during the initial monitoring response.

Step 3: Determine whether the capability requirements and monitoring arrangements of the activity exceed or are met by the capability requirements outlined in Section 8 and capability arrangements described in Sections 9 and 10 of the North West Shelf OSM-BIP

As per Step 3, Appendix B of the North West Shelf OSM-BIP, Santos has reviewed the following worst-case OSM capability assessment criteria for Bedout Multi Well Drilling activities:

- *Review stochastic modelling results to determine if more than 8 floating, 6 shoreline or 12 dissolved locations are contacted within 7 days:* Table N-1 shows that 5 floating and 2 shoreline receptors are contacted by the Ara LOWC (Caley Condensate) spill within 7 days at a probability >5%; and Table N-3 show that 6 dissolved receptors are contacted by the Curie LOWC (Caley Condensate) within 7 days at a probability >5%.
- *Is the hydrocarbon type adequately represented in the existing suite of hydrocarbons analysed in Section 8 of the OSM-BIP:* Section 8 of the OSM-BIP (Resourcing Requirements) includes the Ara LOWC spill scenario (Caley Condensate), which also reflects the northern-most extent of Santos' operational areas in the North West Shelf.

As the Bedout Multi Well Drilling activities include a very light crude[45] (Group 2) and are located at the northern-most extent of Santos' operational areas in the North West Shelf, Santos has updated the North West Shelf OSM-BIP (Section 8) to include the deterministic modelling results for the Ara LOWC scenario. The Ara scenario was selected for further analysis as it contacted the highest number of receptors for both floating and shoreline contact at the low thresholds within 7 days and >5%. Due to the hydrocarbon type and location of the Bedout Multi Well Drilling activity, this scenario now informs OSM resourcing requirements (North West Shelf OSM-BIP Section 8) and capability arrangements (North West Shelf OSM-BIP Sections 9 and 10).

The results of the baseline assessment are provided within the Environment Functional Team Folder on the Santos ER SharePoint so that this information is accessible to guide Santos IMT Environmental roles and OSM Services Provider roles in the event of activating oil spill scientific monitoring.

[45] *Caley Crude properties – API = 51.4; residual components = 15%*

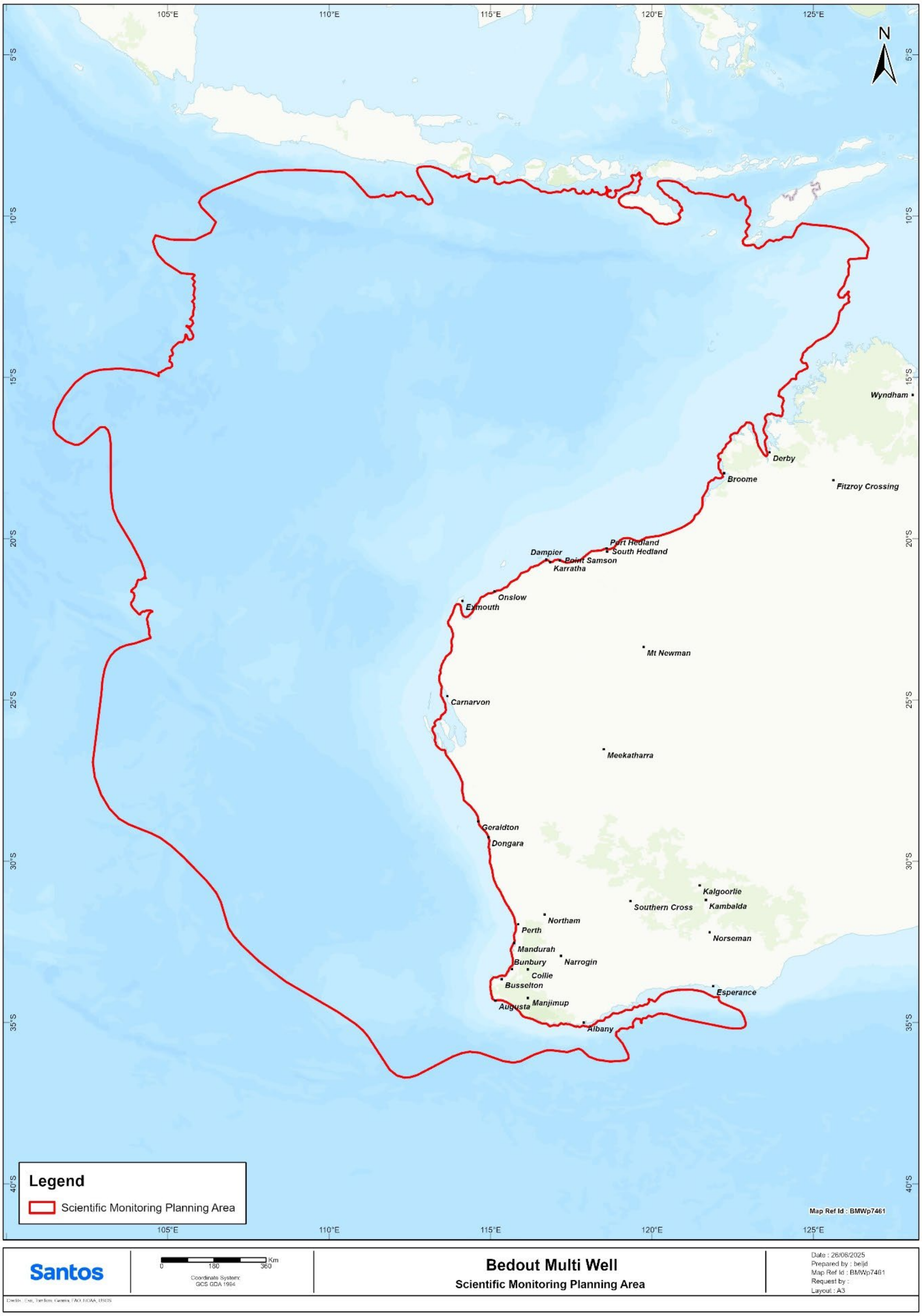


Figure N-1: Scientific Monitoring Planning Area for the Bedout Multi Well Exploration and Appraisal Drilling EP (7720-650-EMP-0005)

Table N-1: LOWC release of Caley Crude stochastic modelling results for locations with a probability of contact >5% and <7 days (Ara operational area)

Floating oil contact locations	Contact probability (%) floating oil ≥1 g/m^2	Minimum arrival time ≥1 g/m^2 (hours / days)
Clerke Reef MP	23.33	61 (2 days, 13 hours)
Imperieuse Reef MP	40.33	64 (2 days, 16 hours)
Mermaid Reef AMP	13.67	84 (3 days, 12 hours)
Outer Argo-Rowley Terrace AMP	10.67	138 (5 days, 18 hours)
Rowley Shoals surrounds	50.66	35 (1 day, 11 hours)
WA State Waters	40.33	61 (2 days, 13 hours)
Shoreline contact locations	**Contact probably (%) Shoreline oil ≥10 g/m^2**	**Minimum arrival time ≥10 g/m^2 (hours / days)**
Clerke Reef MP	18.33	94 (3 days, 22 hours)
Imperieuse Reef MP	34	77 (3 days, 5 hours
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Clerke Reef MP	78.33	57 (2 days, 9 hours)
Imperieuse Reef MP	86.99	57 (2 days, 9 hours)
Mermaid Reef AMP	78.33	83 (3 days, 11 hours)
Outer Argo-Rowley Terrace AMP	87.66	115 (4 days, 19 hours)
Rowley Shoals surrounds	91.66	30 (1 day, 6 hours)
WA State Waters	86.99	57 (2 days, 9 hours)
Dissolved hydrocarbon contact locations	**Contact probably (%) dissolved hydrocarbons ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Clerke Reef MP	40	64 (2 days, 16 hours)
Imperieuse Reef MP	55.33	69 (2 days, 21 hours)
Mermaid Reef AMP	29.66	91 (3 days, 19 hours)
Outer Argo-Rowley Terrace AMP	37.33	128 (5 days, 8 hours)
Rowley Shoals surrounds	61.66	32 (1 day, 8 hours)
WA State Waters	55.33	64 (2 days, 16 hours)

Source: RPS (2025)

= intertidal receptor

= submerged receptor

Table N-2: LOWC release of Caley Crude stochastic modelling results for locations with a probability of contact >5% and <7 days (Mestrel/Bancroft operational area)

Floating oil contact locations	Contact probability (%) floating oil ≥1 g/m^2	Minimum arrival time ≥1 g/m^2 (hours / days)
Glomar Shoals	13	166 (6 days, 22 hours)
Shoreline contact locations	**Contact probably (%) Shoreline oil ≥10 g/m^2**	**Minimum arrival time ≥10 g/m^2 (hours / days)**
Criteria not met	-	-
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Glomar Shoals	92.99	78 (3 days, 6 hours)

