Santos

Ningaloo Vision Operations Oil Pollution Emergency Plan (Van Gogh and Coniston-Novara fields)

PROJECT / FACILITY	Ningaloo Vision
REVIEW INTERVAL	60 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s Managerial/Technical/Site	Approver
	Senior Adviser – Oil Spill Response	**Team Lead – Security & ER**	**General Manager – HSE**
5	L. Macfall		

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REV No	DATE	REVISION
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0	05/08/13	Submitted to DSEWPC
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4	27/3/20	5-year regulatory revision – submission to NOPSEMA
5	25/08/20	Updated for resubmission to NOPSEMA following NOPSEMA and DoT comments Update to industry oiled wildlife resources Include information on DISER Update to align with revised DoT Industry Guidance Note

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Distribution	OPEP	
	Electronic	Hardcopy
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General Manager – Oil Assets	link only	
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Team Leader – Security & Emergency Response	link only	
Library		●
IMT Room – Perth office		● x 4
CMT Room – Perth office		●
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DoT	●	
AMSA	●	
OSRL	●	
Internet – Public Notices	●	
Intranet – Emergency Preparedness	●	

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Parameter	Description			Further Information
	FPSO collision with third-party vessel (surface spill)	Van Gogh[1] crude	8,630	
	Surface diesel release (surface spill)	Marine Diesel Oil	1,787	
Hydrocarbon Properties	Van Gogh[1,2] crude Density kg/m^3 at 15°C = 952.3 Dynamic viscosity (cSt) = 31.21 @ 70° C API Gravity = 17.0 Marine Diesel Oil (MDO) Density kg/m^3 at 25°C = 829 Dynamic viscosity (cP) = 4 @ 25° C API Gravity = 37.6			**Appendix A**
Weathering Potential	**Van Gogh[1] crude** is a heavy crude oil with a relatively high degree of persistence in the marine environment. Under moderate winds (5m/s), 80% of the initial surface slick is expected to remain after 5 days. **MDO** is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Up to 60% will generally evaporate over the first two days. Approximately 5% is considered "persistent hydrocarbons", which are unlikely to evaporate and will decay over time.			**Appendix A**
Protection Priorities	Ningaloo Coast north, Muiron Islands, Ningaloo Coast south, Montebello Islands, Barrow Island and Outer Shark Bay Coast			**Section 6.7**

[1] Van Gogh crude refers to crude oil from either Van Gogh, Coniston or Novara wells which is applicable for the well leak scenario or a blend of up to all three of these oils for the flowline and cargo tank release scenarios.

[2] Properties taken from Intertek (2019) assay of Van Gogh crude oil which represents a blend of crude from Van Gogh, Coniston or Novara wells. These properties are representative of a blend of up to all three oils or each oil separately.

2 First Strike Response Actions

The initial response actions to major incidents at the Ningaloo Vision FPSO are outlined within the Ningaloo Vision Incident Response Plan (NV IRP) (TV-22-IF-00005) and are under the direction of the designated On-scene Commander. The NV IRP includes site- and role-specific information relevant to the initial stages of an incident response including raising the alarm, mustering of personnel, ESD of facility infrastructure and medical evacuation. The NV IRP nominates the On-scene Commander as the Ningaloo Vision Offshore Installation Manager (OIM) when the FPSO is connected to the DTM. When the FPSO is disconnected from the DTM and operating as a ship at sea, the Marine and Safety Supervisor (MSS) is the Vessel Master and On-scene Commander.

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

Response information contained within this OPEP is concerned primarily with a large scale (Level 2/3) hydrocarbon spill where the Perth-based IMT and CSTs are engaged for support. Level 1 spills do not typically require the stand-up of the IMT/CST for support, however on-site response actions to monitor the spill and regulatory requirements for reporting these spills still apply. Therefore, the immediate response actions listed in **Table 2-1** are relevant for any spill. Once sufficient information is known about the spill, the Incident Commander will classify the level of the spill. If the spill is classified as a Level 1 spill, then the actions related to Level 2/3 spills do not apply, unless specified by the Incident Commander.

Table 2-1: First strike activations

When (indicative)	Activations		Who
	Objective	Action	
All spills			
Immediate	Manage the safety of personnel	Implement site incident response procedures (NV Incident Response Plan or vessel-specific procedures, as applicable)	On-scene Commander/ Vessel Master
Immediate	Control the source using site resources, where possible	Implement site source control procedures (NV Incident Response Plan or Vessel SOPEP, as applicable)	On-scene Commander/ Vessel Master
30 minutes of incident being identified	Notify Santos Offshore Duty Manager	Verbal communication to Offshore Duty Manager's 's duty phone	On-scene Commander
As soon as practicable	Obtain as much information about the spill as possible	Provide as much information to the IMT (Incident Commander or delegate) as soon as possible	On-Scene Commander
60 minutes	Gain situational awareness and begin onsite spill surveillance	Level 1 spills may only require use of onsite resources to conduct monitor and evaluate activities (e.g. vessel surveillance and tracking buoys). Refer Activate the Monitor and Evaluate Plan (**Section 10**).	On-scene Commander Incident Commander
Refer timeframes Go to **Section 7**	Make regulatory notifications within regulatory timeframes	Activate the External Notifications and Reporting Procedures Go to **Section 7**	Initial notifications by Environment/ Safety Team Leads
Level 2/3 spills (in addition to actions above)			

When (indicative)	Activations		Who
	Objective	Action	
Immediately once notified of spill (to Incident Commander)	Activate IMT, if required	Notify IMT	Duty Manager Incident Commander
IMT Actions (0-48 hours)			
Within 90 minutes from IMT callout	Set-up IMT room	Refer to IMT tools and checklists for room and incident log set-up	Incident Commander IMT Data Manager
	Gain situational awareness and set incident objectives, strategies and tasks	Begin reactive Incident Action Planning process Go to **Section 8** Review First Strike Activations (this table)	Incident Commander Planning Team Leader
Refer timeframes **Section 7**	Make regulatory notifications as required Notify and mobilise/put on standby external Oil Spill Response Organisations (OSROs) and Support Organisations, as required	Go to **Section 7**	Initial notifications by Environment/ Safety Team Leads OSRO (AMOSC and OSRL) activation by designated call-out authorities (Incident Commanders/ Duty Managers)
Refer timeframes **Section 10**	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making	Vessel surveillance (**Section 10.1**) Aerial Surveillance (**Section 10.2**) Tracking Buoys (**Section 10.3**) Oil spill Trajectory Modelling (**Section 10.4**) Initial Oil Characterisation (**Section 10.5**) Operational Water Quality Monitoring **(Section 10.7)**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders IMT Environment Team Leaders

When (indicative)	Activations		Who
	Objective	Action	
		Shoreline and Coastal Habitat Assessment (**Section 10.8**)	
Activate on Day 1 for applicable scenarios	Source control support to stop the release of hydrocarbons into the marine environment. **Degree of IMT support will be scenario dependent**	Go to **Section 9**	IMT Operations Team Leader (Drilling Team Leader as appropriate to scenario) IMT Logistics/ Supply Team Leaders
Activate on Day 1 for applicable scenarios Refer **Section 12** and/or **13**	Reduce exposure of shorelines and wildlife to floating oil through mechanical/ chemical dispersion	For crude spills: Activate the Mechanical and/or Chemical Dispersion Plan. Go to **Section 12** and/or **13**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
Activate on Day 1 for applicable scenarios Refer **Section 11**	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons to reduce contact with protection priorities	Activate the Containment and Recovery Plan. Go to **Section 11**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
Day 1	Identify environmental sensitivities at risk and conduct NEBA	Review situational awareness and spill trajectory modelling Review strategic NEBA and begin operational NEBA (**Section 6.7**)	IMT Environmental Team Leader
Day 1	Develop forward operational base/s to support forward operations	Begin planning for forward operations base as per Forward Operations Plan. **Appendix Q**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
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	IMT Safety Team Leader

When (indicative)	Activations		Who
	Objective	Action	
		Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	
If/when initiated Refer **Section 14**	Protect identified shoreline protection priorities	Activate Shoreline Protection and Deflection Plan. Go to **Section 14**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders IMT Environment Team Leader
If/when initiated Refer **Section 16**	Prevent or reduce impacts to wildlife	Activate the Oiled Wildlife Response Plan. Go to **Section 16**	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
If/when initiated Refer **Section 18**	Assess and monitor impacts from spill and response	Activate the Scientific Monitoring Plan – Go to **Section 18**	IMT Environment Team Leader IMT Logistics/ Supply Team Leaders IMT Operations Team Leader
If/when initiated	Clean-up oiled shorelines	Activate Shoreline Clean Up resources. Go to **Section 15**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
If/when initiated	Safely transfer, transport and dispose of waste collected from response activities.	Activate the Waste Management Plan. Go to **Section 17**	IMT Operations Team Leader IMT Logistics/ Supply Team Leaders
IMT Actions (48+ hours)			
Ongoing	• For ongoing incident management – indicatively 48 + hours – a formal incident action planning process is to be adopted to continue with spill response strategies identified above. An Incident Action Plan (IAP) is to be developed for each successive operational period. • Santos WA will maintain control for those activities for which it is the designated Control Agency/ Lead IMT. • Depending on the specifics of the spill AMSA and/or DoT may be relevant Control Agencies (refer **Section 4.2**).		Control Agency IMT Santos WA to provide the following roles to DoT MEECC/IMT for State waters response: CMT Liaison Officer IMT Liaison Officer Intelligence Support Officer

When (indicative)	Activations		Who
	Objective	Action	
	• Where another Control Agency has taken control of aspects of the response, Santos WA will provide support to that Control Agency. Santos WA's support to DoT for a State waters response is detailed in **Section 5.2.3**.		Deputy Planning Officer Environmental Support Officer Public Information Support & Media Liaison Officer Deputy Logistics Officer Facilities Support Officer Deputy Finance Officer Deputy On Scene Commander (FOB)

3 Introduction

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the *Ningaloo Vision Operations Environment Plan (EP) WA-35-L* (*TV-00-RI-00003*) required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations).

3.1 Description of Activity

Santos WA recovers oil from the Van Gogh, Coniston and Novara oil fields in production licence area WA-35-L using the Ningaloo Vision floating production, storage and offloading (FPSO) facility.

Oil is recovered through production wells and subsea equipment that directs production liquids to the FPSO for processing and storage. As part of the operational activities, produced water and gas (besides gas required for fuel and gas lift) are reinjected and a tanker offloads the recovered oil on a regular basis. Support vessels provide logistical support for loading of supplies, offloading of wastes, oil spill response and carrying out of maintenance and inspection activities.

Refer to Section 2 of the *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003)* for detail on the activity.

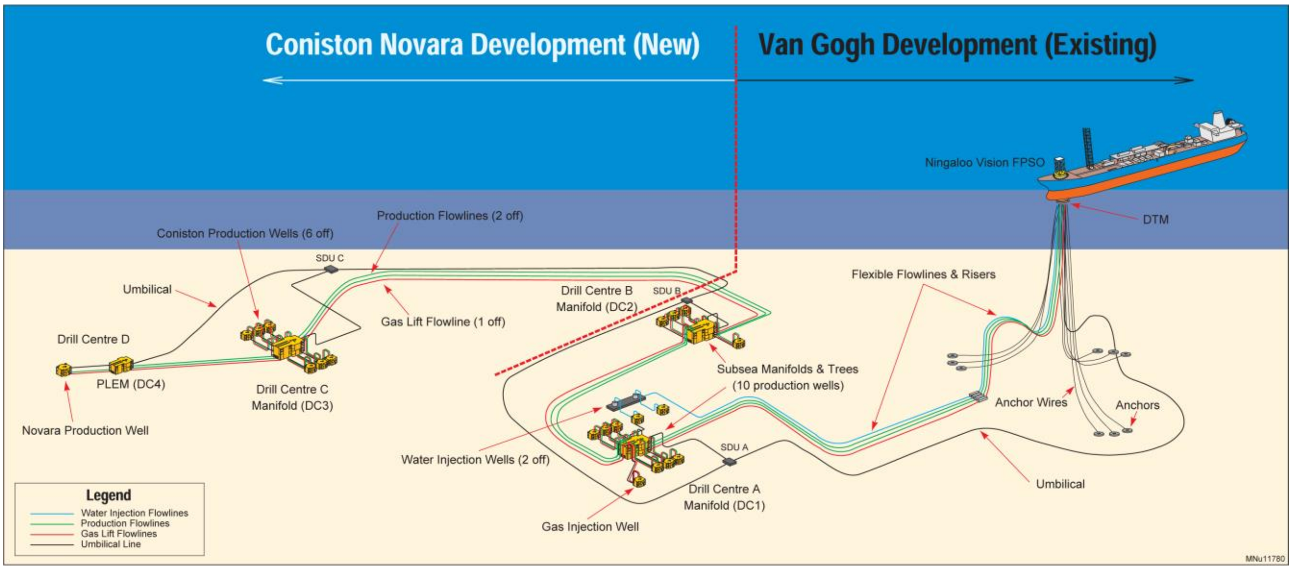

Figure 3-1: Schematic of the Ningaloo Vision FPSO and subsea infrastructure

3.2 Purpose

The purpose of this Oil Pollution Emergency Plan (OPEP) is to describe Santos WA's response to a hydrocarbon spill during operation of the Ningaloo Vision FPSO and associated subsea infrastructure.

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

This OPEP is to be read in conjunction with the *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003)* when considering the existing environment, environmental impacts, risk management, performance standards and the reporting compliance requirements.

This OPEP will apply from acceptance of the Santos WA *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003)* and will remain valid for the duration of life of the EP. Operations include the commissioning of new wells associated with the Van Gogh and Coniston Novara reservoirs. If improved preparedness measures are identified within this time frame the OPEP will be revised accordingly.

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

3.3 Objectives

The aim of this OPEP is to provide detailed guidance to Santos WA's Incident Management Team (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 WA will:

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

3.4 Area of Operation

The Van Gogh, Coniston and Novara fields are located within Production Licence WA-35-L in Commonwealth waters, 45 km north-northwest off the Cape Range Peninsula in Western Australia. It is located 53 km north-northwest of the Exmouth township and 29 km from the northern boundary of Ningaloo Marine Park (see **Figure 3-2**). The development is positioned in water depths ranging from 340 m in the east of the production licence to 400 m depth in the west, with the FPSO moored in a water depth of 341 m AHD and the two manifolds in respectively 367.5 m (DC1) and 362 m (DC2) AHD.

Section 3 of the *Ningaloo Vision Operations Environment Plan (EP) (TV-00-RI-00003)* includes a comprehensive description of the existing environment. A summary of nearest regional features and distances from the Van Gogh field and Coniston / Novara fields are provided in **Table 3-1**.

Table 3-1: Distances from Van Gogh/ Coniston Novara fields to key regional features

Regional Feature	Distance from Coniston / Novara fields	Distance from Van Gogh Field (and direction)
Ningaloo Marine Park (boundary) – State waters	36 km S	30 km S
Ningaloo Reef proper	48 km SSE	43 km SSE
State/Commonwealth waters boundary	41 km SE	35 km SE
Muiron Islands Marine Management Area	38 km SE	35 km SE
Muiron Island South	45 km SE	41 km SE
Barrow Island	146 km NE	141 km NE
North West Cape (mainland WA)	50 km SSE	44 km SSE
Exmouth (Mainland WA)	65 km S	59 km S

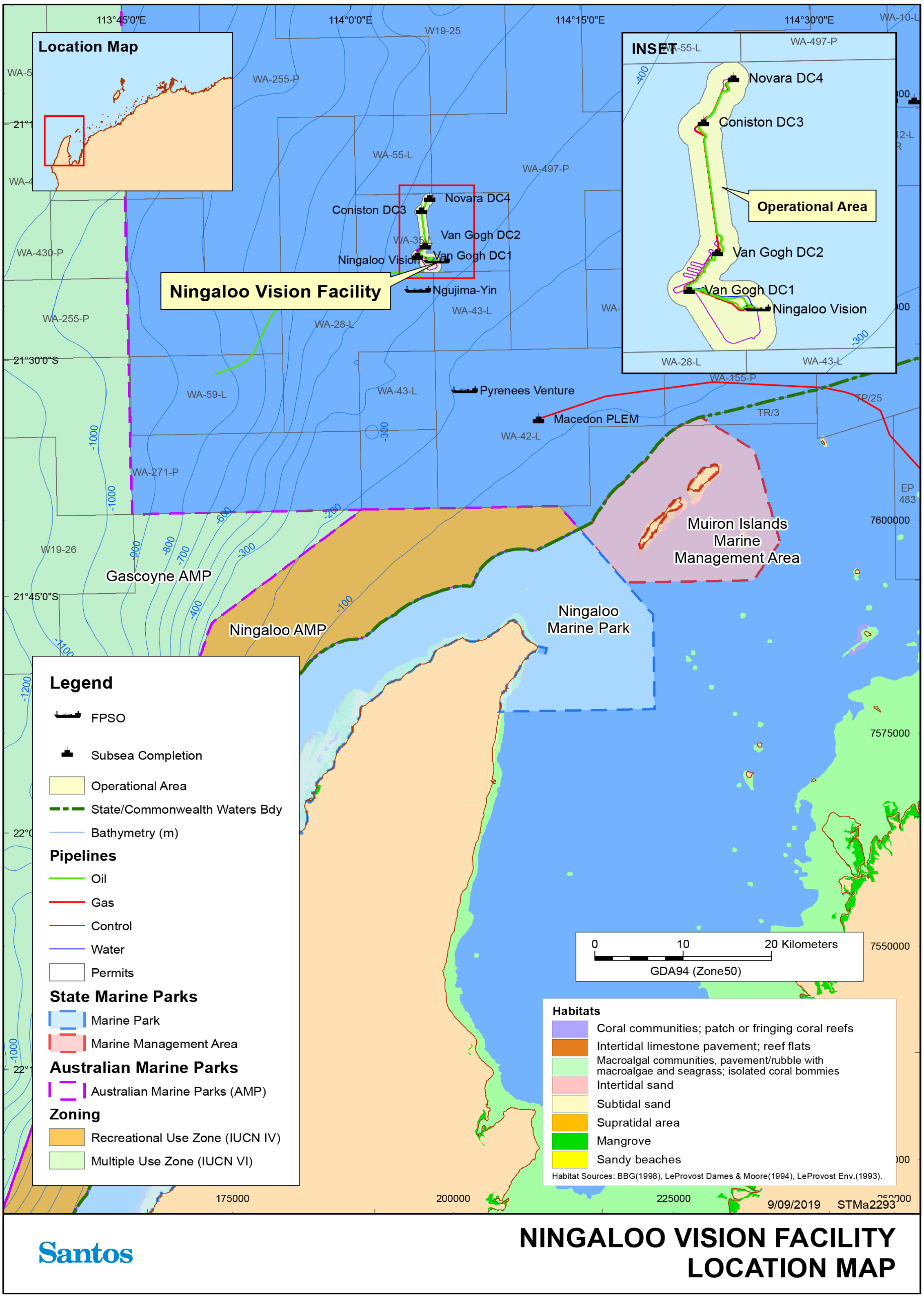

Figure 3-2: Ningaloo Vision location map and regional features

3.5 Interface with Internal Documents

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

+ Incident Command & Management Manual (SO-00-ZF-00025);
+ Santos Offshore Incident and Crisis Management Bridging Procedure (SO-91-IF-20012);
+ Ningaloo Vision Operations Environment Plan (TV-00-RI-00003);
+ Ningaloo Vision Incident Response Plan (TV-22-IF-00005);
+ Berthing and Terminal Handbook (TV-22-IG-00067);
+ Offtake Operational & Pilotage Procedure (NV-91-IG-10010.03);
+ Bunkering Operations Procedure (NV-91-IG-10006.03);
+ Ningaloo Vision Shipboard Oil Pollution Emergency Plan (SOPEP) (NV-00-ZF-100001);
+ Incident Response Telephone Directory (SO-00-ZF-00025.020);
+ Refuelling and Chemical Management Standard (QE-91-IQ-00098);
+ Santos Offshore Source Control Planning and Response Guideline (DR-00-ZF-10001);
+ Van Gogh Well Operations Management Plan (DR-91-ZG-10006);
+ Coniston Novara Well Operations Management Plan (DR-91-ZG-140);
+ Oil Pollution Waste Management Plan (QE-91-IF-10053);
+ Oil Spill Response Health and Safety Manual (SO-91-RF-10016);
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
+ Oil Spill Scientific Monitoring Baseline Data Review (QE-00-BI-20001); and
+ Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

4 Oil Spill Response Framework

4.1 Spill Response Levels

Santos WA uses a tiered system of incident response levels consistent with State and National incident response plans including the State Hazard Plan: Maritime Environmental Emergencies and the National Plan for Maritime Environmental Emergencies (NatPlan). Spill Response Levels help to identify the severity of an oil spill incident and the level of response required to manage the incident and mitigate environmental impacts. Incident response levels are outlined within the Santos WA Incident Command and Management Manual (QE-00-ZF-00025) and further detailed in **Table 4-1** below for hydrocarbon spills.

Table 4-1: Santos WA Oil Spill Response Levels

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

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

Definitions of Jurisdictional Authority and Control Agency are as follows:

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

With respect to a hydrocarbon spill from Ningaloo Vision operations, the relevant Jurisdictional Authority and Control Agency varies dependent upon the location of the oil pollution (Commonwealth or State waters), the nature of the incident (vessel based or petroleum activity) and the spill response level (refer Table 4-2).

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

+ A vessel is a ship at sea to which to which the *Navigation Act 2012* applies;
+ A facility is a petroleum facility as defined under the OPGGS Act, Volume 3, Schedule 3, Part 1, Clause 4 & Volume 2, Part 6.8, Section 640; and
+ The Ningaloo Vision FPSO is considered a facility when connected to the Detachable Turret Mooring (DTM) and a vessel when off-station. Subsea infrastructure spills and spills during the transfer of oil to a berthed offtake tanker are also classified as facility spills under the OPGGS Act.