Dissolved hydrocarbon contact locations	Contact probably (%) dissolved hydrocarbons ≥10 ppb	Minimum arrival time ≥10 ppb (hours / days)
Glomar Shoals	64.99	(80) 3 days, 8 hours

Source: RPS (2025)

= submerged receptor

Table N-3: LOWC release of Caley Crude stochastic modelling results for locations with a probability of contact >5% and <7 days (Curie operational area)

Floating oil contact locations	Contact probability (%) floating oil ≥1 g/m^2	Minimum arrival time ≥1 g/m^2 (hours / days)
Imperieuse Reef MP	10.67	90 (3 days, 18 hours)
Outer Argo-Rowley Terrace AMP	5.33	162 (6 days, 18 hours)
Rowley Shoals surrounds	12.33	66 (2 days, 18 hours)
WA State Waters	10.67	90 (3 days, 18 hours
Shoreline contact locations	**Contact probably (%) Shoreline oil ≥10 g/m^2**	**Minimum arrival time ≥10 g/m^2 (hours / days)**
Imperieuse Reef MP	19	123 (5 days, 3 hours)
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Barrow-Montebello Surrounds	49	148 (6 days, 4 hours)
Dampier AMP	32	97 (4 days, 1 hour)
Dampier Archipelago	28.66	114 (4 days, 18 hours)
Glomar Shoals	67.99	64 (2 days, 16 hours)
Imperieuse Reef	73.33	89 (3 days, 17 hours)
Madeleine Shoals	31	101 (4 days, 5 hours)
Montebello AMP	62.33	97 (4 days, 1 hour)
Montebello Islands	46	150 (6 days, 6 hours)
Outer Argo-Rowley Terrace AMP	86.32	97 (4 days, 1 hour)
Rankin Bank	66.66	143 (5 days, 23 hours)
Rowley Shoals surrounds	87.32	51 (2 days, 3 hours)
WA State Waters	73.33	89 (3 days, 17 hours)
Dissolved hydrocarbon contact locations	**Contact probably (%) dissolved hydrocarbons ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Glomar Shoals	40.66	67 (2 days, 19 hours)
Imperieuse Reef MP	37	100 (4 days, 4 hours)
Montebello AMP	28.66	99 (4 days, 3 hours)
Outer Argo-Rowley Terrace AMP	29	136 (5 days, 16 hours)
Rankin Bank	39	160 (6 days, 16 hours)
Rowley Shoals surrounds	39.33	56 (2 days, 8 hours)
WA State Waters	37	100 (4 days, 4 hours)

Source: RPS (2025)

= intertidal receptor

= submerged receptor

Table N-4: Vessel collision release of MDO entrained stochastic modelling results for locations with a probability of contact >5% and <7 days (Ara, Mestrel/Bancroft and Curie operational areas)

Ara operational area		
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Imperieuse Reef MP	10.67	90 (3 days, 18 hours)
Outer Argo-Rowley Terrace AMP	5.33	162 (6 days, 18 hours)
Rowley Shoals surrounds	12.33	66 (2 days, 18 hours)
Mestrel/Bancroft operational area		
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Glomar Shoals	5.00	153 (6 days, 9 hours)
Curie operational area		
Entrained hydrocarbon contact locations	**Contact probably (%) entrained oil ≥10 ppb**	**Minimum arrival time ≥10 ppb (hours / days)**
Criteria not met for any receptor	-	-

Source: RPS (2025)

= submerged receptor

Table N-5: Baseline data assessment for Bedout Multi Well Drilling activities - monitoring priorities versus SMPs

Receptor	SMP									
	SM1: Water quality impact	SM2: Sediment quality impact	SM3: Intertidal and coastal habitat	SM4: Seabirds and shorebirds	SM5: Marine mega-fauna assessment – reptiles	SM5: Marine mega-fauna assessment – whale sharks, dugong and cetaceans	SM6: Benthic habitat	SM7: Marine fish and elasmobranch assemblages	SM8: Fisheries impact+	SM9 & 10: Heritage and social impact^
Dampier AMP*										
Montebello AMP*										
Outer Argo-Rowley Terrace AMP*										
Rowley Shoals MP* (Clerk Reef and Imperieuse Reef)										
Dampier Archipelago					Turtles: Rosemary Island					
Barrow Island and Barrow Montebello surrounds*	Barrow Island Port	Barrow Island Port			Flatback turtle					
Montebello Islands				Wedge-tailed shearwater Ah Chong Island						
Reefs, Shoals, Banks*										

Key	
	Priority survey: Current baseline data is not in place, not suitable or not sufficient; and post-spill pre-impact baseline data collection should be prioritised
	Survey: Collectively there is substantial baseline data or on-going monitoring from within the last 5 years, therefore current monitoring/knowledge is considered adequate (i.e. could be used to detect level of change in the event of a significant impact) and is considered a lower priority for post-spill, pre-impact data collection
	NA: not applicable

** Submerged EVA*

+ Locations to be determined in consultation with key stakeholders to reflect current fishing zones/effort

^ Locations to be determined in consultation with key stakeholders

Appendix O Forward operations guidance

The IMT operate from Perth within the Santos ICC. This room is equipped and subject to reviews and updates as detailed in the Santos Incident Management Plan – WANATL (7700-670-PLA-0016).

For a significant Level 2/3 response requiring coordination of resources to be deployed to the field, Santos will establish a FOB. For a Level 2/3 spill crossing from Commonwealth to State waters (cross-jurisdictional spills) DTMI will establish an FOB.

To facilitate a streamlined response, FOBs are required close to the response operational areas equipped with near duplicated IMT equipment and personnel. Further information on FOBs is provided in the Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017).

For a Bedout Multi Well drilling activities spill response, Santos will establish an FOB at the Santos Dampier facilities leased from Toll Energy. These facilities are located in Toll Energy's Yard 4 on Hammonds Road in the King Bay precinct, Dampier. The facilities consist of 1 x demountable office space containing 4 small offices, an open planned computer station, a reception desk area and boardroom. There is also an ablutions block and basic tearoom facilities. The Toll Energy Dampier facilities are connected to the Santos internet and telephone system. These facilities are also available to the DTMI to establish an FOB for State based response.

Additional FOBs may be set up as operational requirements dictate. Exmouth is a potential additional FOB location. There is also an option to use the Port of Onslow at Beadon Creek, subject to approval from DTMI. The Port of Onslow has a suitable dredged berth and tarmacked areas for equipment laydown, and a building suitable for set-up of an FOB. Refer to Santos Oil Spill Response – Forward Operating Base Guideline (SO-91-IF-20017) for details on the other potential FOB locations.

Appendix P Oiled wildlife response personnel and equipment

In the event of a spill impacting wildlife, Santos will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the Santos Oiled Wildlife Response Framework Plan (7700-650-PLA-0017) and WAOWRP.

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

Overall OWR capability per OWR strategy

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

Santos has the capability to set up oiled wildlife field stations within 3–4 days of a spill through access to AMOSC equipment and equipment purchased at the time of a spill. Santos could also arrange the transport of wildlife from the field to a primary care facility. In the unlikely event that a worst-case LOWC situation is realised, there is the potential for OWR impacts in offshore intertidal reef areas (i.e. Imperieuse Reed and Clerke Reef), as well as the potential for a large area of surface oil offshore. There are additional logistical constraints to OWR in these environments, which are considered in Table P-2. Specifications for vessels that could be used as offshore OWR field stations are also considered in the Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001).

The indicative personnel required for a high impact-rated response is 93 personnel (as per the WAOWRP) (DBCA, 2022a), however depending on the number and species impacted, many more may be required. Santos' current arrangements could support a large scale OWR (requiring >93 personnel) mainly through support staff such as non-technical wildlife support roles (management, logistics, planning, human resourcing, transport, 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 P-1: Santos OWR capability per OWR strategy

OWR Strategy	Considerations	Equipment/Personnel	Location	Mobilisation Timeframe
Reconnaissance	Identify opportunities to create synergies with surveys required for Monitor and Evaluate, and Operational and Scientific Monitoring activities.	Rotary Wing Aircraft & Flight Crew	Karratha	Wheels up within 1 hour for ER
		Drones and pilots	Local WA hire companies	1-2 days
		Contracted vessels and VOO Santos Contracted Vessel Providers VOO identified through AIS Vessel Tracking	Vessels mobilised from Darwin. Locations verified through AIS Vessel Tracking Software.	Pending availability and location Expected within 12 hours
		Aerial Surveillance Crew Santos Staff AMOSC Staff AMOSC Core Group personnel available Additional trained industry mutual aid personnel available	Perth and Varanus Island (Santos aerial observers) Australia wide	Santos trained personnel – next day mobilisation to airbase <24 hours
Preventative actions	Mainly effective for bird species	2x AMOSC wildlife fauna hazing and exclusion kits	1x Fremantle, 1x Geelong	Location dependent