Table 4-2: Jurisdictional Authorities and Control Agencies for Ningaloo Vision oil spill response

Role	Spill Level	State waters/shoreline oil pollution		Commonwealth waters oil pollution	
		Petroleum Activity[1]	Vessel[2]	Petroleum Activity	Vessel
Control Agency	1	Petroleum Titleholder (Santos WA)	DoT	Petroleum Titleholder (Santos WA)	AMSA
	2/3	DoT	DoT	Petroleum Titleholder (Santos WA)	AMSA
Jurisdictional Authority	1/2/3	DoT	DoT	NOPSEMA	AMSA

[1] 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 OPGGSA 2006.

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

4.3 Petroleum Activity Spill in Commonwealth Waters

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

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

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

4.4 Cross-jurisdiction facility spills

For a Level 2/3 Petroleum Activity spill, there is the possibility of the spill crossing jurisdictions between Commonwealth and State waters. In these instances, the Jurisdictional Authority remains true to the source of the spill (i.e. NOPSEMA for Commonwealth waters and DoT for State waters). Where a Level 2/3 spill originating in Commonwealth waters moves into State waters two Controlling Agencies will exist: DoT and the Petroleum Titleholder (Santos WA), each with its own Incident Management Team (IMT) and Lead IMT responsibilities.

The arrangements between DoT and Santos WA for sharing resources and coordinating a response across both Commonwealth and State waters are further detailed in **Section 5.2.3.**

4.5 Vessel spills in Commonwealth Waters

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

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

4.6 Cross-jurisdictional Vessel Spills

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

5 Santos WA Incident Management

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

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

Santos WA's incident response structure relevant to a Ningaloo Vision incident includes:

+ Ningaloo Vision Incident Response Team (IRT);
+ Santos Offshore Incident Management Team (IMT) – Perth based to coordinate and execute responses to an oil spill incident;
+ Santos Offshore Crisis Support Team (CST) and Santos corporate Crisis Management Team (CMT) - to coordinate and manage threats to the company's reputation and to handle Santos WA's corporate requirements as an operator; and
+ Other field-based command, response and monitoring teams for implementing strategies outlined within the OPEP.

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

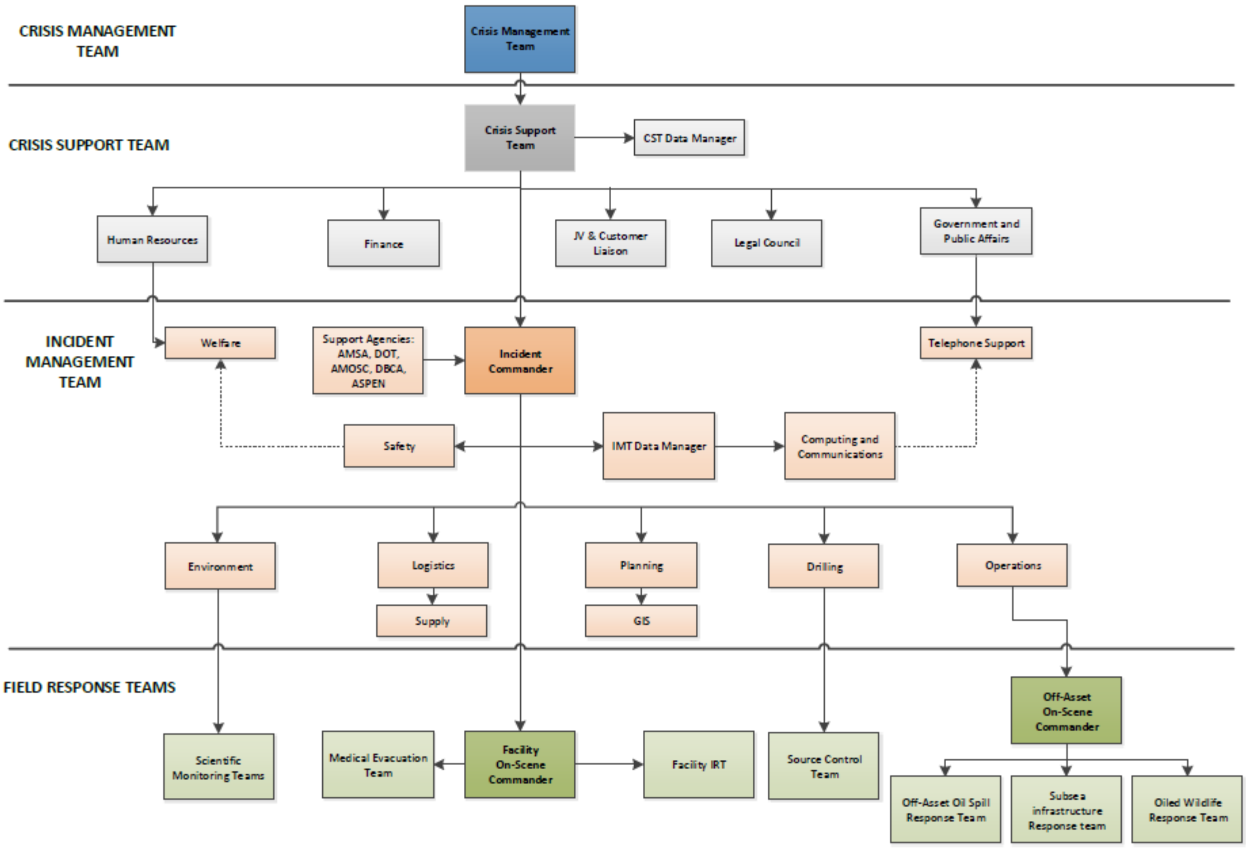

Figure 5-1: Santos WA Incident Response Organisational Structure

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

5.1 Roles and Responsibilities

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

Also provided are the roles and responsibilities of Santos WA personnel required to work within DoT's organisational structure (**Table 5-5**), where DoT has responsibilities for spill response as a Control Agency, as per DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements..

DoT will provide two roles to the Santos WA CST/IMT in a coordinated response. These are also outlined for reference (**Table 5-4)**.

Table 5-1: Roles and Responsibilities in the Crisis Support Team (CST)

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

CST Member	Main Responsibilities
CST Data Manager	+ Ensure CST Centre resources are in place and functional + Distribute manuals, contact lists and supporting information to CST personnel + Records and collects all information associated with the response to the incident + Maintain filing system for Incident Response

Table 5-2: Roles and Responsibilities in the Incident Management Team (IMT)

Santos WA IMT Member	Main Responsibilities
Incident Commander	+ Coordinate all onshore support in accordance with the IRP and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan. + Set the response objectives and strategic direction + Oversee the development and implementation of Incident Action Plans + Oversee implementation of MoUs and contracted support for 'mutual aid' + Ensure co-ordination with external organisations/police, etc. + Prepare and review strategic and tactical objectives with the CST + Liaise with the CST and provide factual information + Set response termination criteria in consultation with regulatory authorities
Planning Team Leader	+ Collect and document situational awareness information of the incident + Develop, document, communicate and implement Incident Action Plans to achieve incident objectives + Determine the status of action/s or planned activities under the Incident Action Plans and assess and document performance against the objectives. + Assess long term consequences of incident and plan for long term recovery + Manage the GIS Team in a response
Operations Team Leader or Drilling Team Leader	+ Coordinate operational aspects of Incident Response + Provide the key contact for On-Scene Commanders + Liaise with contractors or third parties + Mobilise additional Santos WA staff and external experts to form Technical Support Team + Assist Planning Team Leader with overall general plan preparation and preparation of Incident Action Plans + Implement Incident Action Plans + Manage field response teams and activities
Logistics Team Leader	+ Mobilise response equipment, helicopters, vessels, supplies and personnel

Santos WA IMT Member	Main Responsibilities
	+ Provide transport and accommodation for evacuated personnel + Oversee the implementation of the Waste Management Plan throughout a Tier 2 or Tier 3 oil spill response. + Liaise with the Supply Team to activate supply contracts and arrange procurements + Coordinate authorities for search and rescue
Supply Team Leader	+ Arrange fast track procurement + Activate supply contracts as required + Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident
Environmental Team Leader	+ Manage notification to Designated Environmental Authorities and liaise as required. + Assist in the development of Incident Action Plans + Advise of the Net Environmental Benefit Analysis of oil spill response strategies and tactics + Oversee the implementation of scientific monitoring programs in an oil spill response + Provide liaison for implementation of the WA Oiled Wildlife Response Plan in an oil spill response
Welfare Team Leader	+ Obtain personnel status involved in the incident + Review POB lists and clarify accuracy through Safety Team Leader + Obtain list of Contactor Companies involved in the incident and obtain 3rd-Party Contractor contact to advise of situation and safety of personnel when appropriate + Liaise with 3rd-Party Contractor contact regarding their personnel and organise handover + Obtain employee’s emergency contact list (NOK) to advise of situation and safety of personnel when appropriate + Take instructions from the CST HR Team Leader + Work with Logistics Team Leader to arrange transport for affected families to hospitals etc. + Assist with arrangements through EAP to support families/employees
Safety Team Leader	+ Manage notification to Designated Safety Authorities and liaise as required + Assist in the development of Incident Action Plans + Oversee the development and implementation of incident Safety Management Plans as required. + Work with the Welfare Team Leader to support personnel safety
IMT Data Manager	+ Ensure IMT resources are in place and functional in the ICC + Oversee the setting up of communications systems by the Computing and Communications Leader

Santos WA IMT Member	Main Responsibilities
	+ Distribute manuals, contact lists and supporting information to IMT personnel + Record and collect all information associated with the response to the incident + Maintain filing system for Incident Response
GIS Support	+ Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database' + Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database' + Manage and keep up-to-date marine maps in the 'GIS in IMT Database'. + Provide IMT with quick access to up-to-date drawings and data sets in the ICC + Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps

Table 5-3: Roles and Responsibilities in the Field-Based Response Team

Field-Based Position	Main Responsibilities
Ningaloo Vision On-Scene Commander	+ Commands the onsite response to NV incidents, including oil spills, using onsite resources, including the Facility IRT + Notifies the Perth based Incident Commander of Level 2/3 incidents, including oil spills, requiring offsite support + Single point of communications between facility/site and IMT
Ningaloo Vision Incident Response Team (IRT)	+ Respond to incidents under the instruction of an Incident Response Team Leader in accordance with actions developed by the NV On Scene Commander.
Off-Asset On Scene Commander	+ Coordinates the field response as outlined in the Incident Action Plan developed by the IMT + Commands a Forward Operating Base (FOB) for the coordination of resources mobilised to site
Off-Asset Oil Spill Response Teams	+ Undertake oil spill response activities as defined in Incident Action Plans and Oil Pollution Emergency Plans.
Source Control Team	+ Respond to incidents involving well loss of containment to stop the flow of oil to sea + Refer to the Source Control Emergency Response Plan (DR-00-ZF-1001) for detailed descriptions of roles and responsibilities within the Source Control Team
Oiled Wildlife Response Team	+ Respond to oiled wildlife incidents to minimise the impacts to wildlife + Refer to the Western Australia Oiled Wildlife Response Plan for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team

Field-Based Position	Main Responsibilities
Scientific Monitoring Teams	+ Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions + Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities

Table 5-4: Department of Transport Roles Embedded within Santos WA's CST/IMT

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

Table 5-5: Santos WA Personnel Roles Embedded within the State Maritime Environmental Emergency Coordination Centre (MEECC)/ Department of Transport (DOT) IMT

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

Santos WA roles embedded within the State MECC/ DoT IMT	Main Responsibilities
	+ Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the Santos WA IMT + (Note this individual must have intimate knowledge of the relevant Santos WA OPEP and planning processes)
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 WA OPEP and relevant TRP plans + Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the Santos WA IMT + Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the Santos WA IMT
Deputy Public Information Officer	+ As part of the Public Information Team, provide a direct liaison between the Santos Media team and DoT IMT Media team + Facilitate effective communications and coordination between Santos and DoT media teams + Assist in the release of joint media statements and conduct of joint media briefings + Assist in the release of joint information and warnings through the DoT Information & Warnings team + Offer advice to the DoT Media Coordinator on matters pertaining to Santos WA media policies and procedures + Facilitate effective communications and coordination between Santos and DoT Community Liaison teams + Assist in the conduct of joint community briefings and events + Offer advice to the DoT Community Liaison Coordinator on matters pertaining to Santos community liaison policies and procedures + Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the Santos WA IMT
Deputy Logistics Officer	+ As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort + Facilitate the acquisition of appropriate supplies through Santos WA's existing OSRL, AMOSC and private contract arrangements + Collects Request Forms from DoT to action via the Santos WA IMT + (Note this individual must have intimate knowledge of the relevant Santos WA logistics processes and contracts)
Deputy 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

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

5.2 Regulatory Arrangements and External Support

5.2.1 Australian Marine Oil Spill Centre (AMOSC)

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

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

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

5.2.2 Australian Maritime Safety Authority (AMSA)

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

Upon notification of an incident involving a ship, AMSA will assume control of the incident and response in accordance with AMSA's Marine Pollution Response Plan. AMSA's Marine Pollution Response Plan is the operational response plan for the management of ship-source incidents. AMSA is to be notified immediately of all ship-source incidents through RCC Australia on +61 2 62306811.

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

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

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

5.2.3 WA Department of Transport (DoT)

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

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

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

Santos will conduct initial response actions in State waters as necessary in accordance with its OPEP and continue to manage those operations until formal handover of incident control is completed. Appendix 1 within

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

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

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

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

For a cross jurisdictional response Santos will be responsible for ensuring adequate resources are provided to DoT as Control Agency, initially 11x personnel to fill roles in the DoT IMT or FOB (refer **Section 5.1**) and operational personnel to assist with those response strategies where DoT is the Lead IMT. Santos' CMT Liaison Officer and the Deputy Incident Controller are to attends the DoT Fremantle ICC as soon as possible after the formal request has been made by the SMEEC. It is an expectation that the remaining initial cohort will attend the DoT Fremantle ICC no later than 8am on the day following the request being formally made to Santos by the SMEEC.

Figure 5-2 shows the cross jurisdictional organisational structure for a petroleum facility spill where both the Santos WA IMT and DoT IMT will provide a coordinated response.

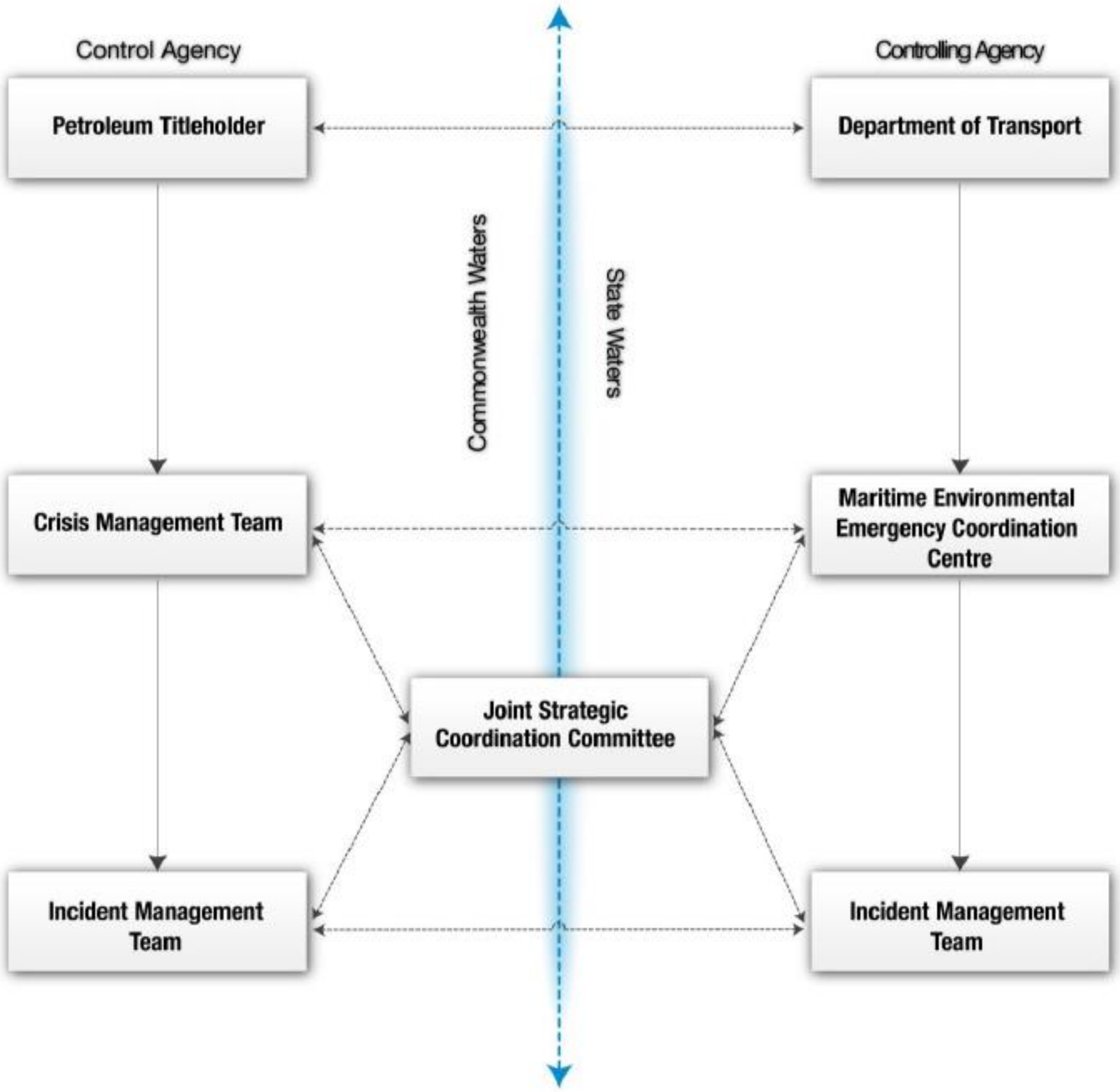

Figure 5-2: Cross jurisdictional incident management structure for Commonwealth waters Level 2/3 facility oil pollution incident entering State waters

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

The Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) has responsibilities associated with wildlife and activities in national parks, reserves and State marine parks. The *Biodiversity Conservation Act 2016* (WA) is the legislation that provides DBCA with the responsibility and Statutory Authority to treat, protect and destroy wildlife. In State waters, DBCA is the Jurisdictional Authority for Oiled Wildlife Response (OWR), providing advice to the Control Agency (DoT). The role of DBCA in an OWR is outlined in the Western Australian Oiled Wildlife Response Plan (WAOWRP) and regional sub-plans.

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

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

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

5.2.5 Oil Spill Response Limited (OSRL)

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

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

5.2.6 Department of Industry, Science, Energy and Resources (DISER)

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

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

5.3 External Plans

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

+ AMOSPlan – Australian Industry Cooperative Spill Response Arrangements
  - Details the cooperative arrangements for response to oil spills by Australian oil and associated industries.
+ Offshore Petroleum Incident Coordination Framework - provides overarching guidance on the Commonwealth Government's role and responsibilities in the event of an offshore petroleum incident in Commonwealth waters
+ NatPlan - National Plan for Maritime Environmental Emergencies and National Marine Oil Spill Contingency Plan

- Sets out national arrangements, policies and principles for the management of maritime environmental emergencies. The Plan provides for a comprehensive response to maritime environmental emergencies regardless of how costs might be attributed or ultimately recovered.

+ HazPlan - MEE – Western Australia State Hazard Plan for Maritime Environmental Emergencies
  - Details the management arrangements for preparation and response to a marine pollution incident occurring in State waters.
+ DoT Oil Spill Contingency Plan
  - Defines the steps required for the management of marine oil pollution responses that are the responsibility of the DoT.
  - DoT's Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (available online: DoT's Offshore Petroleum Industry Guidance Note – Marine Oil pollution: Response and Consultation Arrangements.).
+ Shipboard Oil Pollution Emergency Plans (SOPEP)
  - Under MARPOL Annex I requirements, all vessels of over 400 gross tonnage are required to have a current SOPEP. The SOPEP includes actions to be taken by the crew in the event of an oil spill including steps taken to contain the source with equipment available onboard the vessel.
+ Western Australia Oiled Wildlife Response Plan (WAOWRP)
  - Defines the steps, personnel, equipment and infrastructure required for the management of wildlife in an oil pollution response. Each region has a Regional Oiled Wildlife Response Plan that gives further details on sensitivities and available resources. The Pilbara Region Oiled Wildlife Response Plan is the relevant regional plan for OWR associated with Ningaloo Vision operations.
+ Oil Spill Response Limited (OSRL) Associate Agreement
  - Defines the activation and mobilisation methods of OSRL spill response personnel and equipment allocated under contract.
+ Australian Government Coordination Arrangements for Maritime Environmental Emergencies
  - Provides a framework for the coordination of Australian Government departments and agencies in response to maritime environmental emergencies.

5.4 Cost Recovery

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

5.5 Training and Exercises

5.5.1 Incident Management Team and Crisis Support Team Training and Exercises

Santos WA provides training to its personnel to fill all required positions within the IMT and Crisis Support Team (CST).

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

Table 5-6: Training and Exercise Requirements for CST/IMT Positions

CST Role	Exercise	Training
CST Leader	1 x Level 3 exercise annually or 3 x Level 3 desktop exercises annually.	+ PMAOMIR320 + AMOSC – Oil Spill Response Familiarisation Training
CST Members: Finance Team Leader GPA Team Leader JV Coordinator/ Legal Team Leader Data Manager		
IMT Role	**Exercise**	**Training**
Incident Commander Operations/ Drilling Team Leader	1 x Level 2 exercise annually or 3 x Level 2 desktop exercises annually.	+ PMAOMIR320; + PMAOMIR418; and + AMOSC – IMO3 Oil Spill Command & Control;
Planning Team Leader Logistics Team Leader Environmental Team Leader		+ PMAOMIR320; and + AMOSC – IMO2 Oil Spill Management Course
Safety Team Leader Supply Team Leader GIS Team Leader Data Manager HR/ Welfare Team Leader		+ PMAOMIR320; and + AMOSC – Oil Spill Response Familiarisation Training

5.5.2 Oil Spill Responder Training

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

Table 5-7: Spill Responder Personnel Resources

Responder	Role	Training	Available Number
Santos AMOSC Core Group Responders	Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group. Deployed by IMT for spill response operations	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course	12

Responder	Role	Training	Available Number
Santos WA Facility Incident Response Teams	Present at Devil Creek, Varanus Island and Ningaloo Vision Facilities for first strike response to incidents	Internal Santos training and exercises as defined in each facility's Incident Response Plan On-scene commander to have AMOSC – Oil Spill Response Familiarisation Training.	One IR team per operational facility per shift.
Santos WA Aerial Observers	Undertake aerial surveillance of spill. Deployed by IMT in the aerial surveillance aircrafts.	AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually).	7
AMOSC Core Group Oil Spill Responders	Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan. For providing incident management (IMT) and operations (field response) assistance.	AMOSC Core Group Workshop (refresher training undertaken every 2 years). AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course	As defined in Core Group Member Reports Min.84 Max. 140 (incl. Santos).
OSRL Oil Spill Response Personnel	Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos-OSRL contract.	As per OSRL training and competency matrix.	18
AMOSC Oil Spill Response Specialists	Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract.	As per AMOSC training and competency matrix.	8
Oiled Wildlife Response Roles (Level 4)	Refer OPEP Section 15 and Appendix M.		

Responder	Role	Training	Available Number
Monitoring Service Provider: Monitoring Coordination Team (MCT) and SMP Teams	Monitoring Coordination Team (MCT) SMP Teams: Technical Advisers Field Team Leader Field Team Member	As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Capability defined in Monthly Capability Reports. MCT – 5 personnel SMP Teams 12+ per team
Level 1 Oiled Wildlife Responders (Workforce Hire)	Provide oiled wildlife support activities under supervision.	No previous training required; on the job training provided.	Nominally over 1,000.
Shoreline clean-up personnel (Workforce Hire)	Manual clean-up activities under supervision.		

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

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

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

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

5.5.3 Response Testing

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

CST and IMT members undertake workshops and exercises as outlined within the Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001) to clarify and familiarise themselves with their respective roles and responsibilities within OPEPs and other emergency plans. Learning aids are also introduced through these workshops to assist improvement of capability for the personnel to perform the functions of their role. Santos WA conducts IMT/CST desktop and activation exercises using emergency scenarios across its main operating facilities on the North West Shelf or a drilling activity. An oil spill incident scenario is used for the activation exercise once per year. Both safety and oil spill incidents test the chain of command of the Santos WA response system, communications and notification with external parties, communication processes between office and facility, and field response tactics.

Testing of key response provider arrangements is 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.

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

5.5.4 Testing Schedule

Oil spill specific training, exercises, workshops and tests are detailed in the Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001). Once completed, records of exercises and workshops are entered into the Santos WA Training and Induction Database (Learning Management System). Key actions arising from exercises are recorded and tracked through the Santos WA Action Tracking System. Progress of training, exercise and workshop completion against the schedule is tracked and reported against on a monthly basis.

The Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001) is reviewed and revised annually.

5.5.5 Oil Spill Response Audits

Oil spill response audits will follow the Santos WA Assurance Procedure (QE-91-IQ-10022) and are scheduled as per the Santos WA Assurance Schedule. Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and corrective actions required (non-conformances) will be formally noted and discussed, with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong and Fremantle are audited every two years under the direction of AMOSC's participating members. The intent of this audit is to provide assurances to Santos WA and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in oil pollution emergency plans.

The deployment readiness and capability of OSRL's oil spill response equipment and personnel in Singapore are audited every 2 years. The intent of this audit is to provide assurances to Santos WA of OSRL's ability to respond to an oil spill incident as per its service level agreement (SLA).

The objectives and frequency of oil spill response testing and auditing relevant to Ningaloo Vision operations oil spill response are summarised in **Table 5-8.**

Table 5-8: Oil Spill Response Testing Arrangements

Exercise	Objective	Frequency	Recording and review
Communication Test	To test all communication and notification processes to service providers and regulatory agencies defined within the OPEP.	Required for every approved OPEP. When response arrangements have changed. At least annually.	Any results of the test are recorded in a Test Report. Corrections are updated within the Incident Response Telephone Directory (QE-00-ZF-00025.20)
IMT/CST Workshops	To refresh IMT & CST roles and responsibilities and provide familiarisation with OPEP processes and arrangements.	As per Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001)	All workshops undertaken are recorded in Santos WA's Learning Management System.
OPEP Desktop and Activation Exercise	Desktop Exercise To familiarise IMT with functions and process in	As per Incident and Crisis Management Training and Exercise	All exercises undertaken are recorded in Santos

Exercise	Objective	Frequency	Recording and review
	response to a simulated oil spill scenario Activation Exercise To activate full IMT/CST in response to oil spill scenario and test arrangements contained within OPEP	Plan (QE-92-HG-10001) Minimum of one oil spill response activation oil spill exercise per year.	WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System.
Response arrangement tests	Tests of response arrangements outlined within the OPEP either as part of desktop/ activation exercises or as standalone desktop tests. Response arrangement tests to include testing of OPEP response timeframes which include EPBC Act Approval conditions (refer Section 6.10)	As per Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001)	Test reports are recorded if not already included within reports for IMT desktop/ activation exercises or field deployment exercises. Key recommendations are recorded are tracked in Santos WA's Action Tracking System
Equipment deployment exercises/ tests	To focus on Santos WA's deployment capability. To inspect and maintain the condition of the Santos oil spill response equipment. To maintain training of field response personnel.	When new response equipment is added. As per Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001) The following Santos-owned equipment is inspected and/or tested Tracker buoys Offshore boom/ nearshore boom Power packs Vessel dispersant spray systems	Reports are generated for exercises and recorded in Santos WA's Learning Management System. Key recommendations are recorded are tracked in Santos WA's Action Tracking System. Tracker Buoy tests are recorded.
AMOSC audit	To test deployment readiness and capability of AMOSC.	Every 2 years.	Undertaken by two of AMOSC's participating members and the audit report made available to members.

Exercise	Objective	Frequency	Recording and review
OSRL Audit	To test deployment readiness and capability of OSRL in Singapore.	Every 2 years.	Undertaken by Santos WA or in coordination/ consultation with other member company. Recommendations provided to OSRL for action and close-out.

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 Ningaloo Vision operations. Of the credible spill scenarios identified in the *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003)*, a sub-set have been selected to represent worst case spills from a response perspective taking into account the following characteristics:

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

The worst case credible spill risks selected to inform this OPEP are presented in **Table 6-1**. Detail on the derivation of these maximum credible spills is provided within the *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003)*.

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

Table 6-1: Maximum credible spill scenarios for Ningaloo Vision operations

Worst-case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)	Release duration	Maximum extent of surface hydrocarbons >1g/m^2
Production Well Leak (subsea spill)	Van Gogh Crude	10,236*	100 days*	~400 km
Flowline rupture (subsea spill)	Van Gogh Crude	1,681	24 hours	~350 km
FPSO collision with third-party vessel (surface spill)	Van Gogh Crude	8,630	1 hour	~450 km
Surface diesel release (surface spill)	Marine Diesel Oil	1,787	1 hour	~280 km
Surface Heavy Fuel Oil release (surface spill)	Heavy Fuel Oil	950	1 hour	~300 km

* A release duration of 100 days has been used to inform spill modelling, risk assessment and spill response planning to be consistent with previous revision of the EP and OPEP, however a relief well drilling time timeline of 77 days has been assessed as achievable (Section 9.4.4). Therefore the 100 days spill scenario of is considered a conservative representation of risk and response requirements.

6.2 Response planning thresholds

Environmental impact assessment thresholds are addressed in **Section 7.5.3** of the EP. In addition to the environmental impact assessment thresholds, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These are shown in **Table 6-2**.

Table 6-2: Surface Hydrocarbon Thresholds for Response Planning

Hydrocarbon concentration (g/m^2)	Description
>1	+ Estimated minimum threshold for commencing some scientific monitoring components (refer to **Appendix O**)
>50	+ Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
>100	+ Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application + Estimated minimum shoreline accumulation threshold for shoreline clean-up

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

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of $50\text{-}100g/m^2$ 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) (Table 13-2).

6.3 Stochastic spill modelling results

Table 6-3 presents the spill modelling results at Protection Priority locations for selected worst-case scenarios only. All scenarios were modelled using a stochastic approach running multiple simulations (150 simulations) across all seasons using a number of unique environmental conditions sampled from historical metocean data.

As detailed in Section 7.5.3.2 of the EP, modelling was conducted using a hydrocarbon analogue (Linerle crude oil) to represent Van Gogh crude oil. Across properties influencing weathering behaviour (e.g. density, boiling point curve, pour point) the analogue used very closely resembles that of Van Gogh crude oil (refer Section 7.5.3.2 of the EP). Wax content and asphaltene content are key drivers of emulsification potential since emulsification increases with the proportion of these components, especially over a threshold above 0.5% for asphaltene content (CSIRO, 2016). Increased rates of emulsification reduce the rate of natural weathering and increase the volume of oily waste, making recovery and treatment of oil more difficult. The modelled hydrocarbon has a higher asphaltene content (0.77%) than recent assays of Van Gogh crude oil (<0.5%) and has a wax content of 0.27%. There is uncertainty on the similarity of wax content since the limit of detection in Van Gogh crude oil assays is 5% (i.e. the assay cannot determine accurately a concentration lower than this). While wax content in Van Gogh crude oil could potentially be higher than that of the modelled assay – this would be negated by the lower asphaltene content. On that basis, and in view of the similarity in other factors influencing weathering and persistence in the environment (refer Section 7.5.3.2 of the EP), the modelling conducted is considered representative of how Van Gogh crude oil would behave in the environment.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed through the use of spill response strategies) for the allocation and mobilisation of spill response resources. Therefore, these are the results presented in this OPEP for primary consideration.

Modelling results for dissolved and entrained oil for the worst case scenarios have not been included given there are limited response strategies that will reduce subsurface impacts.

Refer to **Section 7.5** of the EP for further description on selection of oil exposure values presented in **Table 6-3**.

Table 6-3: Worst-case Spill Modelling Results for Ningaloo Vision Operations

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation>10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Production Well Leak (Van Gogh Crude) of 10,236 m^3 over 100 days								
Ningaloo Coast North	53.3	2.8	100	2.4	100	2.2	446.3	204
Ningaloo Coast South	NC	NC	63	8.2	18.7	8.8	37.5	85
Muiron Islands	18.7	5.8	81	4.3	74.7	4.3	85.8	17
Montebello Islands	NC	NC	28.7	14.5	15.3	13.8	15.8	21.2
Barrow Island	0.7	26.8	38	10.6	26	11.4	31.1	38.2
Thevenard Island	NC	NC	15.3	9	9.3	9	3.1	8.5
Outer Shark Bay Coast	NC	NC	65.3	24.1	7.3	14.9	3.4	12.7

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation>10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Flowline rupture (Van Gogh crude oil) of 1,681 m^3 over 24 hours								
Ningaloo Coast North	7.3	1	80	1.3	23.4	1.3	615.4	141.6
Ningaloo Coast South	NC	NC	27	6.5	<5	6.8	71.4	127.4
Muiron Islands	NC	NC	23	2.8	5	2.8	39.4	11.3
Montebello Islands	0.7	7.8	7.3	7.7	2.1	7.7	16.6	17.0
Barrow Island	0.7	6.7	11.3	6.7	2.1	6.6	5.0	8.5
FPSO collision with third-party vessel and surface spill (Van Gogh crude oil) of 8,630 m^3 over 1 hour								
Ningaloo Coast North	7.3	0.9	56	2.2	39	2.2	1254.4	133.1
Muiron Islands	1.3	5.6	19.3	2.1	13	1.7	308	11.3

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation>10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Ningaloo Coast South	1.3	5.6	14	4.9	5.3	4.8	258.7	127.4
Montebello Islands	NC	NC	2.7	15.9	0.7	16.1	6.0	11.3
Barrow Island	NC	NC	6.0	11.3	1.3	11.7	9.7	14.2
Outer Shark Bay Coast	NC	NC	10.7	14.1	2.0	16.9	19.2	34.0
FPSO collision with third-party vessel and surface spill (Diesel) of 1,787 m^3 over 1 hour								
Ningaloo Coast North	2.0	0.9	15.3	2.2	<5	2.2	176.3	19.8
Muiron Islands	0.7	2.3	3.3	2.2	1.3	2.3	19.2	11.3
Ningaloo Coast South	NC	NC	0.7	5.8	NC	NC	NC	NC

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation>10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Outer Shark Bay Coast	NC	NC	0.7	18.7	NC	NC	NC	NC
Offtake tanker collision and surface spill (HFO) of 950 m^3 over 1 hour								
Ningaloo Coast North	3.3	1.0	58.7	2.2	12	2.2	424.8	110
Muiron Islands	0.7	2.4	19.3	1.8	4.0	1.7	13.4	11.3
Ningaloo Coast South	NC	NC	14.0	5.5	2.0	5.5	61.9	87.8
Montebello Islands	NC	NC	6.0	14.3	1.3	14.2	2.1	5.7
Barrow Island	NC	NC	5.3	9.5	0.7	12.6	6.3	14.2
Outer Shark Bay Coast	NC	NC	12.7	15.4	0.7	17.4	0.6	2.8

Location	Total contact probability (%) floating oil >1g/m^2	Minimum arrival time floating oil >1g/m^2 (days)	Total probability (%) shoreline oil accumulation>10g/m^2	Minimum arrival time shoreline oil accumulation >10g/m^2 (days)	Total probability (%) shoreline oil accumulation >100 g/m^2	Minimum arrival time shoreline oil accumulation >100 g/m^2 (days)	Maximum total accumulated oil ashore (tonnes) >100 g/m^2	Maximum length of shoreline oiled (km) >100 g/m^2
Thevenard Island	NC	NC	2.0	12.8	NC	NC	NC	NC

6.4 Deterministic modelling

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

Deterministic runs were selected for each scenario based on the largest predicted oil mass stranded on all shorelines. To help further understand the predicted effectiveness of response options, deterministic realisations were run for all of the crude oil spills both with and without the inclusion of surface dispersant application to predict its effectiveness as a mitigation strategy to reduce oil on the sea surface and shorelines. Surface dispersant application was simulated using vessel and Fixed Wing Aerial Dispersant Capability (FWADC), using the parameters described in **Table 6-4** and **Table 6-5**.

Table 6-4: Surface dispersant application parameters used in modelling

Parameter	Vessel/s	Aircraft (FWADC)
Location of operational base	Exmouth Harbour	Learmonth Airport
Daily operational hours	2 hours	0.5 hours
Maximum No. sorties	1 per day	8 per day
Dispersant application rate	1:20	
Dispersant efficacy	30% for Van Gogh Crude (Refer to **Appendix A**)	
Minimum thickness threshold for dispersant application	>50 g/m^2	
Exclusion zones	+ Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone) + State Marine Parks + State Waters + Within 10 km of water depths <20 m LAT + Within exclusion zones of offshore facilities	

Table 6-5: Predicted asset availability used in modelling

Asset type	Timeframe for deployment		
	12-24 hours	24-48 hours	>48 hours
Vessels	1	2	5
FWADC (aircraft)	0	1	2

6.5 Dispersant mitigated scenario results

Table 6-6 presents modelling results of applying surface dispersants to the crude spill scenarios (listed in **Table 6-1).** The sections below provide an explanation of the results. These results do not take into account the application of any other spill response strategy (e.g. containment and recovery).

6.5.1 Production well leak scenario

Surface dispersant application was most effective on the production well leak scenario, due to its prolonged release duration (100 days). Modelling for this scenario predicted a total shoreline loading of ~342 tonnes (unmitigated), primarily at Ningaloo Coast North (~277 tonnes). The application of surface dispersant (as per **Table 6-4** and **Table 6-5**) reduced total shoreline loading to ~112 tonnes (reduction of 230 tonnes), with Ningaloo Coast North receiving a total of ~104 tonnes (a reduction of ~173 tonnes) under the mitigated scenario.

Additionally, the simulation found that the mass of surface (floating) oil significantly reduced from a peak of ~900 tonnes (unmitigated) to ~300-400 tonnes (mitigated). However, a reduction in surface oil was accompanied by a marginal increase in the total mass of entrained droplets within the water column for the mitigated case.

6.5.2 Flowline rupture scenario

There was a moderate reduction in the predicted shoreline loadings from the application of surface dispersants for the flowline rupture scenario. Dispersants were only applied for 5-6 days following the release (release duration of 24 hours), as the minimum oil spill thickness for effective dispersant application (50g/m^2) did not occur after this period of time.

A predicted peak shoreline loading of ~544 tonnes (unmitigated), was almost entirely shown to contact Ningaloo Coast North (~543 tonnes). The application of dispersants reduced shoreline loading by ~88 tonnes. This did result in an increase in the total mass of entrained droplets from ~100 tonnes (unmitigated) to 200-300 tonnes (mitigated) within the water column for the mitigated case over the ~5-6 days of active surface dispersant response.

6.5.3 FPSO collision with third-party vessel scenario

As the duration of this scenario was only expected to be one hour, the minimum oil spill thickness for effective dispersant application (50g/m^2) was limited. The modelling results (Table 6-6) indicate that the application of dispersants led to an increase in shoreline loading at Ningaloo Coast North for this scenario, whereas there was a reduction in shoreline loading at Ningaloo Coast South (90 tonnes (unmitigated) to 3.2 tonnes (mitigated)). This scenario also predicted a significant decrease in surface (floating) oil from 2,000 tonnes to ~500 tonnes, but this resulted in a sizeable increase in entrained droplets from ~4,500 tonnes (unmitigated) to ~6,000 tonnes (mitigated).

It appears that sub-surface currents were responsible for transporting the entrained droplets towards the Ningaloo shoreline, where they were predicted to resurface. This explains the predicted increase in shoreline loading at Ningaloo Coast North for the mitigated scenario.

Table 6-6: Spill modelling results showing application of surface dispersants as a mitigation strategy

Spill Scenario			Location	Maximum mass oil ashore (tonnes)		Minimum arrival time (days)		Peak loading time (days)	
Event	Oil Type	Maximum volume (m^3) /duration		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Production Well Leak (subsea spill)	Van Gogh Crude	10,236/ 100 days	Ningaloo Coast North	276.9	104	16.5	17.4	39	38.8
			Ningaloo Coast South	7	0.9	20.6	83.8	38.6	83.9
			Muiron Islands	25.5	5.5	15.9	20.1	89.7	86.8
			Montebello Islands	16.4	NC	25.9	NC	30	NC
			Barrow Island	10.2	0.3	23.4	90.5	24.3	90.5
			Thevenard Island	NC	0.4	NC	23.1	NC	23.1
			Southern Islands Coast	6.9	1.2	20.3	86.7	91.3	89.9

Spill Scenario			Location	Maximum mass oil ashore (tonnes)		Minimum arrival time (days)		Peak loading time (days)	
Event	Oil Type	Maximum volume (m^3) /duration		Unmitigated	Mitigated	Unmitigated	Mitigated	Unmitigated	Mitigated
Flowline rupture (subsea spill)	Van Gogh Crude	1,681/ 24 hours	Ningaloo Coast North	543.5	455.4	2.4	2.3	3.2	3.2
			Muiron Islands	0.8	1.1	5	4.8	10	12.7
FPSO collision with third-party vessel (surface spill)	Van Gogh Crude	8,630/ 1 hour	Ningaloo Coast North	809.5	1057.6	2.4	2.6	10.3	10.1
			Ningaloo Coast South	90.5	3.2	5.8	6.8	9.3	22.8

6.6 Evaluation of Applicable Response Strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 6.1** and spill modelling results (**Sections 6.3 and 6.4**) the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 6-7**).

Note: The information contained in **Table 6-7** has been developed by Santos WA for preparedness purposes. Santos WA may not be the Control Agency or Lead IMT for implementing a spill response. For example, for Level 2/3 spills within or entering State waters, DoT will ultimately determine the strategies and controls implemented for most State water activities with Santos WA providing resources and planning assistance.

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Table 6-7: Evaluation of Applicable Response Strategies

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
Source Control	Spill kits	✔ 1	✔ 1	✔ 1	Relevant for containing spills that may arise on board a vessel or FPSO.
	Secondary containment	✔ 1	✔ 1	✔ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or FPSO. Bunded areas will contain hydrocarbons reducing the potential for a spill escaping to marine waters. Where applicable open deck drainage will be closed to prevent hydrocarbon draining into marine environment.
	Shipboard Oil Pollution Emergency Plan (SOPEP)	✔ 1	✔ 1	✔ 1	MARPOL requirement for applicable vessels. In the event a vessel hydrocarbon storage tank is ruptured, applicable strategies for reducing the volume of hydrocarbon releases will be contained within the vessel SOPEP. This may include securing cargo via transfer to another storage area on-board the vessel, transfer to another vessel, or through pumping in water to affected tank to create a water cushion (tank water bottom). Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will aim to minimise the volume of fuel spilt.
	Emergency Shutdown (ESD)	✔ 1	X	X	Triggered automatically or manually as per Ningaloo Vision Incident Response Plan.
	Surface well kill	X	X	X	Not applicable given all wells are subsea.
	Capping Stack	X	X	X	Capping Stacks cannot be landed and connected to subsea wellheads under the credible production well leak scenarios outlined in the EP and this strategy is therefore not considered applicable.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
	Relief well drilling	✔ 1	X	X	Relevant to for production well leak. Relief well drilling is the primary method for killing the well. To be conducted as per the Source Control Emergency Response Plan (SCERP - DR-00-ZF-10001).
In-Situ Burning	Controlled burning of oil spill	X	X	X	Not applicable to gas wells due to safety hazards. Not applicable to diesel spills due to inability to contain marine diesel making it very difficult to maintain necessary slick thickness for ignition and sustained burning.
Monitor and Evaluate Plan (Operational Monitoring)	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. Limited to visual range from the vessel. Limited capacity to evaluate possible interactions with sensitive receptors.
	Aerial surveillance				Provides real-time information on spill trajectory and behaviour (e.g. weathering).