	Requires relevant WA licence approval	1x AMOSC Breco buoy	1x Fremantle	
Rescue and field processing	Wildlife handling and first aid should only be done by persons with appropriate skills and experience or under the direction of DBCA. A beach access support vessel or accommodation vessel could be used for field processing in remote locations (benefits associated with temperature regulation and access to heated water and electricity)	4x AMOSC oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	1x Exmouth, 1x Broome, 2x Geelong	Location dependent
		2x DBCA OWR trailers	1x Kensington WA, 1x Karratha	Location dependent
		50% of OSRL OWR response packages (wildlife search and rescue kits/cleaning and rehab kits, including field first aid).	5x Singapore, 2x Bahrain, 7x UK, 5x Fort Lauderdale	Location dependent
Transport	Transport of oiled animals by aeroplane or helicopter may be restricted due to Civil Aviation Safety Authority (CASA) regulations. Such transport will depend on the level of oiling remaining on animals. Therefore, consultation with the air transport provider must take place before transport to ensure the safest and most efficient means.	Contracted vessels and VOO Santos Contracted Vessel Providers VOO identified through AIS Vessel Tracking	Vessels mobilised from Dampier. Locations verified through AIS Vessel Tracking Software.	Pending availability and location Expected within 12 hours
Primary care facility	OWR container could be placed on the deck of a suitably sized vessel for field processing in remote locations (benefits associated with temperature regulation and access to water and electricity). An OWR container on a vessel could also be used to aide transport form offshore islands.	OWR container/mobile washing facility: 2x AMOSC 4x AMSA 2x DTMI	AMOSC – 1x Fremantle, 1x Geelong AMSA – 1x Dampier, 1x Darwin, 1x Devonport, 1x Townsville DTMI – 2x Fremantle (1x Primary Care Kit [20ft container]; 1x Sustainment Kit [20ft container])	Location dependent
		AMOSC call off contract with DWYERTech NZ – a facilities management group	New Zealand	Availability within 24 hours of call-off
Personnel	Untrained personnel would receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	Santos provides OWR training to staff, and to-date, 16 personnel have received OWR training.	Perth and Varanus Island	<48 hours
		Santos maintains labour hire arrangements for access to untrained personnel.		
		1 x AMOSC OWA	Perth	<48 hours

		62 x trained industry personnel (AMOSC OWR Strike Team members)	-	<48 hours
		AMOSC MOU with Phillip Island National Park (PINP) (best-endeavours availability)	Victoria	Best-endeavour availability
		AMOSC MOUs – WA organisations	WA	Best-endeavour availability
	Sea Alarm Via OSRL's contract with the Sea Alarm Foundation, two oiled wildlife response technical advisors are on call to support Members. 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.	1 x OWR Technical Advisor available for deployment in-field or at the Command Post (typically supporting the Wildlife Branch Director or the Planning and Operations sections) 1 x OWR Technical Advisor available to support remotely.	Sea Alarm Belgium	Location dependent. Notification via existing OSRL notification and mobilisation process.
	GOWRS Oiled Wildlife Assessment Service Through OSRL's ongoing funding of the Global Oiled Wildlife Response System (GOWRS) project, a wildlife assessment team of four wildlife experts can be mobilised in-field to provide an on-the-ground technical assessment of wildlife response needs and the professional capabilities of local responders.	4 x wildlife experts can be mobilised in-field for up to 4 days. Access to additional oiled wildlife resources on a 'reasonable endeavours' only basis through the GOWRS partners	Various locations in northern and southern hemisphere	Location dependent. Notification via existing OSRL notification and mobilisation process.

Table P-2: Logistical considerations for implementing an OWR in remote offshore reef locations

OWR Strategy	Logistical Considerations
Reconnaissance and rescue	Imperieuse Reef: • Intertidal coral reef limits access to Cunningham Island during low tides • Optimal landing time is around high tide • Access to Cunningham Island is limited to approximately 3 to 4 hours depending on tides • Shallow draft vessels required. Entrance/channel is not navigable by larger vessels.

	Clerke Reef: • Intertidal coral reef limits access to Bedwell Island during low tides • Optimal landing time is around high tide • Access to Bedwell Island is limited to approximately 3 to 4 hours depending on tides • Main entrance is navigable by larger vessels. However, shallow draft vessels required to land at Bedwell Island. *Refer to Section 15.4.1.1 for further information on Imperieuse Reef and Clerke Reef.*
OWR Field station	Vessel minimum specifications: • Suitable deck area for: – 1 x OWR container (e.g. AMOSC, AMSA) and small tender vessel – 1-2 air conditioned animal holding containers • Oily water separator and/or waste oily water holding tanks • Accommodation for 10 minimum OWR personnel (including personnel for reconnaissance, rescue and field processing). • Personnel transfer basket for transferring personnel and wildlife from smaller vessels to the field station vessel (adult sized turtles may require a hiab crane for transfer). Transfer is metocean condition dependent - only to be undertaken in suitable conditions. Refer to Figure P-4-3 in the WA OWR Manual (DBCA, 2022b) for an example layout for a vessel-based OW facility and Appendix A of the WA OWR Plan (DBCA, 2022a) for associated equipment lists. Vessel based wildlife field station: • 1 x OWR container for undertaking wildlife assessments and triage • 1 x OWR container for washing, or as a holding room if washing is not undertaken (situation dependent) – Consideration may be given to washing lightly oiled but otherwise normal turtles (Stacey *et al.* 2019) if they can be returned to an unoiled marine environment quickly – Oiled birds should not be washed in the field unless necessary for transport (refer to transport considerations below) – Seawater is effective for washing oiled wildlife (Finlayson *et al.* 2018) and could be used for cleaning onboard a vessel if required. • If an OWR container is not available or is not large enough, a temporary holding area could be placed on the deck of the field station vessel (e.g. airconditioned container/demountable) – The holding area will need sufficient room (subject to the number of wildlife and species requirements) to hold wildlife for 2 to 5 days (allowing for weather and wildlife stabilisation) before transport – Will need to be enclosed – Will require ventilation – Will be advantageous if this is a climate controlled area (air conditioners/fans/heaters utilising vessel power source). • Carcass storage requirements: – Refrigerators/freezers (refer to Section 4.4 of the WA OWR Manual [DBCA, 2022b]) – Refrigeration of carcasses if necropsy is feasible in <24 hours (unlikely given the remote location) – Freeze carcasses if necropsy will occur >24 hours. *Note: These vessel specifications are included in the Santos Marine Vessel Requirements for Oil Spill Response (7710-650-ERP-0001)*
Transport	Helicopter: • Could be an option if the vessel has a helideck. • 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 of transport. Vessel transport to mainland via dedicated transport vessel: • Clerke Reef to Dampier (470 km; steam time ~25 hours at 10 kts) • Imperieuse Reef to Dampier (~410 km; steam time ~22 hours at 10 kts).
Primary care facility	• Arrangements via AMOSC and DBCA for setting up a Primary Care Facility in Dampier or utilising existing rehabilitation facilities (if affected wildlife numbers are low)

	• Santos will be responsible for resourcing the facility.

Australian Maritime Safety Authority

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

Western Australian Department of Transport & Major Infrastructure

The WA DTMI maintains two OWR containers (located at Port of Fremantle in D-shed) which are available through the SHP-MEE and the AMSA National Plan on request.

Australian Marine Oil Spill Centre

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

Equipment

Table P-3 provides a summary of the oiled wildlife response equipment maintained by AMOSC.

Table P-3: AMOSC wildlife equipment

Location	Oiled fauna kits (basic medical supplies, cleaning/rehab, PPE)	Fauna hazing and exclusion equipment	Oiled wildlife washdown container (mobile washing facility)
Fremantle	-	1x fauna hazing & exclusion kit 1x Breco bird hazing buoy	1x oiled wildlife washdown container
Exmouth	1x oiled fauna kit	-	-
Broome	1x oiled fauna kit	-	-
Geelong	2x oiled fauna kit	1x fauna hazing & exclusion kit	1x oiled wildlife washdown container
Total	4x Oiled fauna kit	5x fauna hazing & exclusion kits 1x Breco bird hazing buoy	2x oiled wildlife washdown containers

Personnel

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

- 1x AMOSC OWR Officer available to act as an industry OWA.
- 62x trained industry personnel (AMOSC OWR Strike Team members).
  - Volunteer OWR trained industry personnel.
- Wildlife Care Groups:
  - 35x introductory trained personnel.
  - 24x completed management course.
  - 16x completed Responder course.
- AMOSC call off contract with DWYERtech Response NZ.
  - A facilities management group with availability within 24 hours of call off (2x personnel).

AMOSC has the following MoUs in place:

- PINP (best-endeavours availability).
  - Approx. 50x PINP Staff – collection/facility ops/rehabilitation.
  - Approx. 45x volunteers – collection/facility ops/rehabilitation.
  - Approx. 20x staff (animal feeding).
  - 6x PINP Staff – wildlife ER including cetacean stranding/entanglement.
  - 17x PINP Staff – wildlife team leaders.
  - 5x PINP Staff – IMT Training.
- Blue Planet Marine (WA).
  - 10-20x Personnel (best endeavours to respond).
- WA Seabird Rescue.
  - No permanent staff (~30x volunteers).
- WA Native Animal Rescue.
  - 5x staff (~80x volunteers).
  - Wangara (avifauna and mammals).
  - Broome (marine turtles).
- WA Wildlife.
  - 10x staff (~80 volunteers).
- Darling Range Wildlife (WA).
  - 5x staff (~50 volunteers).
- Mandurah Wildlife (WA).
  - 5x staff (~30 volunteers).

Oil Spill Response Limited

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

Equipment

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

Table P-3: OSRL wildlife equipment (as per OSRL Equipment Stockpile Status Report, August 2025)

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

The latest OSRL equipment inventory available to members can be found in the SLA equipment stockpile status report: https://www.osrl.com/in-action/publications/.

Personnel

Through the OSRL SLA, Santos has access to 24/7 technical advice (remote or on-site) from the Sea Alarm Foundation, a small non-governmental organisation based in Brussels, Belgium that works to improve global preparedness and response for oiled wildlife incidents. 2 x Technical Advisors are available, with one providing remote support and the other available to be mobilised for on-site support, either in-field or at the Command Post (typically working with the Wildlife Branch Director or the Planning and Operations sections as appropriate. Sea Alarm staff will act in a technical advisory role at the incident management level and will work impartially with all parties (titleholder, local authorities, mobilised experts and local experts, and response groups), with the aim of maximising the effectiveness of the wildlife response.

Through OSRL's ongoing funding of the Global Oiled Wildlife Response System (GOWRS) Project, a wildlife assessment team of four wildlife experts can be mobilised in-field for up to four days in addition to the Sea Alarm resources noted above. The GOWRS Oiled Wildlife Assessment Service is a ready-to-deploy 4-person team delivered by a network of 10 leading wildlife response organisations. The four-person team will initially deploy for four days to provide an on-the-ground technical assessment of wildlife response needs and the professional capabilities of local responders. The team will inform the client of the feasibility of a full-scale professional response and the details of the GOWRS expertise that is available to deliver to the scale of such a response. There is also access to additional oiled wildlife resources on a 'reasonable endeavours' only basis through the GOWRS partners.

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

Appendix Q Dispersant supply and logistics plan

Table Q-1: Surface dispersant supply and logistics plan summary

All dispersant delivered to Karratha Airbase FOB, vessel supply forwarded to Dampier Port.

Day	Vol. needed for aerial application (Response Needs Calculator, OPEP Table 13-11)	Vol. needed for vessel application (Response Needs Calculator, OPEP Table 13-14)	Total Vol. needed (vessel + aerial)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
1	0	0	0	AMSA	Karratha, WA	20	3	20	20
2	0	0	0	AMOSC	Exmouth HEH Base, WA	75	3	95	95
3	75	0	75	AMSA	Fremantle Port, WA	100	4	195	120
4	75	5	80	AMOSC	Altona North, VIC	137	5	332	177
5	75	20	95	AMSA	Darwin Port, NT	20	6	352	102
6	75	20	95	AMOSC	Welshpool, WA	143	7	495	150
7	75	30	105	AMOSC	Welshpool, WA	142	8	637	187
8	75	45	120	AMSA AMOSC	Melbourne: 20 Broome: 14	34	9	671	101
9	75	45	120	AMSA	Sydney	100	10	771	81
10	75	45	120	AMSA	Adelaide: 20 Brisbane: 20 Townsville: 25	65	11	836	26
11	75	45	120	OSRL SLA	Singapore	150	12	986	56
12	75	45	120	OSRL SLA	Singapore	150	13	1,136	86
13	75	45	120	OSRL SLA	Singapore: 75 Southampton, UK: 75	150	14	1,286	116
14	75	45	120	OSRL SLA	Southampton, UK	150	15	1,436	146
15	75	45	120	OSRL SLA	Southampton, UK	150	16	1,586	176
16	75	45	120	AMSA	Devonport, TAS: 20 Horne Island, QLD: 10	30	17	1,616	86
17	75	45	120	OSRL GDS	GDS - Singapore	140	18	1,756	106

Day	Vol. needed for aerial application (Response Needs Calculator, OPEP Table 13-11)	Vol. needed for vessel application (Response Needs Calculator, OPEP Table 13-14)	Total Vol. needed (vessel + aerial)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
18	75	45	120	OSRL GDS	GDS - Singapore	140	19	1,896	126
19	75	45	120	OSRL GDS	GDS - Singapore	140	20	2,036	146
20	75	45	120	OSRL GDS	GDS - Singapore	140	21	2,176	166
21	75	45	120	OSRL GDS	GDS - Singapore	140	22	2,316	186
22	75	45	120	OSRL GDS	GDS - France	110	23	2,426	176
23	75	45	120	OSRL GDS	GDS - France	110	24	2,536	166
24	75	45	120	OSRL GDS	GDS - France	110	25	2,646	156
25	75	45	120	OSRL GDS	GDS - France	110	26	2,756	146
26	75	45	120	OSRL GDS	GDS - France	110	27	2,866	136
27	75	45	120	OSRL GDS	GDS - France	110	28	2,976	126
28	75	45	120	OSRL GDS	GDS - France	110	29	3,086	116
29	75	45	120	OSRL GDS	GDS - France	110	30	3,196	106
30	75	45	120	OSRL GDS	GDS - France	110	31	3,306	96
31	75	45	120	OSRL GDS	GDS - France	110	32	3,416	86
32	75	45	120	OSRL GDS	GDS - France	110	33	3,526	76
33	75	45	120	OSRL GDS	GDS - France	110	34	3,636	66
34	75	45	120	OSRL GDS	GDS - France	110	35	3,746	56
35	75	45	120	OSRL GDS	GDS - France	110	36	3,856	46
36	75	45	120	OSRL GDS	GDS - France	110	37	3,966	36
37	75	45	120	OSRL GDS	GDS - France	110	38	4,076	26
38	75	45	120	OSRL GDS	GDS - France	148	39	4,224	54
39	75	45	120	OSRL GDS	GDS - France	148	40	4,372	82
40	75	45	120	OSRL GDS	GDS - France	148	41	4,520	110

Day	Vol. needed for aerial application (Response Needs Calculator, OPEP Table 13-11)	Vol. needed for vessel application (Response Needs Calculator, OPEP Table 13-14)	Total Vol. needed (vessel + aerial)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
41	75	45	120	OSRL GDS	GDS - France	148	42	4,668	138
42	75	45	120	OSRL GDS	GDS - France	148	43	4,816	166
43	75	45	120	OSRL GDS	GDS – South Africa	120	44	4,936	166
44	75	45	120	OSRL GDS	GDS – South Africa	120	45	5,056	166
45	75	45	120	OSRL GDS	GDS - South Africa	120	46	5,176	166
46	75	45	120	OSRL GDS	GDS - South Africa	120	47	5,296	166
47	75	45	120	OSRL GDS	GDS - South Africa	120	48	5,416	166
48	75	45	120	OSRL GDS	GDS - South Africa	100	49	5,516	146
49	75	45	120	OSRL GDS	GDS - South Africa	1010	50	5,616	126
50	75	45	120	OSRL GDS	GDS - Brazil	100	51	5,716	106
51	75	45	120	OSRL GDS	GDS - Brazil	100	52	5,816	86
52	75	45	120	OSRL GDS	GDS - Brazil	100	53	5,916	66
53	75	45	120	OSRL GDS	GDS - Brazil	100	54	6,016	46
54	75	45	120	OSRL GDS	GDS - Brazil	100	55	6,116	26
55	75	45	120	OSRL GDS	GDS - Florida, USA	120	56	6,236	26
56	75	45	120	OSRL GDS	GDS - Florida, USA	120	57	6,356	26
57	75	45	120	OSRL GDS	GDS - Florida, USA	130	58	6,486	36
58	75	45	120	OSRL GDS	GDS - Florida, USA	130	59	6,616	46
59†	75	45	120	Manufactured	Manufactured	120	60	6,736	46
60	75	45	120	Manufactured	Manufactured	120	61	6,856	46
61	75	45	120	Manufactured	Manufactured	120	62	6,976	46
62	75	45	120	Manufactured	Manufactured	120	63	7,096	46
63	75	45	120	Manufactured	Manufactured	120	64	7,216	46