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					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				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				Can be implemented rapidly. Predictive - provides estimate of where the oil may go, which can be used to prepare and implement other responses. No additional field personnel required. Not constrained by weather conditions. Can predict floating, entrained, dissolved and stranded hydrocarbon fractions. May not be accurate. Requires in-field calibration.
	Satellite Imagery				Can work under large range of weather conditions (e.g. night time, cloud cover etc) Mobilisation likely to be >24 hours

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Requires processing May return false-positives
	Operational Water Quality Monitoring				Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of a continuous subsea spill and validate the spill fate modelling predictions.
	Shoreline and Coastal Habitat Assessment				Provides information on shoreline oiling (state of the oil, extent of pollution etc.). Can provide information on amenability of shoreline response options (e.g. clean-up, protect and deflect). Provides information on status of impacts to sensitive receptors. Considerable health & safety considerations. Requires trained observers. Constrained to daylight. Delayed response time.
Chemical dispersion	Vessel Application	✔ 1	X	✔ 2	*Van Gogh Crude* Van Gogh crude is a persistent hydrocarbon and has been tested for amenability to dispersants (Corexit 9500, Slickgone NS and Finasol

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
	Aerial Application	✔1	X	✔2	OSR 52). Testing indicated the crude to be amenable to dispersants, particularly against fresh crude, although amenability declined rapidly once the hydrocarbon had weathered (>3 days). Modelling conducted on surface dispersants as a mitigation strategy (Section 6.4) shows that application via vessel and aerial application is considered a feasible response strategy, especially if hydrocarbon is relatively fresh. SSDI is only suitable for the well leak, not suitable for surface spills and not suitable for flowline rupture (because the worst case leak is a finite volume predicted to be released within 24 hours). For the well leak scenario worst case leak rate and expression of oil at the surface are expected to be well within the suitable parameters for surface dispersant application and containment and recovery for these reasons surface dispersant application is considered a primary strategy with SSDI considered a secondary strategy that might be employed if surface dispersant application and containment and recovery were not effective in meeting their performance outcome. The effectiveness of SSDI for low flow leak scenarios, such as the worst case well leak scenario, is unknown. A potential drawback of SSDI is that it will result in smaller droplet sizes and entrainment of hydrocarbons into the water column, which may affect some oceanic and benthic organisms (e.g. fish, plankton). However, this is likely to be temporary and restricted to the top ~3m of the water column whilst SSDI is being used (RPS, 2019). This increase in entrainment is partially offset by significant increases in biodegradation rates. *Marine Diesel*
	Subsea dispersant injection (SSDI)	✔2	X	X	

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Marine diesel is not considered a persistent hydrocarbon and has high natural dispersion rates in the marine environment. Chemical dispersant application is not recommended as a beneficial option for diesel as it has a low additional benefit of increasing the dispersal rate of the spill while introducing the potential for more chemicals into the marine environment. *Heavy Fuel Oil* Some dispersants are effective on different HFO/IFO's, although effectiveness rapidly decreases as the product weathers. Testing conducted by the New Zealand Maritime Safety Authority indicated that Corexit 9500 and Slickgone EW were most effective on a range of IFOs and heavy fuel oils (Stevens and Roberts, 2003). Due to the persistent and viscous nature of this product, it is expected that repeated application or increased dispersant dosage ratios will be required to achieve the recommended treatment rate of dispersant. Consideration should be given to any impacts this may cause on sub-surface receptors and the location of spraying.
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	✔ 1	X	✔ 1	*Van Gogh Crude* Likely to be effective on Van Gogh Crude, as it is a more persistent hydrocarbon and is likely to have a sufficient thickness on the water for some time after release due to its relatively low rates of weathering. If metocean weather conditions are unsuitable for containment and recovery (>1.8m for offshore systems and >1.0m for nearshore systems), then this will result in significantly higher rates of weathering in the product.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Marine Diesel Not suitable for marine diesel given its rapid weathering nature. Marine diesel spreads quickly to a thin film, making recovery via skimmers difficult and ineffective. *Heavy Fuel Oil* HFO is a persistent hydrocarbon and is likely to have a sufficient thickness on the water for some time after release due to its relatively low rates of weathering. The drawbacks of this strategy include production of significant volumes of waste due to the collection of water with floating oil, however this can be mitigated to some extent if decanting is permitted.
Mechanical Dispersion	Vessel prop-washing	✔ 2	✔ 2	X	Safety is a key factor and slicks with potential for high VOC emission are not suitable. Mechanical dispersion may be applicable for the localised entrainment of surface oil but is not considered to have a significant effect on removing oil from the surface. Mechanical dispersion will entrain surface oil into the top layer of the water column. The aim of mechanical dispersion is to reduce the concentration of oil floating at the surface which could potentially contact receptors at the sea surface (e.g. sea birds) or shoreline receptors (e.g. mangroves). Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Marine diesel is a light oil that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. Mechanical dispersion may be considered for targeted small breakaway patches of crude but may have limited effectiveness. It is not considered to be effective on HFO given this oil is resistant to entrainment. The potential disadvantage of mechanical dispersion is that it could temporarily increase the concentration of entrained and dissolved oil in the vicinity of submerged shallow water receptors (e.g. corals, seagrass ad macroalgae). This is most likely in shallow water of a few metres deep. The suitability of mechanical dispersion as a response measure would consider the prevailing environmental conditions (it mimics the action of wave induced entrained so is most beneficial in calm conditions) and the type, proximity and depth (as applicable) of sensitivities in the area. Mechanical dispersion will be considered for petroleum activity sourced spills at the discretion of the On-Scene Commander/IMT or by the relevant Control Agency. It is unlikely that vessels would be specifically allocated for mechanical dispersion but vessels undertaking primary strategies may be used opportunistically.
Protection and Deflection	Booming in nearshore waters and at shorelines	✔ 1	✔ 2	✔ 1	Considered if operational monitoring shows or predicts contact with sensitive shorelines. *Van Gogh Crude*

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Modelling shows high probability of contact, above impact and response thresholds for some scenarios. The effectiveness of this response will be dependent on local bathymetry, sea state, currents, tidal variations and wind conditions at the time of implementation. It is typically more effective in areas with low to moderate tidal ranges on low energy coastline types such as sandy beaches. Moderate to high tidal ranges generally include stronger currents and larger/longer intertidal areas that make it less effective and more difficult to keep booms in place. Protection and deflection is feasible in locations where access to the coastline allows vehicles and vessels to undertake operations. Activities would focus on areas of high protection value in low energy environments based upon real-time operational surveillance, provided the environmental and metocean conditions are favourable for an effective implementation. Consequently, this strategy may not be applicable across all areas or receptors identified as priority for protection. *Marine Diesel* Modelling shows low probability of contact with shorelines. Shoreline protection and deflection activities can result in physical disturbance to intertidal and shoreline habitats. Given the relatively small volumes predicted to come ashore, and the high rates of natural biodegradation of marine diesel, it would be better to focus on high priority areas for protection. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impact from marine diesel. *Heavy Fuel Oil*

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Heavy Fuel Oil is a persistent hydrocarbon, and once it makes contact with shorelines, it has the potential to impact sensitive receptors and create considerable volumes of waste during shoreline clean-up activities. Therefore, protecting shorelines from contact is important. Protection and deflection activities would focus on areas of high protection value in low energy environments based upon real-time operational surveillance, provided the environmental and metocean conditions are favourable for an effective implementation. Consequently, this strategy may not be applicable across all areas or receptors identified as priority for protection.
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✔ 1	✔ 2	✔ 1	Considered if operational monitoring shows or predicts contact with sensitive shorelines. *Van Gogh Crude and Heavy Fuel Oil* Shoreline clean-up has the ability to reduce stranded oil on shorelines and/or reduce remobilisation of oil. However, this response has potential to cause more impacts than benefits, especially if oiling is light. Shoreline assessments as part of operational monitoring provide site-specific guidance on the applicability and likely benefits of different clean-up techniques. 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

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					will require site access, decontamination, waste storage, PPE, catering and transport services to support personnel working on shorelines. Flushing may be considered if the oil enters high priority/slow recovery habitats such as mangroves. Natural dispersion will occur as the hydrocarbon is remobilised from rock shelves and hard substrates, while residual hydrocarbons will biodegrade. *Marine Diesel* Modelling shows low probability of contact with shorelines. Shoreline clean-up activities can result in physical disturbance to shoreline habitats. Given the relatively small volumes predicted to come ashore, and the high rates of natural biodegradation of marine diesel, it would be better to focus on high priority areas for clean-up. This strategy is considered to be a secondary response strategy where it is safe and practical to implement and where priority protection areas are at risk of impacts from marine diesel.
Oiled wildlife response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✔ 1	✔ 2	✔ 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.

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging) Permitting requirements for hazing and pre-emptive capture.
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery form the oil spill and associated response activities.	✔ 1	✔ 1	✔ 1	Monitoring activities include: + Water and sediment quality + Biota of shorelines (sandy beaches, rocky shores and intertidal mudflats) + Mangrove monitoring + Benthic habitat monitoring (seagrass, algae, corals, non-coral benthic filter feeders) + Seabirds and shorebirds + Marine megafauna (incl. whale sharks and mammals) + Marine reptiles (incl. turtles) + Seafood quality + Fish, fisheries and aquaculture The type and extent of scientific monitoring will depend upon the nature and scale of oil contact to sensitive receptor locations as determined through operational monitoring. Pre-defined initiation criteria exist for

OSR Strategy	Tactic	Applicability and Designated Primary (1) or Secondary (2) Response Strategy			Considerations
		Van Gogh Crude	Diesel	Heavy Fuel Oil	
					scientific monitoring plans associated with marine and coastal sensitivities.

6.7 Identify Priority Protection Areas and Initial Response Priorities

Combined spill modelling results were used to predict the Environment that may be Affected (EMBA) for Ningaloo Vision operations (refer **Section 3.1** of the Ningaloo Vision Operations Environment Plan WA-35 – L (Van Gogh/Coniston/Novara Fields)). The EMBA is the largest area within which effects from hydrocarbons spills associated with this activity, could extend. Within the EMBA, Santos WA has determined Hot Spots (key areas of high ecological value that have the greatest potential to be impacted by a Ningaloo Vision operational spill) for which detailed oil spill risk assessment has been conducted (refer **Section 7.5.6.3** of the Ningaloo Vision Operations Environment Plan WA-35 – L). From these Hot Spot areas, priority protection areas for spill response have been identified (as per **Section 7.5.6.4** of the Ningaloo Vision Operations Environment Plan WA-35 – L). Protection priority areas are emergent features (i.e. coastal areas and islands) that would be targeted by nearshore spill response operations such as protection and deflection and shoreline clean-up.

Table 6-8 to **Table 6-12** list the key sensitivities and associated locations within the protection priority areas identified for each worst case spill scenario. The ranking of these sensitivities (also referred to as receptors) are listed, which is consistent with the rankings in *Provision of Western Australian Marine Oil Pollution Risk Assessment – Protection Priorities: Assessment for Zone 2: Pilbara* (DoT, 2017). Using a combination of sensitivities, and their associated rankings; together with the modelled maximum total volumes ashore and minimum time to shoreline contact, an initial response priority is provided in 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.

For example, for the production well leak scenario, Ningaloo Coast has the shortest time to shoreline contact (modelled to be 2.4 days) and highest shoreline loadings of all priority protection areas. Therefore, the response priority for this scenario would be to protect the highest ranked sensitivities, being mangroves (Mangrove Bay and Yardie Creek), turtles (nesting seasons higher priority and listed in tables below) and World Heritage Area values. As the spill progresses, additional priority protection areas are likely to be impacted, however, modelling predicts time to impact ranges from 4.3 days at Muiron Islands to 24 days for Outer Shark Bay Coast. This allows the IMT and response teams time to source additional resources to protect these key sensitivities, so the initial response priority is lower as the time to impact extends and loadings decrease.

Table 6-8: Initial Response Priorities during a Production Well Leak (subsea spill of Van Gogh Crude)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
Ningaloo Coast	World Heritage Area	5	5	N/A	N/A	484[5]	2.2	High
	Mangroves	3	3	Mangrove Bay Yardie Creek	N/A			High
	Turtles – loggerhead (Endangered), green (Vulnerable)	4	3	North Mauds Landing, south of Point Cloates, Mandu Creek to Yardie Creek, Jurabi point, Gnarraloo Bay and Cape Farquhar	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			High
	<u>Marine mammals</u> Pygmy blue whales (Endangered) foraging area. Dugongs (Marine/migratory) (breeding and foraging)	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Medium

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

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

[5] Total for Ningaloo North and Ningaloo South (446m^3 + 38m^3)

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Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Sharks and rays Seasonal aggregations of whale sharks (Vulnerable) and manta rays	2	3	N/A	Whale sharks – Mar-Jul			Medium
	Birds 33 species seabirds and avifauna (Including Critically Endangered Eastern Curlew)	5	4	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island	Nesting: Sept-Feb			High
	Coral and other subsea benthic primary producers	3	4	Largest fringing reef in Australia	Coral spawning: Mar & Oct			High
	Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)	2	2	Numerous campsites and snorkelling sites along western Cape Range shorelines, Coral Bay, Waroora Station	Year-round			Medium
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site,	4	3	Loggerhead – south island	Turtle nesting and breeding Nov-Mar	86	4.3	High

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Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence				with peak in late Dec/early Jan			
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low
Barrow Island	Mangroves	3	3	Bandicoot Bay	N/A	31.1	11.4	Medium
	Regionally and nationally significant green (western side)	4	3	Green turtles on the western side of Barrow Island and	Year-round, peaking Oct - Jan			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	and flatback turtle (eastern side) nesting beaches, Turtle Bay north beach, North and west coasts- John Wayne Beach, loggerheads and hawksbill			flatback turtle nesting on the eastern side. Turtle Bay north beach, North and west coasts and John Wayne Beach have loggerhead and hawksbill turtle nesting				
	Birds Migratory birds (important habitat); 10th of top 147 bird sites, Highest population of migratory birds in Barrow Island Nature reserve (south-south east island), Double Island has important bird nesting (shearwaters, sea eagles)	2	1	Double Islands, migratory birds at Bandicoot Bay and widespread on Barrow Island	Nesting: Sept-Feb			Medium

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Coral and other subsea benthic primary producers	3	4	Eastern side – Biggada Reef	Coral spawning: Mar & Oct			Low
	Socio-economic Significant for recreational fishing and charter boat tourism, Nominated place (National heritage), Industry – Reverse Osmosis Plant and port operations	5	5	Reverse Osmosis plant and port on eastern side of Island	N/A			Medium
Montebello Islands	Mangroves	3	3	Widespread and present in lagoons. Important stands in Stephenson Channel	N/A	15.8	13.8	Medium
	Turtles – loggerhead (Endangered) and green (Vulnerable) (significant rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles	4	3	Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green)	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			Medium

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Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Marine mammals Pygmy blue whale (Vulnerable) and humpback whale (Vulnerable) migration area	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Low
	Birds Migratory and threatened seabirds – at least 14 species Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Socio-economic Pearling (inactive/pearling zones) Very significant for recreational fishing and charter boat tourism	2	2	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	(Marine Management Area) Social amenities and other tourism Nominated place (national heritage)							
Thevenard Island	Turtles –green (Vulnerable) (significant rookeries); hawksbill (Vulnerable), flatback (Vulnerable) turtles	4	3	Northwest and Eastern Trimouille Islands (hawksbill) Western Reef and Southern Bay at Northwest Island (green)	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan	3.1	9	Medium
	Coral and other subsea benthic primary producers	3	4	Widespread	Coral spawning: Mar & Oct			Low
	Birds Migratory seabirds Significant nesting, foraging and resting areas	3	2	Widespread	Nesting: Sept-Feb			Low
	Socio-economic Eco-tourism (Mackerel Islands Resort)	1	1	Widespread	Year-round			Low

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[3]	DoT Ranking (Dissolved oil)[4]	Key locations	Relevant key periods	Maximum total accumulated oil ashore (m^3) >100g/m^2	Minimum arrival time accumulated oil ashore >100 g/m^2 (days)	Initial response priority
	Very significant for recreational fishing, diving							
Outer Shark Bay Coast	World Heritage Area	5	5	N/A	N/A	3.4	14.9	Medium
	Marine mammals Humpback whale migration path and resting area. Dugongs (breeding and foraging)	3	2	N/A	Humpback whale migration: Jun-Jul			Low
	Cultural Heritage Cape Inscription (Dirk Hartog Island) earliest European landing in Australia (Dirk Hartog on 1616)	4	3	Cape Inscription	N/A			Low
	Socio-economic Tourism, fishing, campsites and Surf Point Sanctuary Zone, sightseeing, Steep Point	1	2	Widespread	Year round			Low

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Table 6-9: Initial Response Priorities during a Flowline Rupture (subsea spill of Van Gogh Crude)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[6]	DoT Ranking (Dissolved oil)[7]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
Ningaloo Coast	World Heritage Area	5	5	N/A	N/A	677	1.3	High
	Mangroves	3	3	Mangrove Bay Yardie Creek	N/A			High
	Turtles – loggerhead (Endangered), green (Vulnerable)	4	3	North Mauds Landing, south of Point Cloates, Mandu Creek to Yardie Creek, Jurabi point, Gnarraloo Bay and Cape Farquhar	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			High
	<u>Marine mammals</u> Pygmy blue whales (Endangered) foraging area. Dugongs (Marine/migratory) (breeding and foraging)	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale			Medium

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

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

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[6]	DoT Ranking (Dissolved oil)[7]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
					migration: Jun-Jul			
	Sharks and rays Seasonal aggregations of whale sharks (Vulnerable) and manta rays	2	3	N/A	Whale sharks – Mar-Jul			Medium
	Birds 33 species seabirds and avifauna (Including Critically Endangered Eastern Curlew)	5	4	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island	Nesting: Sept-Feb			High
	Coral and other subsea benthic primary producers	3	4	Largest fringing reef in Australia	Coral spawning: Mar & Oct			High
	Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)	2	2	Numerous campsites and snorkelling sites along western Cape Range shorelines, Coral Bay, Waroora Station	Year-round			Medium
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site,	4	3	Loggerhead – south island	Turtle nesting and	39.4	2.8	High

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[6]	DoT Ranking (Dissolved oil)[7]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
	significant Green turtle (Vulnerable) nesting site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence				breeding Nov-Mar with peak in late Dec/early Jan			
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			Medium
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low

Table 6-10: Initial Response Priorities during a FPSO collision with third-party vessel (surface spill of Van Gogh Crude)

<table>
<tr><th>Protection Priority Area</th><th>Key sensitivities</th><th>DoT Ranking (Floating oil)[8]</th><th>DoT Ranking (Dissolved oil)[9]</th><th>Key locations</th><th>Relevant key periods</th><th>Maximum time-averaged oil ashore (m^3) >100g/m^2</th><th>Minimum arrival time (days)</th><th>Initial response priority</th></tr>
<tr><td rowspan="4">Ningaloo Coast</td><td>World Heritage Area</td><td>5</td><td>5</td><td>N/A</td><td>N/A</td><td rowspan="4">1,513</td><td rowspan="4">2.2</td><td>High</td></tr>
<tr><td>Mangroves</td><td>3</td><td>3</td><td>Mangrove Bay
Yardie Creek</td><td>N/A</td><td>High</td></tr>
<tr><td>Turtles – loggerhead (Endangered), green (Vulnerable)</td><td>4</td><td>3</td><td>North Mauds Landing, south of Point Cloates, Mandu Creek to Yardie Creek, Jurabi point, Gnarraloo Bay and Cape Farquhar</td><td>Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan</td><td>High</td></tr>
<tr><td><u>Marine mammals</u>
Pygmy blue whales (Endangered) foraging area. Dugongs (Marine/migratory) (breeding and foraging)</td><td>3</td><td>2</td><td>N/A</td><td>Pygmy blue whale migration: Apr-Aug
Humpback whale migration: Jun-Jul</td><td>Medium</td></tr>
</table>

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Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[8]	DoT Ranking (Dissolved oil)[9]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
	Sharks and rays Seasonal aggregations of whale sharks (Vulnerable) and manta rays	2	3	N/A	Whale sharks – Mar-Jul			Medium
	Birds 33 species seabirds and avifauna (Including Critically Endangered Eastern Curlew)	5	4	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island	Nesting: Sept-Feb			High
	Coral and other subsea benthic primary producers	3	4	Largest fringing reef in Australia	Coral spawning: Mar & Oct			High
	Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)	2	2	Numerous campsites and snorkelling sites along western Cape Range shorelines, Coral Bay, Waroora Station	Year-round			Medium
Muiron Islands	Turtle nesting – major loggerhead (Endangered) site, significant Green turtle (Vulnerable) nesting	4	3	Loggerhead – south island	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan	308	1.7	High

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[8]	DoT Ranking (Dissolved oil)[9]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
	site, low density Hawksbill nesting (Vulnerable), occasional Flatback (Vulnerable) presence							
	Coral and other subsea benthic primary producers	3	4	N/A	Coral spawning: Mar & Oct			High
	Seabird nesting	2	1	Widespread	Nesting: Sept-Feb			Low
	Humpback whale (Vulnerable) migration	3	2	N/A	Jun-Jul			Medium
	Exmouth gulf prawn fishery (Muiron is western boundary); significant for recreational fishing and charter boat tourism	1	2		Prawn fishery – April to November Tourism and recreation: year-round			Low