Day	Vol. needed for aerial application (Response Needs Calculator, OPEP Table 13-11)	Vol. needed for vessel application (Response Needs Calculator, OPEP Table 13-14)	Total Vol. needed (vessel + aerial)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
64	75	45	120	Manufactured	Manufactured	120	65	7,336	46
65	75	45	120	Manufactured	Manufactured	120	66	7,456	46
66	75	45	120	Manufactured	Manufactured	120	67	7,576	46
67	75	45	120	Manufactured	Manufactured	120	68	7,696	46
68	75	45	120	Manufactured	Manufactured	120	69	7,816	46
69	75	45	120	Manufactured	Manufactured	120	70	7,936	46
70	75	45	120	Manufactured	Manufactured	120	71	8,056	46
71	75	45	120	Manufactured	Manufactured	120	72	8,176	46
72	75	45	120	Manufactured	Manufactured	120	73	8,296	46
73	75	45	120	Manufactured	Manufactured	120	74	8,416	46
74	75	45	120	Manufactured	Manufactured	110	75	8,526	36
75	75	45	120	Manufactured	Manufactured	110	76	8,636	26
76	75	45	120	Manufactured	Manufactured	110	77	8,746	16
77	75	45	120	Manufactured	Manufactured	110	78	8,856	6
Totals:	**5,625**	**3,225**	**8,850**						

† - Manufactured dispersant required from Day 59

Table Q-2: SSDI dispersant supply and logistics plan summary

Day	Vol. needed for SSDI application (Response Needs Calculator, OPEP Table 13-15)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
11	0	AMOSC	Welshpool, WA (SFRT)	100	12	100	100
12	54	AMOSC	Welshpool, WA (SFRT)	100	13	200	146
13	54	AMOSC	Welshpool, WA (SFRT)	100	14	300	192
14	54	AMOSC	Welshpool, WA (SFRT)	100	15	400	238
15	54	AMOSC	Welshpool, WA (SFRT)	100	16	500	284
16	54	AMSA	Fremantle Port	100	17	600	330
17	54	AMOSC	Exmouth HEH Base	75	18	675	351
18	54	AMSA	Sydney	100	19	775	397
19	54	AMOSC	Altona North, VIC	137	20	912	480
20	54	OSRL SLA	Singapore	150	21	1,062	576
21	54	OSRL SLA	Singapore	150	22	1,212	672
22	54	OSRL SLA	Singapore / Southampton, UK	150	23	1,362	768
23	54	OSRL SLA	Southampton, UK	150	24	1,512	864
24	54	OSRL SLA	Southampton, UK	150	25	1,662	960
25	54	AMOSC	Welshpool, WA	35	26	1,697	941
26	54	AMSA	Karratha	20	27	1,717	907
27	54	OSRL GDS	GDS - Singapore	140	28	1,857	993
28	54	OSRL GDS	GDS - Singapore	140	29	1,997	1,079
29	54	OSRL GDS	GDS - Singapore	140	30	2,137	1,165
30	54	OSRL GDS	GDS - Singapore	140	31	2,277	1,251
31	54	OSRL GDS	GDS - Singapore	140	32	2,417	1,337
32	54	OSRL GDS	GDS - France	50	33	2,467	1,333
33	54	OSRL GDS	GDS - France	100	34	2,567	1,379
34	54	OSRL GDS	GDS - France	100	35	2,667	1,425

Day	Vol. needed for SSDI application (Response Needs Calculator, OPEP Table 13-15)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
35	54	OSRL GDS	GDS - France	100	36	2,767	1,471
36	54	OSRL GDS	GDS - France	100	37	2,867	1,517
37	54	OSRL GDS	GDS - France	100	38	2,967	1,563
38	54	OSRL GDS	GDS - France	100	39	3,067	1,609
39	54	OSRL GDS	GDS - France	100	40	3,167	1,655
40	54	OSRL GDS	GDS - France	100	41	3,267	1,701
41	54	OSRL GDS	GDS - France	100	42	3,367	1,747
42	54	OSRL GDS	GDS - France	50	43	3,417	1,743
43	54	OSRL GDS	GDS - France	50	44	3,467	1,739
44	54	OSRL GDS	GDS - France	50	45	3,517	1,735
45	54	OSRL GDS	GDS - France	50	46	3,567	1,731
46	54	-	-	0	47	3,567	1,677
47	54	-	-	0	48	3,567	1,623
48	54	-	-	0	49	3,567	1,569
49	54	-	-	0	50	3,567	1,515
50	54	-	-	0	51	3,567	1,461
51	54	-	-	0	52	3,567	1,407
52	54	-	-	0	53	3,567	1,353
53	54	-	-	0	54	3,567	1,299
54	54	-	-	0	55	3,567	1,245
55	54	-	-	0	56	3,567	1,191
56	54	-	-	0	57	3,567	1,137
57	54	-	-	0	58	3,567	1,083
58	54	-	-	0	59	3,567	1,029

Santos

Day	Vol. needed for SSDI application (Response Needs Calculator, OPEP Table 13-15)	Supplier	Place of Origin	Volume Available (m^3)	Required for use on Day	Accumulating Supply Required (m^3)	Supply on hand (m^3)
59	54	-	-	0	60	3,567	975
60	54	-	-	0	61	3,567	921
61	54	-	-	0	62	3,567	867
62	54	-	-	0	63	3,567	813
63	54	-	-	0	64	3,567	759
64	54	-	-	0	65	3,567	705
65	54	-	-	0	66	3,567	651
66	54	-	-	0	67	3,567	597
67	54	-	-	0	68	3,567	543
68	54	-	-	0	69	3,567	489
69	54	-	-	0	70	3,567	435
70	54	-	-	0	71	3,567	381
71	54	-	-	0	72	3,567	327
72	54	-	-	0	73	3,567	273
73	54	-	-	0	74	3,567	219
74	54	-	-	0	75	3,567	165
75	54	-	-	0	76	3,567	111
76	54	-	-	0	77	3,567	57
77	54	-	-	0	-	3,567	3

Appendix R Cumulative response capability assessment

Table R-1 shows the total cumulative worst-case field response needs for the Bedout Multi Well drilling activities. The table assesses the cumulative requirement for personnel based on the predicted requirements from the worst-case resourcing for each response strategy. Note: During a real event, resourcing may be different to that listed in the table, based on an operational NEBA. This information is presented for assessment purposes only, to ensure adequate resources are available for worst-case response strategy implementation. The information provided in Table R-1 is conservative as it assumes that all response strategies are deployed simultaneously.

The personnel numbers in Table R-1 represent the estimated worst-case operational requirements. Additionally, it is assumed the total number of personnel required would be ~50% greater to cover shift arrangements to manage responder fatigue. It is estimated that a total of 96 trained field response personnel will be required throughout the response, including allowing for shift changes. Additional personnel requirements where needed will be resourced through a combination of:

- ad-hoc training for specific response strategy needs on a just-in-time basis
- sourcing additional personnel from OSROs on a case-by-case/ best endeavours basis.

Table R-1: Cumulative response capability assessment – field personnel

Function	Response strategy	LOWC scenario response need requirement	Capability to meet Bedout Multi Well Drilling requirement[1]				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual aid, contractors and service providers
Source control[2]		39	39[3]	-	-	-	Additional personnel available from WWCI and Oceaneering[4]
Monitor and Evaluate	Vessel surveillance	2 vessel crew	-	-	-	-	2 vessel crew
	Aerial surveillance[5]	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 personnel numbers required.*					
	Satellite imagery	*Services provided with no specific personnel numbers required.*					
Containment and recovery (as per Table 12-6)		126 (14 C&R systems, each with 2 vessel masters, 2 supervisors, 4 deployment crew, 1 deckhand)	-	2 supervisors	19 C&R supervisors	7 C&R supervisors	Vessel contracted: Vessel masters (28), deployment crew (56) and deckhands (14)
Mechanical dispersion		*NA – personnel as per vessel availability*	-	-	-	-	As per in-field vessel availability
Chemical dispersant application	Vessel-based application as per Table 13-14	9 vessels	-	4 responders	14 responders	-	Vessel contracted: Vessel masters and deployment crew
	Surface application: Aircraft systems as per Table 13-12 and Table 13-13	27 personnel total	-	1 Air Attack Supervisor	-	1	FWAD Contract: 15 Air Attack aircraft pilot + 1st Officer (Santos-contracted): 2 OSRL Contract: 8 (C-130 flight crew)

Function	Response strategy	LOWC scenario response need requirement	Capability to meet Bedout Multi Well Drilling requirement[1]				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual aid, contractors and service providers
	Subsea injection	8 plus vessel crew	1 Santos representative				Oceaneering staff (via AMOSC SFRT contract): 3 WWCI SSDI staff via contract: 4 SFRT vessel through contracted vessel providers – vessel personnel as per contract.
Shoreline protection and deflection	Protection and deflection resources as per Section 14.3.	2 supervisors 18 Protection and deflection operatives 4 vessel crew (two vessels)	2 Protection and deflection supervisors	-	-	-	Labour hire Up to 2,000 team members available, working under direction of team leader (contracted workforce hire company). Vessel personnel - contracted.
Shoreline clean-up	Shoreline Clean-up Assessment (SCAT) resources as per Appendix M	2 teams (with 1 team leader and 1–2 team members)	2 SCAT team leaders	-	-	Available on request	Up to 2,000 team members available, who can complete shoreline assessment training, working under direction of team leader (contracted workforce hire company).
	Shoreline clean-up resources as per Table 15-5	6 teams: 6 shoreline clean-up supervisors 30 team members	4 shoreline clean-up supervisors	-	2 shoreline clean-up supervisors	-	Labour Hire: 30 team members, working under direction of Shoreline clean-up supervisors. Vessel personnel - contracted

Function	Response strategy	LOWC scenario response need requirement	Capability to meet Bedout Multi Well Drilling requirement[1]				
			Santos	AMOSC staff	Industry Core Group	OSRL	Mutual aid, contractors and service providers
OWR	Refer to Appendix P. Sourced as per the WAOMP arrangements (high predicted impact) (DBCA, 2022a)						
Waste management		*NA – personnel as per shoreline clean-up and OWR resourcing*	-	-	-	-	WSP to provide personnel under existing contract to collect and transport waste
OSM components (excluding SCAT)			Refer to North West Shelf OSM-BIP (7715-650-ERP-0002)				
Response need (excluding Source Control)			9	8	36	8	
Response need including +50% for shift change			14	12	54	12	
Total Available (excluding Source Control)			22[6]	12[7]	124[8]	18[9]	Additional personnel available from WWCI and Oceaneering
Total Required for Source Control			39	-	-	-	

1. The resourcing in this table is for illustrative purposes only. Roles may be resourced differently from the range of OSROs Santos has access to according to the circumstances and requirements of the incident, and may be swapped accordingly between IMT/field roles.

2.The cumulative capability for Source Control is assessed on its own, as the resources do not impact other strategy implementation. Up to 60 Santos source control personnel available.

3. It is estimated that 10 of these Source Control personnel would be required for IMT scale-up roles.

4. WWCI has confirmed availability of 34 source control personnel.

5. Based on 1 aircraft conducting 2 aerial surveillance sorties per day.

6. Santos field personnel made up of 16 AMOSC Core Group members based across Perth, NW Australia and South Australia, and 6 IMO1 trained personnel based in Darwin.

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

8. A total of 124 personnel in the Core Group as of November 2025 (AMOSC Member's website).

9. 18 trained oil spill responders guaranteed. A pool of 80 dedicated spill response specialists approved on a case-by-case basis.

Appendix S IMT Resourcing

Santos uses ICS as its Incident Management System for managing Level 2/3 incidents. This system ensures a structured and scalable approach to incident response with all roles and responsibilities as detailed in the Santos Incident Management Handbook.

To maintain the required level of IMT capability at all times, Santos has established a suite of supporting documents and tools. The two key resources are:

- Santos Incident Management Resourcing Guideline - WANATL (7700-670-GDE-0012)
- Santos IMT Resourcing Register

The Santos Incident Management Resourcing Guideline – WANATL (7700-670-GDE-0012) defines the IMT roles required for various time periods and outlines resourcing assumptions, while the IMT Resourcing Register tracks the availability of IMT personnel through internal and external arrangements.

The IMT resourcing assessment for Santos, as detailed in the Santos Incident Management Resourcing Guideline - WANATL (7700-670-GDE-0012), involves two steps:

1. Define the IMT roles required at defined time periods
2. Determine the number of personnel required for each of the IMT roles to manage the incident response during the defined time periods

The defined time periods, associated incident response phases, and corresponding IMT roles established for the purposes of resourcing assessment are as defined in Table S-1.

Table S-1: Indicative Time Periods and IMT Roles

Indicative Time Periods	Incident Response Phases	IMT Roles Required
~ 0 to 48 hrs	Initial Response Phase	Core Team
~ 48 hrs to 5 days	Escalation Phase	Support Team
~ 5 days and beyond	Long-Term Response Phase	Scale up Team

These phases are intended as guidelines and may be adapted according to the complexity of the incident and operational requirements.

IMT Core and Support Teams

Core Team roles are activated for all Level 2 and Level 3 incidents and are staffed by Santos's personnel to provide initial response support. IMT Support Team roles comprise additional roles beyond those of the Core Team, which are also filled by Santos personnel when supporting Level 2 or Level 3 incidents. The number of IMT personnel required for Core Team and Support Team roles is established based on the following assumptions:

- For a Level 2/3 incident, 2 x 12-hour operational periods per day may be required. Some IMT roles may be required for both the operational periods per day while others may be required only for 1 x 12-hour operational period per day (e.g., Day Shift). This is defined as "Shift Cover" for the purpose of IMT Resourcing Assessment.
- Based upon the nature and scale of the incident, roster rotation may be required and will be based on a 1 week on / 1 week off schedule. This is defined as "Rotational Roster Cover" for the purpose of IMT Resourcing Assessment.

Table S-2 and Table S-3 summarise the resourcing assessment for IMT Core Team and IMT Support Team, based on the above assumptions.

Table S-2: IMT Resourcing – Core Team

#	Type	IMT Role	Resourcing Needs Assessment				Number of Santos Personnel Available
			Shift Cover		Rotational Roster Cover	Number of Personnel Required	
			Day Shift	Night Shift			
1	Core	Incident Commander	1	1	4	4	5
2	Core	Safety Officer	1	0	2	2	3
3	Core	Legal Officer	1	0	2	2	3
4	Core	HR Officer	1	0	2	2	3
5	Core	Public Information Officer	1	0	2	2	3
6	Core	Operations Section Chief	1	1	4	4	5
7	Core	Planning Section Chief	1	1	4	4	5
8	Core	Environment Unit Leader	1	1	4	4	5
9	Core	Situation Unit Leader	1	1	4	4	5
10	Core	Documentation Unit Leader	1	0	2	2	3
11	Core	Logistics Section Chief	1	1	4	4	5
12	Core	Finance Section Chief	1	0	2	2	3
Total number of personnel required for a single Operational Period (12 hrs)						12	
Total number of personnel required including Shift Cover and Rotational Roster Cover						**36**	
Total number of Santos personnel available						**48**	

Table S-3: IMT Resourcing – Support Team

#	Type	IMT Role	Resourcing Needs Assessment				Number of Santos Personnel Available
			Shift Cover		Rotational Roster Cover	Number of Personnel Required	
			Day Shift	Night Shift			
1	Support	Deputy Incident Commander	1	0	2	2	3
2	Support	Liaison Officer	1	0	2	2	3
3	Support	Deputy Operations Section Chief	1	0	2	2	3
4	Support	Recovery & Protection Branch Director	1	0	2	2	3
5	Support	Air Operations Branch Director	1	0	2	2	3
6	Support	Wildlife Branch Director	1	0	2	2	3
7	Support	Staging Area Manager	1	0	2	2	3
8	Support	Deputy Planning Section Chief	1	0	2	2	3
9	Support	Resource Unit Leader	1	0	2	2	3
10	Support	Deputy Logistics Section Chief	1	0	2	2	3
11	Support	Service Branch Director	1	0	2	2	3
12	Support	Support Branch Director	1	0	2	2	3
13	Support	Deputy Finance Section Chief	1	0	2	2	3
Total number of personnel required for a Single Operational Period (12 hrs)						13	
Total number of personnel required including Shift Cover and Rotational Roster Cover						**26**	
Total number of Santos personnel available						**39**	

Santos maintains 48 personnel within its IMT Core Team and 39 personnel for the IMT Support Team. This staffing level is determined by the roles required across both teams, ensuring adequate coverage for Shift Cover and

Rotational Roster Cover. Additionally, an extra individual per role is maintained as reserve capacity for both the IMT Core and Support Teams. The IMT Resourcing Register reflects the available Santos personnel who can support both the Core and Support Teams.

IMT Scale-up

In the event of a Level 3 oil spill incident, the IMT may need to expand beyond the Core and Support roles to include additional lead roles based on the operational and technical needs of the incident. These are referred to as Scale-up Team roles. Based on the response strategies identified in this OPEP, the Scale-up Team roles as listed in Table S-4 are reasonably anticipated to be required.