Table 6-11: Initial Response Priorities during a surface MDO release (surface spill)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[10]	DoT Ranking (Dissolved oil)[11]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
Ningaloo Coast	World Heritage Area	5	5	N/A	N/A	176	2.2	High
	Mangroves	3	3	Mangrove Bay Yardie Creek	N/A			High
	Turtles – loggerhead (Endangered), green (Vulnerable)	4	3	North Mauds Landing, south of Point Cloates, Mandu Creek to Yardie Creek, Jurabi point, Gnarraloo Bay and Cape Farquhar	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			High
	Marine mammals Pygmy blue whales (Endangered) foraging area. Dugongs (Marine/migratory) (breeding and foraging)	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Medium

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

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

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[10]	DoT Ranking (Dissolved oil)[11]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
	Sharks and rays Seasonal aggregations of whale sharks (Vulnerable) and manta rays	2	3	N/A	Whale sharks – Mar-Jul			Medium
	Birds 33 species seabirds and avifauna (Including Critically Endangered Eastern Curlew)	5	4	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island	Nesting: Sept-Feb			High
	Coral and other subsea benthic primary producers	3	4	Largest fringing reef in Australia	Coral spawning: Mar & Oct			High
	Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)	2	2	Numerous campsites and snorkelling sites along western Cape Range shorelines, Coral Bay, Waroora Station	Year-round			Medium

Table 6-12: Initial Response Priorities during a surface HFO release (surface spill)

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[12]	DoT Ranking (Dissolved oil)[13]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
Ningaloo Coast	World Heritage Area	5	5	N/A	N/A	487	2.2	High
	Mangroves	3	3	Mangrove Bay Yardie Creek	N/A			High
	Turtles – loggerhead (Endangered), green (Vulnerable)	4	3	North Mauds Landing, south of Point Cloates, Mandu Creek to Yardie Creek, Jurabi point, Gnarraloo Bay and Cape Farquhar	Turtle nesting and breeding Nov-Mar with peak in late Dec/early Jan			High
	Marine mammals Pygmy blue whales (Endangered) foraging area. Dugongs	3	2	N/A	Pygmy blue whale migration: Apr-Aug Humpback whale migration: Jun-Jul			Medium

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

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

Protection Priority Area	Key sensitivities	DoT Ranking (Floating oil)[12]	DoT Ranking (Dissolved oil)[13]	Key locations	Relevant key periods	Maximum time-averaged oil ashore (m^3) >100g/m^2	Minimum arrival time (days)	Initial response priority
	(Marine/migratory) (breeding and foraging)							
	Sharks and rays Seasonal aggregations of whale sharks (Vulnerable) and manta rays	2	3	N/A	Whale sharks – Mar-Jul			Medium
	Birds 33 species seabirds and avifauna (Including Critically Endangered Eastern Curlew)	5	4	Main breeding areas at Mangrove Bay, Mangrove Point, Point Maud, the Mildura wreck site and Fraser Island	Nesting: Sept-Feb			High
	Coral and other subsea benthic primary producers	3	4	Largest fringing reef in Australia	Coral spawning: Mar & Oct			High
	Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)	2	2	Numerous campsites and snorkelling sites along western Cape Range shorelines, Coral Bay, Waroora Station	Year-round			Medium

6.8 Net Environmental Benefit Analysis (NEBA)

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

The Environmental Team Lead will use the information in Section 6.7 to identify and prioritise initial response priorities and apply the NEBA to identify which response strategies are preferred for the situation, oil type and behaviour, environmental conditions, direction of plume and priorities for protection.

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

A strategic NEBA has been developed for all response strategies identified as applicable to credible spills identified in this OPEP, with the benefit or potential impact to each sensitivity identified (refer **Table 6-13** to **Table 6-15**). While not all spill response activities included in the strategic NEBA would be under the control of Santos WA during a spill incident, they have been included to assist the planning conducted by DoT.

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

+ Identify sensitivities within the area potentially affected by a spill at that time of the year (noting that the sensitivity of some key receptors, such as birdlife and turtles, varies seasonally);
+ Assist in prioritising and allocating resources to sensitivities with a higher protection and response priority (**Table 6-8** to **Table 6-12);** and
+ Assist in determining appropriate response strategies with support of real time metocean conditions, oil spill tracking and fate modelling.

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

+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are recorded; and
+ Potential effects of response strategies on each sensitivity are assessed in terms of their benefit or otherwise to the socioeconmonic sensitivities.

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 6-13: Strategic NEBA Matrix Table - Van Gogh Crude Oil spills

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Ningaloo Coast										
Turtle nesting – loggerhead, green										
Mangroves – Mangrove Bay and Yardie Creek									N/A	
Coral and other subsea benthic primary producers - largest fringing reef in Australia, lagoonal, intertidal and subtidal corals, Seagrass and macroalgae bed									N/A	
Whale sharks and manta rays										
Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)										

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Seabird nesting - incl. breeding areas at Mangrove Bay, Mangrove Point, Point Maud, Mildura wreck and Fraser Island										
Humpback/ Pygmy blue whale migration										
Muiron Islands										
Turtle nesting – major loggerhead site, significant Green turtle nesting site										
Coral and other subsea benthic primary producers									N/A	
Seabird nesting										
Humpback whale migration										
Tourism - significant fishing/charter boat tourism										
Montebello Islands										

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Turtle nesting – North West and Eastern Trimouille Islands (hawksbill); Western Reef, Southern Bay and North West Island (green)										
Mangroves – particularly Stephenson Channel									N/A	
Coral and other subsea benthic primary producers							N/A	N/A	N/A	
Seabird nesting										
Migratory shorebirds										
Humpback/pygmy blue whale migration										
Fishing/charter boat tourism										
Barrow Island										
Turtle nesting – particularly flatback (western side) and										

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
green turtles (eastern side)										
Mangroves and mudflats (shorebird foraging) – Bandicoot Bay									N/A	
Coral and other subsea benthic primary producers – incl. Biggada Reef								N/A	N/A	
Seabird nesting - incl. Double Island										
Migratory shorebirds - particularly Bandicoot Bay										
Aboriginal listed sites incl. pearling camps										
Thevenard Island										
Turtle nesting – green, hawksbill and flatback turtles										
Coral and other subsea benthic primary producers								N/A	N/A	
Seabird nesting										

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Eco-tourism (Mackerel Islands Resort) and recreational fishing, diving										
Outer Shark Bay Coast										
Humpback whale migration path and resting area. Dugongs (breeding and foraging)										
European heritage site at Cape Inscription										
Tourism, fishing, campsites and Surf Point Sanctuary Zone, sightseeing, Steep Point										
Legend										
	Beneficial impact.									
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions to dilute entrained oil).									
	Negative impact.									
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type									

Table 6-14: Strategic NEBA Matrix Table - Marine Diesel Oil spills

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Ningaloo Coast										
Turtle nesting – loggerhead, green				N/A		N/A				
Mangroves – Mangrove Bay and Yardie Creek				N/A		N/A			N/A	
Coral and other subsea benthic primary producers - largest fringing reef in Australia, lagoonal, intertidal and subtidal corals, Seagrass and macroalgae bed				N/A		N/A			N/A	
Whale sharks and manta rays				N/A		N/A				
Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)				N/A		N/A				
Seabird nesting - incl. breeding areas				N/A		N/A				

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
at Mangrove Bay, Mangrove Point, Point Maud, Mildura wreck and Fraser Island										
Humpback/ Pygmy blue whale migration				N/A		N/A				

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

Table 6-15: Strategic NEBA Matrix Table – Heavy Fuel Oil spills

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Ningaloo Coast										
Turtle nesting – loggerhead, green										
Mangroves – Mangrove Bay and Yardie Creek									N/A	
Coral and other subsea benthic primary producers - largest fringing reef in Australia, lagoonal, intertidal and subtidal corals, Seagrass and macroalgae bed									N/A	
Whale sharks and manta rays										
Tourism - significant fishing/ charter boat tourism, camping and use of nearshore sanctuary zones (fishing, snorkelling)										
Seabird nesting - incl. breeding areas										

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Containment and Recovery	Mechanical Dispersion	Chemical Dispersants	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
at Mangrove Bay, Mangrove Point, Point Maud, Mildura wreck and Fraser Island										
Humpback/ Pygmy blue whale migration										
Legend										
	Beneficial impact.									
	Possible beneficial impact depending on the situation (e.g., time frames and metocean conditions to dilute entrained oil).									
	Negative impact.									
N/A	Not applicable for the environmental value or not applicable for hydrocarbon type.									

6.9 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 as low as reasonably practicable (ALARP).

Error! Reference source not found. details the ALARP assessment framework and the results of the ALARP a ssessment conducted to inform the control measures and performance standards contained within this OPEP.

6.10 Resource Mobilisation - EPBC Act Approval Requirements

EPBC Act Approval (EPBC 2007/3213) for the Van Gogh Petroleum Field Development and EPBC Act Approval (EPBC 2011/5995) for the Coniston Novara Development set conditions on the content requirements of the environment plan and oil spill contingency plan covering the operation of development infrastructure.

An overview of how the Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003) (EP) and this OPEP meet the conditions of the EPBC Act Approvals is provided in Appendix B of the EP.

Condition 2a of EPBC Act Approval - EPBC 2007/3213 states that the oil spill contingency plan (i.e. this OPEP) must include a “demonstrated capacity to deploy oil spill response equipment within 12 hours of a spill occurring” while Condition 10d of EPBC Act Approval - EPBC 2011/5995 states the oil spill contingency plan (i.e. this OPEP) must include a “demonstrated capacity to respond to a spill at the site. Identification of the response measures that can feasibly, and will, be applied within the first 48 hours of a spill occurring”

Within each response strategy section of this OPEP, minimum timeframes for mobilisation of first-strike resources have been included. This includes, where relevant, Incident Management Team (IMT) activation time, mobilisation of resources to deployment locations and deployment of resources to the spill site. This information, together with supporting information on oil spill response arrangements, demonstrates that Santos WA:

- Has a capacity to deploy oil spill response equipment within 12 hours of a spill occurring.
- Has a capacity to respond to a spill at the site; and
- Has identified the response measures that can feasibly, and will, be applied within the first 48 hours of a spill occurring

Additional to the nominated timeframes included within the EPBC Act Approvals, the mobilisation timeframes included in this OPEP demonstrate that first-strike resources required to support shoreline operations can be available onsite within worst case minimum shoreline/nearshore contact times (for visible oil >1 g/m^2) of ~24 hours as predicted by stochastic oil spill modelling (refer **Section 6.3**).

In order to demonstrate the ongoing functionality of oil spill response arrangements outlined within this OPEP, including the ability to meet first-strike response mobilisation timeframes, Santos WA conducts an annual exercise program as outlined within **Section 5.5.3** and **Table 5-8**, which includes IMT activation exercise and field deployment exercises. This ongoing program shows that there is means to test that the deployment timeframes include in this OPEP can be met.

7 External Notifications and Reporting Procedures

The Ningaloo Vision Incident Response Plan (TV-22-IF-00005) identifies the initial incident notifications and actions to be conducted by onsite personnel, including notifying the incident to the Process Control Room (PCR) and On-scene Commander (Ningaloo Vision OIM).

For oil spill incidents, the On-scene Commander will notify Perth office for delegation of further notifications to relevant Regulatory Authorities and for further spill response assistance for Level 2/3 spills.

7.1 Regulatory Notification and Reporting

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

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

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

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

Table 7-1 outlines Santos WA oil spill reporting requirements associated with carrying out a Petroleum Activity in State and Commonwealth waters. There are also additional requirements for Vessel Masters to report oil spills from their vessels under relevant marine oil pollution legislation (e.g. MARPOL). This includes, where relevant, reporting oil spills to AMSA (Rescue Coordination Centre) and WA DoT (MEER unit).

The Incident Response Telephone Directory (SO-00-ZF-0025.02) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.2 Activation of External Oil Spill Response Organisations and Support Agencies

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

The Incident Response Telephone Directory (SO-00-ZF-0025.02) contains a more detailed list and contact details for incident response support and is updated every 6 months with up-to-date revisions available within the IMT room and online (intranet procedures and emergency response pages).

7.3 Environmental Performance

Table 7-3 lists the Environmental Performance Standards and Measurement Criteria for external notifications and reporting.

Table 7-1: External Notification and Reporting Requirements (Commonwealth and State Water)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
NOPSEMA Reporting Requirements for Commonwealth water spills					
NOPSEMA (Incident Notification Office)	Verbal notification within 2 hours Written report as soon as practicable, but no later than 3 days	*Petroleum and Greenhouse Gas Storage Act 2006* Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (as amended 2014)	A spill associated with Ningaloo Vision Operations in Commonwealth waters that has the potential to cause moderate to significant environmental damage[1]	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (National Offshore Petroleum Titles Administrator) & DMIRS (WA Department of Mines, Industry Regulation and Safety)	Written report to NOPTA and DMIRS within 7 days of the initial report being submitted to NOPSEMA	Guidance Note (N-03000-GN0926) Notification and Reporting of Environmental Incidents	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Environmental Team Leader (or delegate)	Provide same written report as provided to NOPSEMA
DMIRS Reporting Requirements for State water spills					
WA Department of Mines, Industry Regulation and Safety (DMIRS)	• Verbal phone call within 2 hours of incident being identified • Follow up written notification within 3 days	Guidance Note on Environmental Non-compliance and Incident Reporting	A spill incident associated with Ningaloo Vision in State waters that has the potential to cause an environmental impact that is categorised as moderate or more serious than moderate[1]	Notification by IMT Environmental Team Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/E

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
					nvironment-reports-and-6133.aspx
AMSA and DoT spill reporting requirements					
AMSA Rescue Coordination Centre (RCC)[2]	Verbal notification within 2 hours of incident	Under the MoU between Santos WA and AMSA	Santos WA to notify AMSA of any marine pollution incident[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
WA Department of Transport (WA DoT)[2] (Maritime Environmental Emergency Response (MEER) Duty Officer)	• Verbal notification within 2 hours • Follow up with POLREP as soon as practicable after verbal notification • If requested, submit SITREP within 24 hours of request	Emergency Management Regulations 2006 State Hazard Plan: Maritime Environmental Emergencies Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements	Santos WA to notify of actual or impending Marine Pollution Incidents (MOP) that are in, or may impact, State waters. Emergency Management Regulations 2006 define MOP as an actual or impending spillage, release or escape of oil or an oily mixture that is capable of causing loss of life, injury to a person or damage to the health of a person, property or the environment[1].	Notification by IMT Environmental Team Leader (or delegate)	WA DoT POLREP: https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf WA DoT SITREP: https://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-SituationReport.pdf
Protected areas, fauna and fisheries reporting requirements					
Commonwealth Department of Agriculture, Water and the Environment (DAWE)	Email notification as soon as practicable	Environment Protection and Biodiversity Conservation Act 1999	If MNES are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
(Director of monitoring and audit section)					
Department of Biodiversity Conservation and Attractions (Pilbara Regional Office)	Verbal notification within 2 hours	DBCA consultation	Santos WA to notify AMSA of any marine pollution incident[1] Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (State Duty Officer and Pilbara Regional Office)	Verbal notification within 2 hours	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Parks Australia (Director of National Parks)	Verbal notification as soon as practicable	Environment Protection and Biodiversity Conservation Act 1999	An oil spill which occurs within a marine park or are likely to impact on an Australian Marine Park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected)

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
					Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT
Department of Primary Industry and Regional Development (DPIRD) - Fisheries	Verbal phone call notification within 24 of incident	As per consultation with DPIRD Fisheries	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Australian Fisheries Management Authority	Verbal phone call notification within 24 hours of incident	For consistency with DPIRD Fisheries notification	Reporting of marine oil pollution[1]	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

1- For clarity and consistency across Santos WA regulatory reporting requirements Santos WA 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 WA's environmental impact and risk assessment process outlined in **Section 5** of the EPs. .

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

Table 7-2: List of spill response support notifications

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
AMOSC, AMOSC Duty Manager	As soon as possible but within 2 hours of incident having been identified	Verbal Service Contract	Santos WA is a Participating Company in AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Santos WA can also call upon mutual aid from other trained industry company personnel and response equipment AMOSC's stockpiles of equipment include dispersant, containment, recovery, cleaning, absorbent, oiled wildlife and communications equipment. Equipment is located in Geelong,	**Step 1.** Obtain approval from Incident Commander to mobilise AMOSC **Step 2.** Notify AMOSC that a spill has occurred. Put on standby as required – activate if spill response escalates in order to mobilise spill response resources consistent with the AMOSPlan **Step 3.** E-mail confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment, and callout authorities will be required to supply their credentials to AMOSC. A signed service contract must also be completed by a call out authority and returned to AMOSC prior to mobilisation	IMT Environment Team Leader (or delegate) will notify AMOSC (upon approval from Incident Commander)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
			Fremantle, Exmouth and Broome		
Babcock Helicopters	Within 2 hours of incident having been identified	Verbal	Helicopters/pilots available for aerial surveillance. Contract in place.	Phone call	IMT Logistics Team Leader (or delegate))
Duty Officers/ Incident Commanders **(Woodside, BHP, Chevron)**	Within 2 hours of incident having been identified	Verbal	Mutual aid resources (through AMOSC mutual Aid Arrangement)	Phone call	Incident Commander (or delegate)
Exmouth Freight & Logistics	Within 2 hours of incident having been identified	Verbal	Assistance with mobilising equipment and loading vessels	Phone call	IMT Logistics Team Leader (or delegate)
North West Alliance – Waste	As required for offshore and shoreline clean-up activities	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean-up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	Scientific Monitoring Plan	Verbal and written	Astron has been contracted by Santos to	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring	IMT Environment

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
	initiation criteria are met (**Section 18**)		provide Standby Services for Scientific Monitoring Plans (SMPs) 1-11. This includes provision of personnel and equipment. Aston annually reviews the SMPs for continual improvement.	**Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email **Step 3.** Provide additional details as requested by the Astron Monitoring Coordinator on call-back **Step 4**. Astron initiates Scientific Monitoring Activation and Response Process	Team Leader (or delegate)
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 10.5**)	Verbal	Oil analysis including GC/MS fingerprinting	**Phone call**	IMT Environment Team Leader (or delegate)
Oil Spill Response Limited (OSRL), OSRL Duty Manager	Within 2 hours of incident having been identified	Verbal OSRL Mobilisation Authorisation Form	Santos WA has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios At minimum OSRL will provide technical support to the IMT and	**Step 1.** Contact OSRL Duty Manager in Singapore and request assistance from OSRL **Step 2.** Send notification to OSRL as soon as possible after verbal notification **Step 4.** Upon completion of the OSRL incident notification form, OSRL will plan and place resources on standby.	Designated call-out authorities (including Incident Commanders and CST Leaders)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
			place resources on standby Further details available on the OSRL webpage.		
RPS Group	As soon as possible but within 2 hours of incident having been identified	Verbal and written	Santos WA has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos WA, if required, as part of contracting arrangements with RPS Group	Contact RPS Group Duty Officer	IMT Environment Team Leader (or delegate)
Wild Well Control (WWC)	Within four hours of a production well leak incident having been identified	Production well leak only Verbal	Well intervention services. Under contract.	**Step 1**. Following Santos management confirmation of a subsea loss of containment, the Incident Command Team (IMT) Drilling Team Leader is to call the Wild Well Control 24 hour emergency hotline number to notify WWC of the incident	Drilling Team Leader

Santos

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos WA person responsible for activating
				Step 2. As soon as practical after initial notification and once the scale of the subsea loss of containment is confirmed, an emergency mobilisation authorisation form (saved in ECM) must be filled out, signed off by the authorised Santos Manger sent through to WWC. The form is located on the Santos Intranet Procedures Index under Emergency Procedures (http://ausintranet.enerylimited.com/dept_data/ Procedure_data/index.htm). Email as directed by WWC point of contract provided by the emergency hotline attendant.	

Table 7-3: Environmental Performance – External Notification and Reporting

Environmental Performance Outcome	Make notifications and reports within regulatory and defined timeframes		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
External notifications and reporting plan	**Response Preparedness**		
	Incident Response Telephone Directory (SO-00-ZF-0025.02)	Incident Response Telephone Directory is revised every 6 months	Document revision history
	OPEP Communications Test	OPEP contact details for regulatory and service provider notifications are checked annually	Test records
	Response Implementation		
	External notifications and reporting tables	External notification and reporting undertaken as per **Table 7-1** and **Table** 7-2	Incident Log

8 Incident Action Planning

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

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

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

The Santos WA IMT will use the IAP process to determine and document the appropriate response priorities, objectives, strategies and tasks to guide the incident response which are reviewed and updated as more information becomes available.