Table S-4: IMT Resourcing – Scale-up Team

#	Type	IMT Role	Number of Personnel Required	Minimum Number of Personnel Available through Santos's Arrangements
1	Scale up - DTMI Support	CMT Liaison Officer	1	1
2	Scale up - DTMI Support	Deputy Incident Controller	1	1
3	Scale up - DTMI Support	Deputy Intelligence Officer	1	1
4	Scale up - DTMI Support	Deputy Planning Officer	1	1
5	Scale up - DTMI Support	Environment Support Officer	1	1
6	Scale up - DTMI Support	Deputy Public Information Officer	1	1
7	Scale up - DTMI Support	Deputy Logistics Officer	1	1
8	Scale up - DTMI Support	Deputy Finance Officer	1	1
9	Scale up - DTMI Support	Deputy Operations Officer	1	1
10	Scale up - DTMI Support	Deputy Waste Management Coordinator	1	1
11	Scale up - DTMI Support	Deputy Division Commander (FOB)	1	1
12	Scale up - Operations	On-Water Containment & Recovery Group Supervisor	1	1
13	Scale up - Operations	Protection & Deflection Group Supervisor	1	1
14	Scale up - Operations	Dispersant Operations Group Supervisor	1	1
15	Scale up - Operations	Shoreline Response Group Supervisor	1	1
16	Scale up - Operations	Disposal Group Supervisor	1	1
17	Scale up – Source Control	Source Control Branch Director	1	1
18	Scale up – Source Control	Relief Well Operations Lead	1	1
19	Scale up – Source Control	Relief Well Engineering Lead	1	1
20	Scale up – Source Control	SIMOPS Lead	1	1
21	Scale up – Source Control	Subsea Well Capping Lead	1	1
22	Scale up – Source Control	Engineering Services Lead	1	1
23	Scale up – Source Control	Source Control Logistics Specialist	1	1
24	Scale up – Source Control	Source Control Planning Specialist	1	1
25	Scale up – Source Control	Source Control Finance & Admin Specialist	1	1
26	Scale up – Source Control	Source Control HSE Specialist	1	1
27	Scale up – OSM	Monitoring Branch Director	1	1
28	Scale up – OSM	OSM Implementation Lead	1	1

#	Type	IMT Role	Number of Personnel Required	Minimum Number of Personnel Available through Santos's Arrangements
29	Scale up – OSM	Operational Monitoring Coordinator	1	1
30	Scale up – OSM	Scientific Monitoring Coordinator	1	1
31	Scale up – Planning	SCAT Specialist/Coordinator	1	1
32	Scale up – Planning	Technical Specialists	1	1
33	Scale up - Logistics	Supply Unit Leader	1	1
34	Scale up - Logistics	Facilities Unit Leader	1	1
35	Scale up - Logistics	Ground Support Unit Leader	1	1
36	Scale up - Logistics	Vessel Support Unit Leader	1	1
37	Scale up - Logistics	Communications Unit Leader	1	1
38	Scale up - Logistics	Food Unit Leader	1	1
39	Scale up - Logistics	Medical Unit Leader	1	1
40	Scale up - Finance	Cost Unit Leader	1	1
41	Scale up - Finance	Time Unit Leader	1	1
42	Scale up - Finance	Procurement Unit Leader	1	1
43	Scale up - Finance	Compensation/Claims Unit Leader	1	1
44	Scale up - Finance	Administrative Unit Leader	1	1
Total number of personnel required			**44**	

Santos has established various external arrangements to fulfill the capability requirements for these Scale up team leader roles and their team members, as outlined below:

- AMOSC Participant Member Agreement;
- Industry Mutual Aid / Core Group Personnel;
- OSRL Associate Member Agreement;
- TRG Contract;
- Specialist Service providers including;
  - WWCI: for Source Control support;
  - RPS: For oil spill modelling/visualization support;
  - Monitoring Services through OSRL's OSM Supplementary Service Agreement;
  - NWA: Waste Management Contractor – North West Shelf;
  - Veolia: Waste Management Contractor – Northern Australia;
  - TOLL: Logistics Services Contractor;
  - Aspen: Medical Services Provider;
  - Recruitment Services provider / Labour Hire Companies.

Santos is a Participating Member of AMOSC. This arrangement provides Santos with access to 16 AMOSC staff and at least 84 AMOSC Core Group personnel[46] under the AMOSPlan for support in the event of an oil spill incident.

Santos is also an Associate member of OSRL. Under the membership Service Level Agreement, Santos has guaranteed access to oil spill response support including 18 OSRL personnel to support IMT and/or field response

[46] *Target to maintain at least 100 members [minimum 84, maximum 140] as per AMOSC Core Group program and policies V2.0. A total of 124 personnel in the Core Group as of November 2025 (AMOSC Member's website).*

roles. OSRL maintains a global pool of 80 dedicated responders and access to these additional resources may be available on a case-by-case basis.

Santos also maintains a contract with TRG, a specialist incident management services provider for IMT support for long duration, complex and sustained IMT operations. In the event of a Level 2/3 oil spill incident, TRG will be mobilised to provide Incident Action Planning (IAP) support and to operate and manage the IAP software for Santos. Through the contract with TRG, Santos has access to 60 TRG personnel who can be called upon for support in the event of an oil spill incident.

In addition to the above, recognizing that certain incidents may require the use of technical specialists who have specialized knowledge or expertise, Santos also maintains various arrangements to gain access to specialist services providers as listed above. Overall, Santos can draw upon a pool of personnel through external arrangements to fulfill the Scale-up requirements. The IMT Resourcing Register monitors Scale-up role requirements and available personnel through external arrangements, ensuring that all IMT staffing needs are effectively fulfilled.

The personnel requirements through Santos arrangements have been checked against the Cumulative Response Capability Assessment in Appendix R to ensure that both the field requirements and IMT requirements can be met.

Appendix T Testing Arrangements Plan

Appendix A Testing arrangements program

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
1.	Source Control				
	Source Control a) Relief Well Drilling - Access to MODU	Review - MODU Register	Once per month for the duration of drilling campaign	Identify suitable MODU that can be utilized in the event of a Source control incident requiring a relief well	Document the identified suitable MODU by: • Name • MODU Type • Location • Contract Status
	Source Control b) Access to Capping Stack	Review – Contract / Agreement	Annually (when drilling activity is occurring)	To confirm access to capping stack for well capping	Review to confirm access to Capping Stack through maintenance of service provision contract including the APPEA's MoU: Mutual Aid agreement
	Source Control c) Access to SFRT Equipment	Review – Contract / Agreement	Annually (when drilling activity is occurring)	To confirm access to SFRT equipment for source control operations	Review to confirm access to SFRT equipment through • AMOSC SFRT participant contract • Oceaneering contract
	Source Control d) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for source control operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for source control (capping stack and SFRT) operations
	Source Control e) Access to Source Control Emergency Response Personnel	Desktop Exercise	Annually (when drilling activity is occurring)	To check arrangements for access to Well Control Specialists as per Source Control Planning and Response Guideline DR-00-OZ-20001	Confirmation (email) from WWC that listed Well Control specialists can be made available and will be mobilized within 72 hours of a notification
	Source Control f) 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
	Source Control	Review - SOPEP	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

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	g) Vessel Fuel Tank Rupture - SOPEP				
2.	**Monitor and Evaluate**				
	Monitor and Evaluate - Vessel Surveillance a) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for surveillance	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
	Monitor and Evaluate - Aerial Surveillance a) Access to aircrafts	Review – Contract / Agreement	Annually	To confirm access to aircrafts for surveillance	Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance
	Monitor and Evaluate - Aerial Surveillance b) Access to trained aerial observers	Review – Contract / Agreement	Annually	To confirm access to trained aerial observers	Review to confirm access to trained aerial observers through; • Trained Santos personnel or • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Unmanned Aerial Vehicles (UAV) a) Access to UAV providers	Review – Contract / Agreement	Annually	To confirm access to UAV providers	Review to confirm access to UAV providers through; • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate - Fauna observations a) Maintain a list of air charter companies that could provide fauna observation services	Review – List of air charter companies for fauna observations	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
	Monitor and Evaluate – Tracking Buoys a) Access to Tracking Buoys	Review – Contract / Agreement	Prior to activity commencement	To confirm access to tracking buoys	Review to confirm access to Santos owned Tracking Buoys
	Monitor and Evaluate - 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
	Monitor and Evaluate - Oil Spill Modelling	Review – Contract / Agreement	Annually	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 and critical components	Type of test	Schedule	Objectives	KPIs
	a) Access to oil spill modelling service provider				
	Monitor and Evaluate - Satellite Imagery a) Access to Satellite Imagery service provider	Review – Contract / Agreement	Annually	To confirm access to satellite imagery services	Review to confirm access to satellite imagery services through; • AMOSC Participant Member Contract or • OSRL Associate Member Contract
	Monitor and Evaluate	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
3.	**Containment and Recovery**				
	Containment & Recovery a) Access to offshore containment Booms	Review – Contract / Agreement	Annually	To confirm access to offshore containment booms	Review to confirm access to offshore containment booms through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract
	Containment & Recovery b) Access to offshore recovery devices	Review – Contract / Agreement	Annually	To confirm access to offshore recovery devices	Review to confirm access to offshore recovery devices through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract
	Containment & Recovery c) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for containment and recovery operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for containment and recovery operations