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

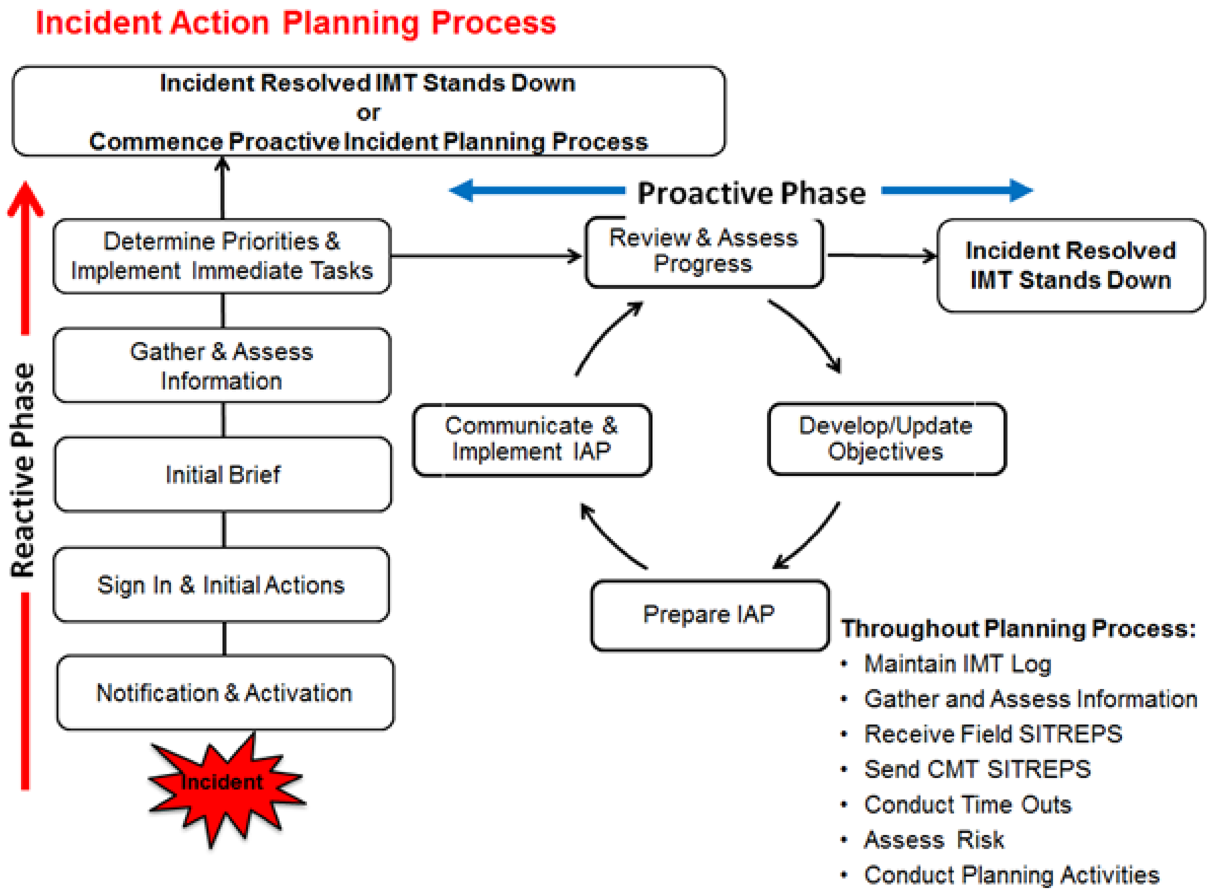

Figure 8-1: Incident Action Plan process

8.1 Reactive Phase Planning

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

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

For each credible oil spill scenario covered by this OPEP the first strikes response actions, have been informed by a pre-assessment of applicable oil spill response strategies, priority response locations and a strategic net environmental benefit analysis (NEBA) also referred to as a spill impact mitigation assessment (SIMA). This pre-planning is included in **Section 6**. During the reactive phase the strategic NEBA is to be reviewed and, using the specific information gathered from the spill, operationalised into an operational NEBA (**Section 6.8**). This assessment helps verify that the response strategies pre-selected for each spill scenario are providing the best environmental outcome for the incident response.

8.2 Developing an Incident Action Plan (IAP)

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

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

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

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

IAP forms and processes are documented in the *Incident Command and Management Manual* (SO-00-ZF-00025) and in the 'Emergency Response' folder sets at *L:\Resource\Emergency Response\Incident-Exercise Number-Name*. Begin the response by copying and saving *Incident-Exercise Number-Name* folder set with a unique incident name and Id number on the lead folder; this is the Incident Log. Access subfolders to display all forms required to conduct incident action planning. Each functional position within the IMT and CMT has subfolders carrying forms and processes unique to the functional position.

8.3 Environmental Performance

Table 8-1 lists the Environmental Performance Standards and Measurement Criteria for incident action planning.

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Table 8-1: Environmental Performance – Incident Action Planning

Environmental Performance Outcome	Manage incident via a systematic planning process		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Incident Action Planning	**Response Preparedness**		
	IMT Exercise and Training Plan	Incident Action Planning and NEBA is practiced by the IMT during exercises	Exercise records
	Response Implementation		
	Incident Action Plan	Incident Action Plan is completed for each operational period and approved by the Incident Commander	Incident Log Incident Action Plan/s
		Monitor effectiveness of response strategies being implemented and use information in the development of IAPs	Incident Log Incident Action Plan/s
	NEBA	An operational NEBA will be undertaken for each operational period of the incident	NEBA Incident Action Plan

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9 Source Control Plan

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

For major hydrocarbon release incidents at Ningaloo Vision facilities, the Ningaloo Vision Incident Response Plan (TV-22-IF-00005) outlines 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 Shipboard Oil Pollution Emergency Plan (SOPEP), the SOPEP will provide the relevant initial actions to control the source of the spill.

For the ongoing response to a production well leak incident, the Santos Offshore Source Control Planning and Response Guideline (DR-00-ZF-10001) 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 Ningaloo Vision Incident Response Plan (TV-22-IF-00005), Vessel SOPEP and Source Control Planning and Response Guideline (DR-00-ZF-10001), where applicable, will provide a higher level of detail for specific incidents.

9.1 Spills from Refuelling, Cargo Loading or FPSO Topside Equipment Failure

Table 9-1 provides the environmental performance outcome, initiation criteria and termination criteria for source control of spills from refuelling, cargo loading or FPSO topside equipment failure. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-1: Refuelling, Cargo Loading or FPSO Topside Release – Source Control Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Notification of a spill		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	X
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.** All refuelling operations will comply with Ningaloo Vision Bunkering Operation Procedure (NV-91-IG-10006.03). For Coniston, Novara and Van Gogh crude oil export (from FPSO to tanker) offtake activities will take place in line with the Ningaloo Vision Offtake Operational Procedure (NV-91-IG-10010.03).

During bunkering and cargo loading activities, pipe/hose rupture, coupling failure, or tank overfilling can cause unplanned hydrocarbon release. Once the leak is detected, pumps will be turned off and bunkering/ cargo loading will cease as per the Ningaloo Vision Incident Response Plan (TV-22-IF-00005). The hydrocarbon remaining in the transfer line may escape to the environment as well as any hydrocarbon released prior to the transfer operation being stopped.

If a rupture or leak occurs in the topside processing equipment, subsea and topside valves will be shut off and production will cease in accordance with the Ningaloo Vision Incident Response Plan (TV-22-IF-00005). Shut off valves are regularly serviced and tested to ensure they will work properly if required. Released oil will be captured in the FPSO's bunding system, which have closed drainage systems that can deliver drainage water (which may contain hydrocarbon contamination) to a designated storage tank. The FPSO also has a closed drainage system for capture of leaks or vessels on the vessel. The mitigation measures to be followed include:

+ Pumping/processing operations ceased immediately following the spill;
+ System receiving product is immediately shut down following a spill;
+ Drainage network is closed as soon as practicable following the spill to prevent discharge to the ocean;
+ Recover hose and identify leak;
+ Make necessary repairs;
+ Use spill kit to clean-up spills on the vessel; and
+ Store any clean up waste in bunded area for onshore disposal.

Sorbent materials will be used from spill kits on-board the vessel to mop up hydrocarbon on deck. Soiled sorbent materials will be bagged and disposed to shore as a controlled waste. Fluids collected on the FPSO are processed and treated to meet the OIW content specification of < 30 mg/l prior to discharge. Areas used for the permanent or temporary storage of bulk fuels and/or chemicals are fully bunded with deck drainage sealed (secondary containment) to prevent accidental discharges to the ocean. Bunding located beneath the refuelling hose connections, operational equipment, fuel tanks on the supply vessel and closed drains on the FPSO will isolate a spill that falls in these areas from the marine environment.

Section 9.4.2 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 9-2: Implementation Guidance – Refuelling, Cargo Loading or FPSO Topside Release

Action		Consideration	Responsibility	Complete
Initial Actions	In the event of a loss of production hydrocarbons from FPSO topside production equipment, consult the Ningaloo Vision Incident Response Plan (TV-22-IF-00005)		Facility On Scene Commander	❑
	For refuelling and chemical transfers between support vessels and between support vessels and offshore platforms, consult the Refuelling and Chemical Management Standard (QE-91-IQ-00098)	+ For spills during pumping operations, pumping activity to cease immediately; + Isolation of damaged, leaking equipment; + Where drainage is open to the marine environment, drainage is to be isolated as soon as practicable following the spill to prevent discharge to the ocean (the Vessel Master or On-scene Commander will confirm that the drainage network is closed on the vessel before washing down the deck after excess oil has been cleaned up); + Use of onsite spill kit resources (i.e. sorbent material) to clean-up spills; + Recovery of dropped container where practicable, where containers of hydrocarbons are dropped during vessel to platform transfers; + Disposal of contaminated waste to licenced waste contractor; and + Isolation and repair of damaged, leaking equipment.	Vessel Master/ Facility On Scene Commander	❑

9.2 Hydrocarbon Storage or Fuel Tank Rupture

Table 9-3 provides the environmental performance outcome, initiation criteria and termination criteria for source control response of a hydrocarbon storage or fuel tank rupture. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-3: Fuel Tank Rupture – Source Control Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Level 2/3 incident (to be determined by On-Scene Commander)		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	The cargo in the ruptured fuel or storage tank is secured and release to the marine environment stopped		

9.2.1 Implementation Guidance

Implementation guidance is summarised in **Table 9-4.** In the event hydrocarbon (Diesel, Van Gogh crude or HFO) is released from a vessel (including FPSO or offtake tanker) due to a ruptured fuel tank, the relevant vessel specific procedures will be applied. For offtake tankers and 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.

For vessel collision involving the Ningaloo Vision FPSO the Ningaloo Vision SOPEP (NV-00-ZF-100001) and Ningaloo Vision Incident Response Plan (TV-22-IF-00005) will be followed.

Section 9.4.2 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

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Table 9-4: Implementation Guidance – Fuel Tank Rupture

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

9.3 Subsea Flowline Rupture

Table 9-5 provides the environmental performance outcome, initiation criteria and termination criteria for this source control strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 9-5: Subsea Flowline Rupture – Source Control Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Subsea flowline rupture or leak		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	X	✔	X
Termination criteria	The cargo in the ruptured subsea flowline has been isolated and release to the marine environment stopped		

9.3.1 Implementation Guidance

The implementation guidance is found in **Table 9-6.**

Section 9.4.2 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Equipment

Where safe to do so, an inspection class ROV will be mobilised to visually identify any subsea incident location. Inspection class ROV's are readily available in Western Australia, although the suitability of any particular ROV will be dependent on conditions at the incident site, e.g. water depth, metocean conditions, prevailing weather.

Typically an ROV could be available for deployment from a WA port within 2-14 days.

An alternative third party vessel could be available within 3-21 days depending on the specification required to work at the subject location.

Personnel

Supervisory personnel required for any vessel deployment are to be sourced from Santos WA's Perth or Ningaloo Operations team and local contract personnel. A minimum competency and experience, appropriate to the task, will be assessed by the IMT prior to undertaking the task.

Table 9-6: Implementation Guidance – Subsea Flowline Rupture

Action		Consideration	Responsibility	Complete
Initial Actions	In the event of a subsea flowline rupture or leak, consult the Ningaloo Vision Incident Response Plan (TV-22-IF-00005)		On Scene Commander	❑
	The IMT will initiate a site survey within 24 hours of the incident being detected that will collect relevant site specific information. Reasoned responses will be initiated when the assessment is complete.	Variables to be considered in the assessment are: + Flowline construction, including presence of mechanical fittings, in-line valves/manifolds; + Flowline contents composition; + Flowline inventory volume; + Flowline operational history; + Pressure & temperature; + Location of leak, proximity to topside structures, other subsea assets; + Opportunities to visually identify leak site; + Topography; + Inventory displacement by produced formation water (or inert fluid), e.g. treated or raw seawater, nitrogen.	Incident Commander	❑
Ongoing actions	The IMT will collate, assess and handover above information to Facilities Engineering Manager. Santos WA engineers will devise a solution and a project team will be assigned to implement the recovery and repair phase(s) using the engineering solution.		Incident Commander	❑

9.4 Production Well Leak

Table 9-7 provides the environmental performance outcome, initiation criteria and termination criteria for controlling the source of a production well leak.

Table 9-7: Production Well leak - Source Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment		
Initiation criteria	Production Well leak		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	X	✔	X
Termination criteria	The primary well is contained and killed to prevent any further release of hydrocarbon to the environment.		

A spill of up to a maximum of 10,236 m^3 is assessed as credible from a Ningaloo Vision production well.

9.4.1 Emergency shutdown

The FPSO's ESD System (refer Ningaloo Vision Well Operations Management Plan (WOMP) (DR-91-ZG-10048) is in place to isolate and limit the loss of hydrocarbons from a subsea well control incident. The Ningaloo Vision Incident Response Plan (TV-22-IF-00005) outlines first strike actions, including emergency shut-downs, for subsea oil spill incidents. As per the Ningaloo Vision Operations Safety Case (TV-9T-RF-007) the gas lift system is to be isolated and depressurised following isolation and depressurisation of hydrocarbons.

9.4.2 Relief Well Implementation Guidance

Relief well drilling is the primary source control strategy to control a well leak at Van Gogh, Coniston and Novara subsea wells that cannot be controlled through onsite systems. For all production well leak events, the installation of a subsea Capping Stack is not considered applicable (refer **Table 6-7**).

The Source Control Planning and Response Guideline (DR-00-ZF-10001) outlines the overarching process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well.

A high level summary of relief well Implementation actions is provided in **Table 9-8.**

Table 9-8 : Implementation Guidance – Production well leak

Action		Responsibility	Complete
Initial Actions	Implement the Source Control Planning and Response Guideline (DR-00-ZF-10001)	IMT Drilling Team Leader	❑
	Notify Santos WA Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations	IMT Drilling Team Leader	❑
	Notify well control service provider personnel for mobilisation	IMT Drilling Team Leader and Drilling & Completions Source Control Team	❑
	Source MODU through nearby drilling operations if available or procure from nearest operator through mutual aid agreement MOU.	Drilling & Completions Source Control Team	❑
	Design Relief Well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel prior to MODU arrival on location	Drilling & Completions Source Control Team	❑
	Assess relief well equipment and personnel requirements. Procure and make ready	Logistics Team Leader	❑
	Deploy equipment and personnel to site to begin spud and drill	Drilling Team Leader	❑
Ongoing actions	Design Relief Well, using relief well pre-planning work, as applicable, and have prepared in time to procure equipment and personnel prior to MODU arrival on location	Drilling & Completions Source Control Team	❑
	Assess relief well equipment and personnel requirements. Procure and make ready	Logistics Team Leader	❑
	Deploy equipment and personnel to site to begin spud and drill	Drilling Team Leader	❑
	Monitor progress of relief well drilling and communicate to IMT	IMT Drilling Team Leader	❑

9.4.3 Relief Well Planning

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

+ SPE Calculation of Worst Case Discharge (WCD) 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; and
+ UKOG Relief Well Guidelines, Issue 2, 2013; this methodology is used to confirm a well complexity analysis and tailor required content for the Well Specific Source Control Plan to the appropriate level of detail.

The following campaign/ well specific source control plans have been developed for the Van Gogh, Coniston and Novara wells and contain relevant information that applies for relief well planning for a leak from any Ningaloo Vision production well:

+ Add Energy Blowout and Kill Study (2012) – includes Coniston & Novara relief well planning;
+ Schlumberger (SIS) VGA-4H Relief Well Plan (2016);
+ Van Gogh Infill Drilling Well Specific Source Control Plan (2018) (DR-00-ZF-10002);
+ VGA-4H (G1) Well Specific Source Control Plan; and
+ Van Gogh Infill Development Phase 2 Source Control Plan (2020).

These plans contain the following relief well planning information:

+ MODU mooring assessment for relief well drilling locations
+ MODU / key equipment requirements and availability
+ Relief well trajectory analysis and casing design
+ Dynamic kill simulation results

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

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

+ Rig name;
+ Rig contract status (Operator and contract duration);
+ Current location;
+ Maximum water depth capability;
+ Rig type (Floating vs jack-up; mooring type; Rig Design/Class);
+ Available drilling envelope;
+ BOP specifications;
+ BOP/LMRP connector specifications;
+ Mud pumps specifications/capability;
+ Choke and Kill line IDs;
+ Storage capability (i.e. diesel, base-oil, brine, drill-water, potable water, bulks); and

+ NOPSEMA safety case (yes/no).

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

A Safety Case Revision will be required for the relief well rig to undertake the activity; this cannot be submitted before the event. The Safety Case Revision will be based on existing documents, specifically the Safety Case Revision approved for the drilling of the original well and the Safety Case in force for the relief well rig. A Safety Case Revision would be submitted within 14 days from the production well leak, however the critical path time allowed for the actual writing of the document is 3 days. The remaining estimated time would be used for gathering post-event data, mobilising the workforce and conducting a HAZID. 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 HAZID.

9.4.4 Relief Well Schedule

An indicative relief well drilling schedule is provided in **Table 9-9.** This is based on control of the well by 11 weeks (77 days). This period is used as a base case well control timeframe by Santos WA across its wells and is based on indicative mobilisation durations, relief well planning and operations. It could take up to 34 days to have a MODU onsite ready to spud.

This time-line 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 DISC Source Control Response Industry (SCRI) Working Group. The SCRI working group is an APPEA DISC initiative which has been established to drive collaboration and continuous improvement in source control emergency response planning. The Working Group will explore and act on opportunities to align and strengthen the Titleholders' source control emergency response capability though "mutual aid" initiatives and drive continuous improvement by implementing fit-for-purpose and effective source control emergency response strategies.

For noting, while 77 days has been assessed as the time within which relief well drilling would be completed well leak spill modelling conducted to inform risk assessment and spill response planning has been based on a more a more conservative 100-day relief well drilling period to remain consistent with previous revisions of the EP and OPEP.

Table 9-9: Schedule for MODU arriving onsite

Production well leak		
Task	**Duration (in days)**	**Controls**
Event reported – begin mobilisation of rig for relief well drilling	1	+ On-site communications + Active IMT on call including Operations/Drilling Team Lead
Relief well MODU confirmed. Relief well MODU suspends operations and prepares to mobilise to relief well location.	10	+ Active IMT + Santos Offshore Source Control Emergency Response Plan (SCERP – DR-00-ZF-10001) + Regional MODU tracking + APPEA Memorandum of Understanding (MOU): Mutual Assistance
Continue preparations for relief well and rig mobilisation	21	+ Stood-up Relief Well Team (as per SCERP) + Pre-complete campaign specific source control plan complete with relief well study. + Relief Well Drilling specialists services contract (Wild Well Control) + Drilling services contracted + Pre-verified access to relief well equipment (e.g. casing and wellhead) + APPEA Memorandum of Understanding (MOU): Mutual Assistance
Rig mobilisation to well offset location (dependent on current and prevailing weather)	2	+ Vessel and rig move services contracted
Total days prior to arrival, ready to spud/commence relief well operations	**34**	
Total days from incident notification to well kill	**77**	

9.5 Environmental Performance

Table 9-10 indicates the Environmental performance outcomes, controls and performance standards for the Source Control response strategy.

Table 9-10 Environmental Performance – Source Control

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Response Preparedness		
Source control – relief well drilling	Source Control Planning and Response Guideline (DR-00-ZF-10001)	The Source Control Planning and Response Guideline (DR-00-ZF-10001) is in place and up to date during the activity	Source Control Planning and Response Guideline (DR-00-ZF-10001)
	MODU Capability Register	A MODU Capability Register is maintained during the activity	Rig Capability Register
	Arrangements for source control emergency response personnel	Arrangements for access to source control personnel are maintained during the activity	Contract/MoUs for source control personnel
Source control - vessel collision	Vessel Spill Response Plan (SOPEP/SMPEP)	Support vessels have a shipboard oil pollution emergency plan (SOPEP) or shipboard marine pollution emergency plan (SMPEP) that outlines steps taken to combat spills	Audit records. Inspection records
		Spill exercises on support vessels are conducted as per the vessels SOPEP or SMPEP	Spill exercise close out reports
	Response Implementation		
Source control – relief well drilling	Drilling and Completions Source Control Team	Drilling and Completions Source Control Team mobilised within 24 hours of production well leak	Incident Log
	Equipment/Services for Relief Well drilling	Equipment/Services for Relief Well drilling sourced within 5 days of production well leak	Incident Log
	Well Control Specialists	Well control specialists mobilised within 72 hours of production well leak	Incident Log

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Relief Well MODU	MODU for relief well drilling to be onsite by Day 34 from the start of a well release.	Incident Log
	Relief Well	Relief well completed within 77 days of well leak incident	Incident Log
	Source Control Planning and Response Guideline (DR-00-ZF-10001)	Relief well drilling implemented in accordance to the Source Control Planning and Response Guideline (DR-00-ZF-10001) during a production well leak	Incident Log
Source control - vessel collision	As per the vessel SOPEP	Actions to control spill associated with a vessel incident followed in accordance with SOPEP	Vessel logs
Source Control – production well and pipeline/flowline	Ningaloo Vision Incident Response Plan (NV IRP) (TV-22-IF-00005)	Actions to control loss of containment from production well/ flowline are in accordance with the relevant facility incident response plan	Incident log

10 Monitor and Evaluate Plan

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

+ Vessel surveillance;
+ Aerial surveillance;
+ Tracking buoys;
+ Oil spill trajectory modelling;
+ Satellite imagery;
+ Initial oil characterisation;
+ Operational water quality monitoring; and
+ Shoreline assessments.

10.1 Vessel Surveillance

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

Table 10-1: Vessel Surveillance – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Initiation criteria	Notification of a Level 2/3 spill - may be deployed in a Level-1 incident (to be determined by On-Scene Commander)		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
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 the FPSO and field support or other vessels can be used to assess the location and visible extent of the hydrocarbon incidents, and to verify modelling predictions and trajectories. Due to the proximity of observers to the water's surface, vessel surveillance is limited in its coverage in comparison to aerial surveillance and may also be compromised in rough sea state conditions or where fresh hydrocarbons at surface poses safety risks.

10.1.1 Implementation Guidance

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

Section 10.9 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-2: Implementation Guidance – Vessel Surveillance

	Action	Consideration	Responsibility	Complete
Initial Actions	Notify nearest available Support Vessel to commence surveillance	Current Santos WA on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page	On-Scene Commander Operations Lead	❑
	Source additional contracted vessels if possible need for assistance		Logistics Team Leader	❑
	Record surface slick location and extent, weather conditions, and marine fauna. Complete vessel surveillance forms, located in **Appendix E** and provide to On-Scene Commander (Level 1 spills) or IMT (Level 2-3 spills)	Photographic images are to be taken where possible and included with surveillance forms Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT	Vessel Observers	❑
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick to the IMT within 60 minutes of completing vessel surveillance	Initial reports to the IMT may be verbal (followed by written transmission) if the vessel is out of range or has no facilities for transmitting forms	Vessel Master and/or On-Scene Commander	❑
Ongoing Actions	Review surveillance information to validate spill fate and trajectory		Planning Team Leader/ GIS	❑
	Use available data to conduct operational NEBA and confirm that pre-identified response options are appropriate		Environment Unit Lead	❑

Action		Consideration	Responsibility	Complete
	Use monitor and evaluate data to periodically reassess the spill and modify the response (through the IAP), as required	Surveillance data is useful in updating the Common Operating Picture	Planning Section Chief	❑

Table 10-3: Vessel Surveillance Resource Capability

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

Table 10-4: Vessel Surveillance – First Strike Response Timeline

Task	Time from IMT call-out
IMT begins sourcing Santos contracted vessel or vessel of opportunity (VOO) for on-water surveillance	<90 minutes
VOO onsite for surveillance	<12 hours (daylight dependent)
Minimum Resource Requirements	
1x vessel. No specific vessel or crew requirements.	

10.2 Aerial Surveillance

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

Table 10-5: Aerial Surveillance – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Initiation criteria	Notification of a Level 2/3 spill		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	+ Aerial surveillance undertaken at scheduled intervals during daylight hours and continues for 24 hours after the source is under control and a surface sheen is no longer observable; OR + As directed by the relevant Control Agency		

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

10.2.1 Implementation Guidance

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

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-6: Implementation Guidance – Aerial Surveillance

Action		Consideration	Responsibility	Complete
Initial Actions	Contact contracted aviation provider- provide details of incident and request mobilisation to spill site for initial surveillance	If aviation asset is available near spill location, utilise where possible to gather as much information about the spill. If aviation asset not available at spill location IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met prior to deployment. There should be an attempt to obtain the following data during initial surveillance: + name of observer, date, time, aircraft type, speed and altitude of aircraft + location of slick or plume (GPS positions, if possible) + spill source + size of the spill, including approximate length and width of the slick or plume + visual appearance of the slick (e.g. colour) + edge description (clear or blurred) + general description (windrows, patches etc.) + wildlife, habitat or other sensitive receptors observed	Operations Team Leader Logistics Team Leader	❑

	Action	Consideration	Responsibility	Complete
		+ basic metocean conditions (e.g. sea state, wind, current) + photographic/video images		
	Source available Santos WA Aerial Observers, arrange accommodation/logistics and deploy to Forward Operations/ Air base location.	Santos WA Aerial Observer list available from First Strike Resources on Santos Offshore ER Intranet page	Operations Team Leader Logistics Team Leader	❑
	Develop flight plan (frequency and flight path) to meet IMT expectations and considering other aviation ops. Expected that 2 overpasses per day of the spill area are completed.	Flying time to the Ningaloo Vision FPSO is 25 minutes each way from Exmouth and 70-80 minutes from Karratha. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks	Operations Team Leader Aviation Superintendent	❑
	Pre-flight briefing		Aerial Observers Contracted aircraft provider/ pilots	❑
	Aerial Observers to commence surveillance	Consider procedure for interacting with marine fauna	Operations Team Leader	❑
	Determine the spill extent by completing Aerial Surveillance Log (**Appendix F**) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (**Appendix G**). Take still and/or video images of the slick	Thickness estimates are to be based on the Bonn Agreement Code (Santos WA Procedure Index)	Aerial Observer	❑
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix H**)		Aerial Observer	❑
	Record shoreline habitat type and degree of oiling by completing the Shoreline Aerial Reconnaissance Log (**Appendix I**)	Thickness estimates are to be based on the Bonn Agreement Code (Santos WA Procedure Index)	Aerial Observer	❑

Action		Consideration	Responsibility	Complete
	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT	Where possible, a verbal report via radio/telephone en-route providing relevant information should be considered if the aircraft has long transits from the spill location to base	Aerial Observer Planning Team Leader Operations Team Leader	❑
Ongoing Actions	Update flight schedule for ongoing aerial surveillance as part of broader Aviation Subplan of IAP	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	Operations Team Leader / Aviation Superintendent Planning Team Leader	❑
	Mobilise additional aircraft and trained observers to the spill location to undertake ongoing surveillance activities		Logistic Team Leader	❑
	Update common operating picture with surveillance information and provide updates to spill trajectory modelling provider		Planning Team Leader GIS Team Leader	❑

Table 10-7: Aerial Surveillance Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Rotary Wing Aircraft & flight Crew	Santos WA contracted provider/s (primary provider currently Babcock)	2 contracted (1 primary + 1 back-up) + additional as required	Karratha (primary base) Learmonth Onslow	Wheels up within 1 hour for Emergency Response. Spill surveillance <6 hours (daylight dependent)
Aerial Surveillance Crew	Santos aerial observers AMOSC Industry Mutual aid	7 x Santos 7 AMOSC staff 5 AMOSC Core Group 54 Additional trained industry personnel	Perth & VI (Santos aerial observers) Australia wide	Santos trained personnel - next day mobilisation to airbase <24 hours
Drones and pilots ** secondary response to assist shoreline and vessel-based surveillance	AMOSC OSRL- 3rd Party UAV provider Local WA hire companies	2 2 x Qualified remote pilots, however response is on best endeavour 10+	Geelong Perth Perth and regional WA	<48 hours OSRL - depending on the port of departure, 1-2 days if within Australia

Table 10-8: Aerial Surveillance – First Strike Response Timeline

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

10.3 Tracking Buoys

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

Table 10-9: Tracking buoys – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

10.3.1 Implementation Guidance

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

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

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-10: Implementation Guidance – Tracking Buoys

	Action	Consideration	Responsibility	Complete
Initial Actions	Organise vessel to mobilise 2 x tracking buoys from NV FPSO to the spill site (if FPSO onsite) or organise vessel to deploy 2x tracking buoys from Exmouth (if FPSO in shipyard)	Personnel and vessel safety is priority Current Santos WA on hire vessels or Vessels of Opportunity (VOO) can be used. AIS vessel tracking is available through ER intranet page.	On-scene Commander/ Operations Team Leader	❑
	Deploy 2x tracking buoys at leading edge of slick.	Note deployment details and weather conditions in incident log	Vessel Master	❑
	Inform IMT that tracking buoys have been deployed and provide deployment details. Monitor movement of tracking buoys	Refer login details of tracking buoy monitoring website on Santos WA ER intranet site	On-Scene Commander Planning Team Leader/ GIS	❑
	Use tracking buoy data to maintain Common Operating Picture	Data tracked online	IMT Planning Team Leader/ GIS	❑
	Relay information to spill fate modelling supplier for calibration of trajectory modelling		IMT Planning Team Leader/ GIS	❑
Ongoing Actions	Assess the need for additional tracking buoys in the spill scenario and identify/nominate preferred deployment locations.	Incident Action Plan to provide guidance regarding any additional deployments of tracking buoys	Planning Team Leader	❑
	Mobilise additional tracking buoys if required from other Santos WA operations (Santos WA presently has 12 Tracker Buoys located on the NWS) or from AMOSC stockpiles		Logistics Team Leader	❑
	Direct the deployment of the Tracker Buoys – for continuous releases over multiple days use a rolling deployment/collection of buoys to provide better coverage of plume direction		Operations Team Leader	❑

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

Table 10-11: Tracking Buoys Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Tracking buoys x 12	Santos	2 2 4 6	Ningaloo Vision Exmouth (when NV in shipyard) Varanus Island Dampier	NV buoys (when NV onsite) - <4 hours for NV incident Exmouth buoys (when NV in shipyard) - <12 hours pending vessel availability VI/ Dampier buoys - 24-48 h pending vessel availability
AMOSC tracking buoys	AMOSC	12 AMOSC	Broome x 2 Fremantle x 6 Geelong x 4	Response via duty officer within 15 minutes of first call- AMOSC personnel available within 1 hour of initial activation call. Equipment logistics varies according to stockpile location. (refer to Table 10-12)

Table 10-12: AMOSC Equipment Mobilisation Timeframes

	Perth	Darwin	Exmouth	Dampier	Broome
Geelong	40 hrs 3395 km	44 hr 3730 km	64 hrs 4520 km	70 hrs 4840 km	68 hrs 4970 km
Perth	NA	48 hrs 4040 km	15 hrs 1250 km	19 hrs 1530 km	27 hrs 2240 km
Exmouth	15 hrs 1250 km	38 hrs 3170 km	NA	7 hrs 555 km	16 hrs 1370 km
Broome	27 hrs 2240 km	22 hrs 1870 km	16 hrs 1370 km	11 hrs 855 km	NA

Table 10-13: Tracking Buoy – First Strike Response Timeline

Task	Time from IMT call-out
Tracking buoys deployed from Ningaloo Vision FPSO (NV onsite only)	<4 hours
OR	
Tracking buoys deployed from Exmouth (if NV in shipyard) using vessel of opportunity	<12 hours
Minimum Resource Requirements	
• 2x tracking buoys for initial deployment	

10.4 Oil Spill Trajectory Modelling

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

Table 10-14: Oil Spill Trajectory Modelling – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

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

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

10.4.1 Implementation Guidance

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

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

lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-15: Implementation Guidance – Oil Spill Trajectory Modelling

Action		Consideration	Responsibility	Complete
	Initiate oil spill trajectory modelling (OSTM) by submission of an oil spill trajectory modelling request form (Santos WA Procedure Index). Request for 3-day forecast trajectory modelling.		Environment Team Leader	❑
	Determine requirement for gas/VOC modelling and request initiation	hydrocarbon releases have human health and safety considerations for responders (volatile gases and organic compounds). This to be considered for any tactics that monitor/recover oil – especially at close proximity to release site.	Safety Team Leader Environmental Team Leader	❑
	Operational surveillance data (aerial, vessel, tracker buoys) to be provided to modelling rpovider to verify and adjust fate predictions of the spill and improve predictive accuracy		Planning Team Leader/ GIS	❑
	Login to the RPS Group data sharing website and maintain connection. Download modelling results.	Data should be stored digitally and backed up on to independent digital storage media. All datasets should be accompanied by a metadata summary and documented QA/QC procedures	Planning Team Leader/ GIS	❑
	Place RPS Group modelling data into GIS/ Common Operating Picture	RPS Group is to provide at least daily updates to the IMT of trajectory model outputs to inform response planning. More frequent updates can be provided if weather conditions are highly variable or change suddenly	Planning Team Leader/ GIS	❑
	In the event that chemical dispersants are considered applicable strategy for spill scenario, request modelling provider to model how dispersant addition effects the distribution and	Planning and Operations to provide inputs for modelled simulation based on potential/planned dispersant operations. – Outputs from dispersant addition modelling to inform NEBA.	Planning Team Leader Operations Team Leader	❑

Action		Consideration	Responsibility	Complete
	concentration of floating oil, subsea oil and shoreline loading			
	Identify location and sensitivities at risk based on the trajectory modelling and inform IMT. Conduct NEBA on proposed response strategies.		Environment Team Leader	❑
Ongoing Actions	Request spill trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture		Planning Team Leader/ GIS	❑
	Use results from other monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input data (if or when available) to improve model accuracy		Planning Team Leader/ GIS	❑

Table 10-16: Oil Spill Trajectory Modelling Resource Capability

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

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Table 10-17: Oil Spill Trajectory Modelling (OSTM) – First Strike Response Timeline

Task	Time from IMT call-out
RPS Oil Spill Trajectory Modelling (OSTM) activated by IMT	<2 hours
OSTM provided to IMT	<4 hours
Minimum Resource Requirements	
• Contracted OST modellers and software • OSTM Activation Form	

10.5 Satellite Imagery

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

Table 10-18: Satellite Imagery – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

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

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

10.5.1 Implementation Guidance

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

Section 10.9 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-19: Satellite Imagery Implementation Guide

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

Table 10-20: Satellite Imagery Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Satellite Imagery	KSAT- Activated through AMOSC GDS- Activated through OSRL	Dependent upon overpass frequency (TBC on activation)	Digital	KSAT: 1 hour- if satellite images available

10.6 Initial Oil Characterisation

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

Table 10-21: Initial Oil Characterisation - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Initiation criteria	Notification of a Level 2 or 3 spill		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	+ Oil sample and analysis to terminate once enough data has been collected to profile the oil characteristics and dispersant amenability throughout weathering and to provide oil for toxicity testing; OR + As directed by the relevant Control Agency		

10.6.1 Overview

Given diesel and HFO are a common fuel type with known properties and Van Gogh, Coniston, Novara crude oil is a production hydrocarbon that has been previously assayed, the general physical and chemical characteristics of these hydrocarbons are known and have been presented in **Appendix A.** Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release.

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

10.6.2 Implementation Guidance

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

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

10.6.3 Oil Sampling and Analysis

Onsite dispersant testing

Using AMOSC dispersant shake test kits, samples of oil are to be tested by onsite vessels/crew for dispersant efficacy using the included dispersants by way of a simple shake test of efficacy. Photos of sample jars and observations are to be reported back to the IMT for evaluation. These tests are not a substitute for laboratory testing and test spraying but provide an early indication of efficacy on the oil and the relative effectiveness of the dispersants included within the test kits.

Laboratory analysis

Using onsite vessels of opportunity, oil samples (2L per sample) are to be taken daily where possible from fresh oil, and from the weathered oil locations and dispatched to a laboratory for analysis. Samples are to be collected for 14 days post release where oil is available for sampling.

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

A laboratory ecotoxicology assessment of Coniston and Novara crude oil with and without dispersants added has been previously conducted (refer **Appendix A**) and can be used to interpret oil spill trajectory and water quality monitoring results and inform the NEBA process. While properties of Van Gogh, Coniston and Novara crude oils have been shown to be similar and stable over time, further ecotoxicological assessment of oil in the event of an oil spill should be conducted where sufficient volumes of oil are available.

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

Table 10-22: Implementation Guidance – Initial Oil Characterisation

	Action	Consideration	Responsibility	Complete
Initial Actions	Source available vessels (on hire or VOO) for oil sampling.	Can be multi-tasked – e.g. for vessel surveillance or tracking buoy deployment	Operations Team Leader Logistics Team Leader	❑
	Source sampling equipment. Confirm sampling methodology Confirm laboratory for sample analysis Develop H&S requirements/ controls	Refer Table 10-23 for resource availability. Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure	Environment Team Leader Safety Team Leader	❑
	Vessel directed to sampling location	Sampling of oil at thickest part of slick – typically leading edge	Operations Team Leader	❑
	Vessel crew to undertake sampling and delivery of samples to Exmouth or Dampier for dispatch to laboratory. Environmental Team Leader to confirm analysis of oil with lab	Exmouth and/or Dampier Logistics personnel to assist with logistics of sending oil samples to laboratory for analysis	Operations Team Leader Environmental Team Leader Logistics Team Leader	❑
Ongoing Actions	Continue sample collection for 14 days post release where oil is available	Initial monitoring by crew of available vessels – Once mobilised to site Santos WA scientific monitoring provider to continue sampling of oil in conjunction with operational water quality monitoring once mobilised to site.	Operations Team Leader Environment Team Leader Logistics Team Leader	❑

Table 10-23: Initial Oil Characterisation - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Dispersant efficacy kits (shake test)	AMOSC/Santos WA	3	Exmouth, Varanus Island, Dampier	Within 12 hours
Oil fingerprinting kits	AMOSC/Santos WA	3	Exmouth, Varanus Island, Dampier*	Within 12 hours
Bulk oil sampling bottles	Intertek/Santos WA	As required	Perth Exmouth, Varanus Island, Dampier*	Within 12 hours
Santos contracted vessel providers - incl. Jetwave, Mermaid Marine, Bhagwan, Offshore Unlimited. Vessels of Opportunity identified through AIS vessel tracking system	Availability dependent upon Santos and Vessel Contractor activities. Santos on-hire vessels include Ningaloo Vision Supply Vessel and Varanus Island Field Support Vessel	Vessels mobilised from Exmouth, Dampier, Varanus Island or offshore location. Locations verified through AIS vessel tracking system	Pending availability and location. Expected within 12 hours.	Santos Contracted Vessel Providers - incl. Jetwave, Mermaid Marine, Bhagwan, Offshore Unlimited. Vessels of Opportunity identified through AIS Vessel Tracking
NATA accredited Laboratory/ personnel for analysis	Intertek	NA	Perth	24+ hrs
*oil sampling kits incl dispersant shake test kits and sample bottles for laboratory analyses are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier.				

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Table 10-24: Initial Oil Characterisation – First Strike Response Timeline

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

[1] oil fingerprinting kits and sample bottles for laboratory analyses are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier.

10.7 Operational Water Quality Monitoring

10.7.1 Operational Water Sampling and Analysis

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

Table 10-25: Operational Water Quality Sampling and Analysis - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

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

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

This monitoring is complimentary to scientific water quality monitoring (SMP1) delivered through the Oil Spill Scientific Monitoring Plan in terms of methodology and required skillset and can be provided through Santos WA's Scientific Monitoring Provider **(Section 18**).

10.7.1.1 Implementation guidance

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

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

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

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

Considerations for Operational Water Quality Sampling and Analysis	
	+ Analytical analysis of oil properties following laboratory evaluation; and + Final report detailing all data collected on oil properties throughout the monitoring program including relevant interpretation.

Table 10-27: Implementation Guidance - Operational Water Quality Sampling and Analysis

Action		Consideration	Responsibility	Complete
Initial Actions	Activate Santos WA Monitoring Service Provider for Operational Water Quality Monitoring		Environment Team Leader	❑
	Obtain spill trajectory modelling and provide to Monitoring Service Provider		Environment Team Leader Planning Team Leader GIS Support	❑
	Develop Monitoring Action Plan (Including Sampling and Analysis Plan) for operational water quality monitoring. Plan to also consider oil characterisation sampling (**Section 10.5**)– Monitoring Service Provider to take over this sampling once mobilised.	Sites to be selected using oil spill trajectory modelling and distribution of oil from surveillance tactics. Refer **Table 10-26** for considerations for Sampling and Analysis Plan	Monitoring Service Provider Environment Team Leader	❑
	Develop health and safety plan including potential exposure to volatile gases/VOCs	Refer Oil Spill Response Health and Safety Management Manual (SO-91-RF-10016)	Monitoring Service Provider Safety Team Leader	❑
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment		Monitoring Service Provider	❑
	Organise Vessels, accommodation and transport requirements to mobilise monitoring team/s to site	Monitoring Service provider to outline requirements in resource request form	Logistics Team Leader	❑
	Sampling and analysis undertaken. Daily communication and confirmation of sampling plan with On-scene commander and IMT. Daily activity/data reports provided to IMT. Oil/water samples dispatched to nominated laboratories for analysis.		Monitoring Service Provider On-scene Commander Operations Team Leader Environment Team Leader Logistics Team Leader	❑

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

Table 10-28: Operational Water Quality Sampling and Analysis - Resource Capability

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

Table 10-29: Operational Water Quality Sampling and Analysis – First Strike Response Timeline

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

10.7.2 Continuous Fluorometry Surveys

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

Table 10-30: Continuous Fluorometry Surveys - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

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

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

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

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

10.7.3 Implementation Guidance

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

Section 10.9 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-31: Continuous Fluorometry Surveys – Implementation Guidance

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

Action		Consideration	Responsibility	Complete
		Appendix F of CSIRO oil spill monitoring handbook provide standard operating procedures for monitoring dispersant effectiveness using fluorometry equipment.		
Ongoing Actions	Provide daily data reports and spatial outputs IMT		Monitoring Provider	❑
	Monitoring results to be incorporated into Common Operating Picture		Planning Team Leader GIS Support	❑

Table 10-32: Continuous Fluorometry Surveys - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Towed fluorometers	OSRL	Towed Fluorometers: 7 x Turner C3 fluorometers globally	4 in Southampton, 2 in Singapore and 1 in Fort Lauderdale	<72 hours
Glider mounted fluorometers	OSRL	Subsea glider: Qty subjected to availability from OSRL contractor - 1 engineer from OSRL contractor to deploy and operate the Glider.	Gliders based in Perth OSRL towed fluorometers out of Singapore, Southampton and Fort Lauderdale	<72 hours dependent upon availability
Water quality monitoring personnel to operate towed fluorometers	Monitoring Service Provider (currently Astron/BMT)	approx. 15 (based on capability reports)	Perth based	<72 hours
Glider (remote) pilot/s and deployment crew	Third-party provider via OSRL	Subsea glider: Qty subjected to availability from OSRL contractor - 1 engineer from OSRL contractor to deploy and operate the Glider.	Perth based pilot and deployment crew	<72 hours dependent upon availability

Table 10-33: Operational Water Quality Sampling and Analysis – First Strike Response Timeline

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

10.8 Shoreline and Coastal Habitat Assessment

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

Table 10-34: Shoreline and Coastal Habitat Assessment - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	As directed by the relevant Control Agency		

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

DoT are the designated Control Agency for shoreline response for all spills identified in this OPEP and will direct resources provided through Santos WA for the purposes of on-ground shoreline assessments and shoreline response activities. Santos WA will provide additional information on shoreline character and oiling collected as part of aerial surveillance activities carried out under its control (refer **Section 10.2**).

Existing shore sensitivity mapping along the Ningaloo Coastline has been conducted by Santos WA in partnership with other companies and AMOSC. This information is available on the Santos WA ER Intranet site.