Santos

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	Containment & Recovery d) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Containment & Recovery	Desktop Exercise	Annually	To test activation procedure to access containment and recovery equipment and trained responders from external arrangements and service providers To confirm access to containment recovery equipment and trained responders from external arrangements and service providers	Emails confirming access to containment and recovery equipment and trained responders through external arrangements and service providers and activation procedures.
	Santos' Vessel Containment and Recovery system - response readiness	Deployment Exercise	Annually	To confirm response readiness for Santos vessel-based Containment and Recovery system	Vessel Containment and Recovery successfully deployed as per Operational Instructions.
4.	**Mechanical Dispersion**				
	Mechanical Dispersion a) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for mechanical dispersion	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels
5.	**Dispersant Application**				
	Dispersant Application a) Access to Dispersants	Review – Contract / Agreement	Annually	To confirm access to dispersants	Review to confirm access to dispersants through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • OSRL Global Dispersant Stockpile (GDS) Supplementary Agreement • Access to National Plan resources through AMSA
	Dispersant Application b) Access to Dispersant Vessel Spray System	Review – Contract / Agreement	Annually	To confirm access to Dispersant vessel spray systems	Review to confirm access to vessel spray systems through; Santos' equipment • AMOSC Participant Member Contract

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
					• OSRL Associate Member Contract
	Dispersant Application c) Access to Aerial Dispersant Application System	Review – Contract / Agreement	Annually	To confirm access to Aerial Dispersant Application System	Review to confirm access to Aerial Dispersant Application systems through; • AMOSC FWAD Contract • OSRL Associate Member Contract
	Dispersant Application d) Access to subsea dispersant injection equipment	Review – Contract / Agreement	Annually	To confirm access to Subsea Dispersant Injection equipment	Review to confirm access to subsea Dispersant Injection equipment through AMOSC SFRT participant contract
	Dispersant Application e) Access to vessels	Review – Contract / Agreement	Annually	To confirm access to vessels for dispersant operations	Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels for dispersant operations
	Dispersant Application f) Santos' Vessel Dispersant Spray System – Response Readiness	Deployment Exercise	Annually	To confirm response readiness for vessel dispersant spray system	Vessel Dispersant Spray system successfully deployed as per operational instructions
	Dispersant Application g) Logistics arrangement for GDS dispersant stockpile mobilization for a Level 3 oil spill incident	Desktop Exercise	Annually	To confirm GDS dispersant stockpiles can be mobilized in the event of a Level 3 incident	Confirm mobilization time frames as per Dispersant Logistics Plan
	Dispersant Application	Desktop Exercise	Annually	To test activation procedure to access dispersants and application systems from external arrangements and service providers To confirm access to dispersants and application systems from external arrangements and service providers	Emails confirming access to dispersants and application systems from service providers/external arrangements

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
6.	**Shoreline Protection and Deflection**				
	Shoreline Deflection & Protection a) Access to shoreline deflection & protection equipment	Review – Contract / Agreement	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 Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Deflection & Protection b) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Deflection & Protection c) Access to shallow draft vessels	Review – 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
	Shoreline Deflection & Protection 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 • Shoreline Equipment Maintenance schedules recorded in SAP
	Shoreline Deflection & Protection	Desktop Exercise	Annually	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 external arrangements and service providers	• Emails confirming access to shoreline deflection and protection equipment and trained responders through external arrangements and service providers

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
7.	**Shoreline Clean-up**				
	Shoreline Clean up a) Access to shoreline clean up equipment	Review – Contract / Agreement	Annually	To confirm access to shoreline clean-up equipment	Review to confirm access to shoreline clean-up equipment through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Clean up b) Access to trained responders	Review – Contract / Agreement	Annually	To confirm access to trained responders	Review to confirm access to trained responders through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Shoreline Clean up c) Access to labour hire	Review – Contract / Agreement	Annually	To confirm access to labour hire	Review to confirm access to labour hire through maintenance of contract with labour hire provider
	Shoreline Clean up	Desktop Exercise	Annually	To test activation procedure to access shoreline clean-up equipment and personnel from external arrangements and service providers To confirm access to shoreline clean-up equipment and personnel from external arrangements and service providers To confirm coordination with DoT to implement shoreline clean-up plans	• Emails confirming access to shoreline clean-up equipment and personnel confirmed through internal and external arrangements/service providers to meet these requirements
	Shoreline Clean up	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	To test coordination with DoT to implement shoreline clean-up plan To test collective response arrangements between Santos and DoT for a Level 2/3 oil spill incident impacting State waters	• IMT interface established 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

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
			exercise with DoT		
8.	**Oiled Wildlife Response**				
	Oiled Wildlife Response a) Access to OWR equipment	Review – Contract / Agreement	Annually	To confirm access to OWR equipment	Contract review to confirm access to OWR equipment through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA
	Oiled Wildlife Response b) Access to OWR personnel	Review – Contract / Agreement	Annually	To confirm access to OWR personnel	Contract review to confirm access to OWR personnel through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Santos personnel
	Oiled Wildlife Response c) Reconnaissance and sample collection	Deployment Exercise	Annually	To confirm readiness for oiled wildlife reconnaissance and sample collection	Oiled wildlife reconnaissance and sample collection successfully conducted as per operational instructions (Santos oiled wildlife sample collection protocol)
	Oiled Wildlife Response	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**				
	Waste Management a) Access to personnel, equipment, and vehicles through Waste Service Provider	Review – Contract / Agreement	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

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	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.	**Operational and Scientific Monitoring**				
	OSM a) Access to specialist monitoring equipment	Review – Contract / Agreement	Annually	To confirm access to specialist monitoring equipment	OSM Services Provider contract review to confirm access to specialist monitoring equipment
	OSM b) Access to specialist monitoring personnel	Review – Contract / Agreement	Annually	To confirm access to specialist monitoring personnel	OSM Services Provider contract review to confirm access to specialist monitoring personnel
	OSM -Shoreline Clean-up Assessment a) Access to trained Shoreline Cleanup and Assessment Technique (SCAT) personnel	Review – Contract / Agreement	Annually	To confirm access to trained SCAT personnel	Review to confirm access to trained SCAT personnel through; • AMOSC Participant Member Contract • OSRL Associate Member Contract / OSRL OSM Contract • TRG Arrangements
	OSM – Oil Sampling a) Access to Oil Sampling Kit	Equipment Check	Annually	To confirm access to Oil Sampling Kit	Review to confirm access to Oil Sampling Kit. Kits to be fully stocked, maintained in good condition and the contents reviewed for adequacy.
	OSM – Oil Sampling b) Access to Rapid Assessment Team (RAT) kit(s)	Equipment Check	Annually	To confirm access to RAT kits	Review to confirm access to RAT kits (pursuant to site-specific first strike response plan). Kits to be fully stocked, maintained in good condition and the contents reviewed for adequacy.
	OSM – Dispersant Efficacy Testing a) 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
	OSM - Water Quality Assessment a) Santos Rapid Assessment Team (RAT) – Response Readiness	Deployment Exercise	Annually	To confirm response readiness for Rapid Assessment Teams	Rapid Assessment Team successfully deployed as per operational instructions (pursuant to site-specific first strike response plan)
	OSM – Monthly Capability Reports	Review	Once per month	To confirm receival of the MSP's monthly capability report	Review monthly capability report each month and record when approved

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
				To confirm monthly capability report is in accordance with OSM services contract	
	OSM	Desktop Exercise	Annually	To confirm activation procedure for OSM services To confirm access to personnel and equipment	Confirmation email from OSM service provider on the notification and activation procedures Confirmation email from OSM services provider on OSM personnel and equipment available
11.	**IMT**				
	Incident Management Team a) Access to trained IMT personnel	Review – Contract / Agreement	Annually	To confirm access to trained IMT personnel	Review to confirm access to IMT personnel through the following; • AMOSC Participant Member Contract • OSRL Associate Member Contract • Access to National Plan resources through AMSA • TRG Arrangements
	Incident Management Team	Desktop Exercise - Availability Test for IMT	Annually	To confirm appropriate Santos's personnel to fill the IMT roles outlined in the OPEP	Each role listed can be filled by appropriately qualified staff and reporting hierarchy understood
	Incident Management Team	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**				
	Others - Communications Testing a) Communications channels in place and functioning	Desktop Exercise	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)

#	Response arrangements and critical components	Type of test	Schedule	Objectives	KPIs
	Others - AMOSC	Audit	Every 2 years	To confirm SLA including equipment readiness and personnel competency	• Audit confirms the OSRO’s ability to meet the SLA/contract commitments • Records indicate appropriate maintenance program confirming equipment readiness • Personnel competency is assessed to be up to date
	Others - OSRL	Audit	Every 2 years	To confirm SLA including equipment readiness and personnel competency	• Audit confirms the OSRO’s ability to meet the SLA/contract commitments • Records indicate appropriate maintenance program confirming equipment readiness • Personnel competency is assessed to be up to date
	Others - Santos Oil Spill Response Equipment Inventory Register	Equipment Check	Minimum every 6 months, or when change is communicated from equipment custodians.	To confirm the status of available oil spill response equipment	Review to confirm access to oil spill response equipment on the register