10.8.1 Implementation Guidance

The information provided below is included for planning purposes and represents how Santos WA would approach shoreline assessments. In the event of a spill with the potential for shoreline contact, DoT, will control shoreline assessments and ultimately personnel supplied through Santos WA will follow the direction of DoT; this may differ from that included below.

DoT provides guidance on shoreline assessments within their Oil Spill Contingency Plan.

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

The implementation guide for Shoreline and Coastal Habitat and Assessment is found in **Table 10-36**.

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

Table 10-39 lists the Environmental Performance Standards and Measurement Criteria for this strategy.

Table 10-35*:* Shoreline and Coastal Habitat Assessment Considerations

Considerations for Shoreline and Coastal Habitat Assessment	
Survey design	A shoreline assessment may include the following tasks: 1. Assessment of shoreline character, habitats and fauna including: + Shoreline structured biotic habitats + Distribution of fauna + Shoreline and processes (e.g. Wave , tidal flows + Shoreline substrate (e.g. Mud, sand, pebble, rock) + Shoreline form (e.g. Width, shape and gradient) + Access/ safety constraints 2. Assessment of shoreline oiling (if present): + Surface distribution and cover + Subsurface distribution + Oil type, thickness, concentration and physical character + Sampling of oil for laboratory analysis 3. Recommendations for response; + Applicable strategies based on oil type and habitat + Potential access, safety and environmental constraints + Likely resourcing (personnel and equipment) requirements Ground surveys undertaken on foot, by vehicles or by small vessel will occur at prioritised areas to provide a close range assessment of shoreline physical characteristics, coastal habitats/fauna, scale and character of oiling and safety/ access constraints. Ground surveys should be undertaken by trained shoreline clean-up specialists and other trained oil spill responders as per those required for managing shoreline clean-up operations. This includes the use of AMOSC Core Group personnel across industry and State and National Response Teams as provided for under MEE and NatPlan. The deployment of ground survey teams will be directed by DoT as the Hazard Management Agency (HMA) and Control Agency for coastal/ shoreline pollution in WA. The deployments will be informed by the observed and predicted contact of oil and from existing baseline information on shoreline character. Shoreline surveys will be undertaken within segments that are recorded and/or mapped that share common traits based on coast geomorphology, habitat type, fauna presence, level of oiling or access. Information on shoreline character and habitat/fauna distribution for each segment should be recorded through the use of the following techniques: + Still or video imagery collected with simultaneous GPS acquisition + Field notes together with simultaneous GPS acquisition + Mud maps outlining key natural features, oil distribution, imagery locations of quantitative data (transects, oil samples) + Transects (cross-shore, longshore) and vertical sediment profiles. + Samples of oil and/or oiled sediments.

Considerations for Shoreline and Coastal Habitat Assessment	
	The following parameters should be assessed: + Physical characteristics: rocky, sandy beach, flat, dune, other wetland + Major habitat types: mangrove, salt marsh, saltpan flats, fringing reef, rubble shore, seagrass verge + Coastal fauna and key habitats (e.g. Nests) including quantification/ distribution of oiled fauna. + State of erosion and deposition: deposition, erosion, stable + Human modified coastline (access tracks, facilities etc) + Oil character, if present, including appearance, surface thickness, depth (into sediments), distribution, area and percentage cover.
Analysis and reporting	Shoreline survey reports to be submitted to the Control Agency IMT at completion of assessments. All raw data collected will be included as appendices to the report and provided in a geospatial format for subsequent use in GIS mapping software.

Table 10-36: Shoreline and Coastal Habitat Assessment – Implementation Guidance

	Action	Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Section 7** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for assistance in identification of priority protection areas and NEBA.	Existing shoreline sensitivity mapping information for the Ningaloo Coastline is available on the Santos WA ER intranet site.	Environment Team Leader Planning Team Leader	❑
	Actions below are indicative only and are at the final determination of DoT as the Control Agency			
	Mobilise the AMOSC core group responders as required for industry support to DoT	Refer to **Table 10-37**	Incident Commander Operations Team Leader Logistics Team Leader	❑
	Assessment of shoreline character, habitats and fauna.	Refer to **Table 10-35**	AMOSC Core group and DoT	❑
	Assessment of shoreline oiling (if present).	Refer to **Table 10-35**	AMOSC Core group and DoT	❑
	Recommendations for response strategies.	Refer to **Table 10-35**	AMOSC Core group and DoT	❑

Table 10-37: Shoreline and Coastal Habitat Assessment - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos and WA industry AMOSC core group staff and responders	Santos Core Group Industry Core Group, AMOSC staff	12 (Santos core group) 60+ (industry core group ops)	Perth, Dampier, Varanus Island and other NW locations	<24 hours from time of shoreline contact prediction

Santos

Table 10-38: Shoreline Assessment – First Strike Response Timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction and begins sourcing personnel for shoreline assessment team	<4 hours
AMOSC core group (shoreline assessment personnel) mobilised to site	<24 hours
Minimum Resource Requirements	
• Minimum 2x AMOSC core group personnel	

Santos

10.9 Environmental Performance

Table 10-39: Environmental Performance- Monitor and Evaluate

Environmental Performance Outcome	Implementation monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Response preparedness		
Monitor and Evaluate – vessel and aerial surveillance	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	MSA with aircraft supplier	Master Services Agreement (MSA) in place with helicopter provider throughout activity	MSA with aircraft suppliers
	Santos WA trained Aerial Observers	Santos WA maintains a pool of trained aerial observers	Exercise Records Training Records
	AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Trained Aerial Observers	AMOSC Participating Member Contract
	Access to certified Unmanned Aerial Vehicles (UAV) providers	Maintenance of contract for access to UAV providers	Maintenance of contract with service provider
	Aircraft charter companies for fauna observations	Maintain a list of aircraft charter companies that could potentially provide fauna observation services	List of providers
	Response Implementation		
Monitor and Evaluate – vessel and aerial surveillance	Vessel surveillance	Minimum first strike resource requirements mobilised in accordance with **Table 10-4**	Incident log
		Daily observation reports submitted to IMT until termination criteria is met	Incident log

	Vessels and aircraft compliant with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003)	Vessels comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising the risk of collision with marine fauna	Completed vessel statement of conformance
		Aircraft comply with Santos's Protected Marine Fauna Interaction and Sighting Procedure (EA-91-11-00003) which ensures compliance with Part 8 of the Environment Protection and Biodiversity Conservation Regulations 2000 which includes controls for minimising interaction with marine fauna	Aircraft contractor procedures align with Santos's Protected Marine Fauna Interaction and Sighting Procedure
	Aerial surveillance	Minimum first strike resource requirements mobilised in accordance with **Table 10-8**	Incident log
		Following initiation two passes per day of spill area by observation aircraft provided	Incident log
		Trained Aerial Observers supplied from Day 2 of response	Incident log
		Flight schedules are maintained throughout response	Incident Action Plan
		Observers completed aerial surveillance	Aerial Observer Logs

		observer log following completion of flight	
	Response Preparedness		
Monitor and Evaluate – tracking buoys	Tracking buoys available	Maintenance of 12 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests
	Response Implementation		
Monitor and Evaluate – tracking buoys	Tracking buoy mobilisation	Minimum requirements mobilised in accordance with Table 10-11	Incident log
	Response Preparedness		
Monitor and Evaluate – oil spill modelling	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract
	Response Implementation		
Monitor and Evaluate – oil spill modelling	Oil spill modelling	Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill	Incident Log
		Modelling delivered to IMT within 2 hours of request to service provider	Incident Log
	Response Preparedness		
Monitor and Evaluate – satellite imagery	Satellite imagery	Contract in place with third party provider to enable access and analysis of satellite imagery	Contract with service provider
	Response Implementation		
Monitor and Evaluate – satellite imagery	Satellite imagery	Data incorporated into common operating picture and provided to spill modelling provider	Incident Log and Incident Action Plan
	Response Preparedness		

Monitor and Evaluate – oil and oil in water monitoring	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Entrained oil monitoring equipment and services	Maintenance of arrangements to enable access to fluorometry services throughout activity	Arrangement with provider of fluorometry equipment
	Water quality monitoring vessels	Maintenance of vessel specification for Water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil and water quality monitoring kits pre-positioned at Exmouth, Dampier and Varanus Island (prior to end of 2020)	Evidence of deployment to site
	Response Implementation		
Monitor and Evaluate – oil and oil in water monitoring	Initial Oil Characterisation	Minimum requirements mobilised in accordance with Table 10-20	Incident Log
		Oil samples sent to laboratory for initial fingerprinting	Incident Log
		If applicable oil samples sent to laboratory for dispersant amenability	Incident Log
		Oil samples to be sent immediately for laboratory ecotoxicity testing of oil	Incident Log
		90, 95 and 99% Species protection triggers levels will be derived from ecotoxicity testing results	Incident Log

		(minimum 5 species' tests) within 24 hours of receiving all results	
	Operational Oil and Oil in Water Monitoring	IMT activates monitoring service provider within 4 hours	Incident Log
		Operational water sampling and analysis surveys mobilised within 72 hours of approval	Incident Log
		Fluorometry surveys mobilised within 5 days of initiation	Incident Log
		Daily report including fluorometry results provided to IMT	Incident Log
	Response Preparedness		
Monitor and Evaluate – shoreline assessments	AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	Maintenance of AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders	AMOSC Participating Member Contract
	Response Implementation		
Monitor and Evaluate – shoreline assessments	Shoreline assessment	Minimum shoreline assessment requirements mobilised as per **Table 10-38**	Incident Log
		Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA	Incident Log
		Santos WA will make available AMOSC Core Group Responders for shoreline and coastal habitat assessment positions to the Control Agency	Incident Log
		Shoreline assessment reports provided to the IMT daily detailing the assessed areas to	Incident Log

		maximise effective utilisation of resources	
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation contained in IAP.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records assessment records
	Establish demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat.	Unless directed otherwise by the designated Control Agency (i.e. DoT) demarcation zones are mapped out in sensitive habitat areas.	IAP demonstrates requirement is met.
	Operational restriction of vehicle and personnel movement to limit erosion and compaction	Unless directed otherwise by the designated Control Agency (i.e. DoT) action plans for shoreline operations include operational restrictions on vehicle and personnel movement	IAP demonstrates requirement is met.

11 Containment and Recovery Plan

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

Table 11-1: 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 to reduce contact with protection priorities		
Initiation criteria	Notification of a spill		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	X	✔	✔
Termination criteria	+ NEBA is no longer being achieved; and + Agreement is reached with Jurisdictional Authorities to terminate the response		

11.1 Overview

Booms and skimming equipment can be used to create physical barriers on the water surface to contain and recover the oil to remove risk of oil contacting environmental, social and cultural sensitivities. This strategy is often used in the offshore environment in close proximity to the hydrocarbon source. Once contained, an attempt to recover the hydrocarbons from the surface waters can be undertaken.

Table 11-2 provides applicability criteria on when containment and recovery may be a suitable response option. Further definition of Bonn Agreement Oil Appearance Codes (BAOAC) is provided in **Table 13-2**.

Table 11-2: Containment and Recovery Application Criteria

Criteria	Recommended	Not Recommended
Spill characteristics	+ Patchy slick + Fresh or emulsified + Extended operations + Surface concentrations >50g/m^2 (Bonn Agreement Oil Appearance Code (BAOAC) of 4) at a minimum, 100g/m^2 (BAOAC of 5) is optimal	+ Situation dependent + Surface thickness <50 g/m^2 (BOAC <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

Criteria	Recommended	Not Recommended
Operating environment	+ Waves <1m for nearshore containment and recovery systems (Santos Expandi Boom) + Waves <1.8m for offshore systems (AMOSC/AMSA offshore boom) + Winds <25 knots	+ Wave heights exceed 1.8m + Current >0.75 knots

11.2 Implementation Guidance

Table 11-3 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 11-4** 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 containment and recovery operations are listed in **Table 11-5**. 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 11-3: Implementation Guidance – Containment and Recovery

	Action	Consideration	Responsibility	Complete
Initial Actions	***Containment and recovery***			
	Identify and activate containment and recovery equipment stockpiles based on incident location. Initial equipment mobilisation from Exmouth and Dampier	Refer for location of containment and recovery resources Initial deployment from Exmouth pending vessel availability Up to date stockpile information accessed through Santos WA Emergency Response Intranet Site	Logistics Team Leader Supply Team Leader Operations Team Leader	❑
	Identify suitable deployment vessels/crew. Mobilise resources port location – Exmouth and Dampier	Refer for location of containment and recovery resources Initial deployment from Exmouth pending vessel availability Preference will be for vessels and crew that are exercised in regular Santos WA booming exercises	Logistics Team Leader Supply Team Leader Operations Team Leader	❑
	Assess the spill trajectory modelling, other operational monitoring data to identify operational area for C&R deployments.	Refer to **Table 11-2** for guidance	Operations Team Leader Planning Team Leader	❑
	Confirm conditions are suitable for containment and recovery activities	Refer to **Table 11-2** for guidance	Operations Team Leader Planning Team Leader	❑

	Action	Consideration	Responsibility	Complete
	Mobilise deployment personnel to nominated marine bases	Each vessel conducting containment and recovery is to be manned with a trained AMOSC, Santos WA or OSRL Oil Spill Responder, who is the Team Leader tasked with controlling the operations and implementing in a safe and responsible method. The Team Leader has the responsibility of evaluating the effectiveness of the containment and recovery operations and communicating the information to the IMT Operations Team Leader	Operations Team Leader Logistics Team Leader	❑
	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 contain and recover activities to areas of slick of a sufficient thickness whereby contain and recover activities will be effective Refer to **Table 11-2** for guidance	Planning Team Leader Operations Team Leader	❑
	Direct containment and recovery operations to designated operational zones		Operations Team Leader	❑
	Decanting (if selected)			
	Obtain decanting approval from AMSA (Commonwealth waters) or DoT (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). This will increase the oil strong capacity of storage tanks.	Environment Team Leader	❑
	Ensure personnel onboard the vessels are familiar with decanting procedure approved by the relevant authority AMSA (Commonwealth waters) or DoT (WA waters)		Operations Team Leader	❑

Action		Consideration	Responsibility	Complete
	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	❑
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 if necessary through existing stockpiles	Operations Team Leader	❑
	Maintain operational zones and provide updates to Vessel Masters on most suitable locations for containment and recovery operations	Continue to utilise aerial surveillance data to inform the location of operational zones	Operations Team Leader	❑
	Develop waste transfer process to secondary vessels/barge to enhance C&R vessel operational time, reduce port visits for waste unloading and reduce contamination.	Consider location and size/ type of waste collection vessel/barge and 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 Team Leader Planning Team Leader Logistics Team Leader	❑

Table 11-4: Containment and Recovery - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos Expandi Boom (inshore/calm seas deployment) c/w accessories and powerpacks	Santos WA	Dampier container (2x 200 m booms + accessories) VI Containers 4 x 200 m boom and accessories	Dampier, Varanus Island	Within 12 hours (for Dampier or VI based deployment)
Santos Disc/Brush Skimmers (Desmi DBD16) (inshore/calm seas deployment) c/w hoses/powerpacks	Santos WA	2 (1 ea. Dampier and VI)	Dampier, Varanus Island	Within 12 hours (for Dampier or VI based deployment)
AMOSC Offshore containment and Recovery Boom AMOSC Heavy Oil Skimmers	AMOSC	RO Boom (200m) – 15 Current Buster Boom System - 1 Speed Sweep system - 1 LWS 500 Weir Skimmer -6 GT 185 Weir Skimmer	Exmouth – 2x, Fremantle - 6x Geelong – 7x Geelong – 1 Geelong – 1 Fremantle – 3, Geelong – 3 Exmouth - 1	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 Table 10-12)
AMSA Offshore containment and Recovery Boom AMSA Heavy Oil Skimmers	AMSA	RO Boom (200m) – 8 Vikoma Hi Sprint Boom – 4 LWS 500 Weir Skimmer – 8 DESMI Termite Skimmer -2	Karratha x 4; Fremantle x 4 Karratha x 2; Fremantle x 2 4 x Fremantle; 4 x Karratha 1 x Fremantle; 1 x Karratha	Access to National Plan equipment through AMOSC. Equipment. Logistics varies according to stockpile location (refer

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
				Table 10-12)
AMOSC offshore waste storage	AMOSC	Lancer Barges - 4 Deck Bladders - 5	Fremantle x 2; Geelong x 2 Fremantle x 2 Geelong x 3	Response via duty officer within 15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. Logistics varies according to stockpile location (refer Table 10-12)
AMSA offshore waste storage	AMSA	Vikoma Flexidam – 8 Canflex Sea Slug – 5 Vikom Frost Barge – 4 Covertex tow tank – 2	Fremantle x 4; Karratha x 4 Fremantle x 3; Karratha x 2 Fremantle x 2; Karratha x 2 Karratha x 2	Access to National Plan equipment through AMOSC. Logistics varies according to stockpile location (refer Table 10-12)
Liquid Waste Tanks	via North West Alliance contract	As required	Perth, Karratha	<24 hours
Offshore Containment & Recovery Vessels and crew Waste transfer vessels/barges	Santos contracted vessel providers. Preference for vessels used in Santos deployment exercises	Varies – check through vessel contractors/ Santos WA vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call.

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
				Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	From <12 hours (NW-based personnel) From <24 hours (Perth personnel)
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.

Table 11-5: Containment and Recovery (C&R) – First Strike Response Timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and begins sourcing C&R resources for applicable spills	<3 hours
Santos Offshore Core Group members mobilised to deployment port	<12 hours
C&R equipment (offshore boom/skimmer) mobilised to deployment port	<12 hours
Waste storage equipment mobilised to port	<24 hours
Suitable C&R vessels mobilised to port	<24 hours
AMOSC Staff / Industry Core Group mobilised to deployment port	<24 hours
C&R operation deployed to spill site (weather/daylight dependent)	<38 hours (weather/daylight dependent)*
Minimum Resource Requirements	
• Two suitable C&R vessels (1x boom deployment vessel + 1 tow vessel) - refer Santos Offshore ER Intranet for vessel specification • 200-400 m of offshore boom (AMOSC/ AMSA) • 1x offshore skimmer appropriate to heavy oil and operating conditions (e.g. large weir) • Waste storage (comprising towable bladder, IBCs, Iso-tanks, inbuilt vessel storage tanks or combination allowing for 30+ m^3 liquid waste volume storage) • 1-2 Santos Core Group responders • 4 AMOSC Industry Core Group / Staff including C&R Team Leader • PPE	

*assumes a 14-hour transit time to spill location by C&R vessels departing Dampier port and that weather/daylight allows operation to commence

11.3 Resource requirements

Containment and recovery is more effective when a sufficient oil thickness can be achieved by the containment booms (minimum of 50g/m^2), which is often limited to Group 3 and 4 (ITOPF) hydrocarbons. Whilst containment and recovery would not be suitable for Marine Diesel, it would be suitable for Van Gogh Crude and HFO. 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 (2015) has been used.

<u>Boom Encounter Rate (BER) Formula</u> = (Length of Boom (LB) x 0.3) x Velocity of vessel (knots/hr) x Thickness of slick (mm)

LB = assumed as 200m (based on typical available minimum boom lengths of 200m)

Velocity = 1 knot

Thickness of slick (Group IV) = 50g/m^2 or 0.047mm

Note: percentage cover is assumed to be 100% during initial stages of the operation

<u>BER = (300 x 0.3) x 1 x 0.047 = 4.2m^3 per operation/hour x 12 hours of operation = 30 m^3/operation/day</u>

An assessment of potential ongoing resource requirements for a continuous spill (subsea production well leak) has been undertaken using modelling results and a daily recovery rate of 30 m^3 for one C&R operation (assumed to comprise two vessels operating in a J-sweep formation) and using modelled daily mass of oil above a 50 g/m^2 assuming no other intervention to reduce the mass of oil on surface (i.e. dispersant application). For the purposes of the assessment one C&R operation is assumed to remove 30 tonnes of oil and assumes adequate storage receptacles in place. Results are presented in **Table 11-6**

Noting that this assessment is theoretical in nature and makes general assumptions on the effectiveness on C&R effectiveness with no concurrent dispersant operations, the C&R requirements for this scenario start at 3 operations (6 vessels) on average per day for the first week , doubling to 6 operations in the second week and remaining at 6 or less operations per day, with the exception of week 4 (8 operations), week 8 (13 operations) and week 11 (7 operations) (**Table 11-6**).

Based on the resource (personnel and equipment) capability available for containment and recovery operations (**Error! Reference source not found.**), these levels could be maintained through available booms, s kimmers and responder personnel. Vessel availability and the capacity to store and transfer oil volumes are key factors that could restrict ability to deploy operations and ability of operations to meet maximum recovery levels. Vessels may be tasked with dispersant spraying over containment and recovery operations if this is deemed more effective in meeting performance outcome of reducing floating oil volumes.

Short duration release scenarios where containment and recovery would be applied, i.e. vessel tank ruptures of crude oil and HFO, and flowline rupture of Van Gogh crude oil have also been modelled. These results indicate that oil thickness above 50 g/m^2, most suitable for containment and recovery operations, would be present only within the first 2-4 days following a worst-case vessel surface spill of crude oil and HFO, respectively. For a subsea flowline rupture, oil volume above this threshold is modelled to drop away to very low levels after 6 days. Notwithstanding these results, in an incident operational monitoring of oil distribution and thickness would be assessed and C&R operations deployed for as long as deemed to provide a net benefit. For these scenarios, timely mobilisation within the first few days of a spill would likely have greatest effectiveness – equipment stockpiles based in Exmouth and Dampier would be deployed within a timeframe allowing operations on the second day following notification pending vessel availability.

Table 11-6: Indicative Containment and Recovery Calculations for ongoing production well leak

Week	Avg daily oil mass (t) above >50 g/m^2	Indictive no. containment and recovery operations per day (2 vessels per operation and 200 m of boom)
1	83	3
2	154	6
3	131	5
4	216	8
5	153	6
6	153	6
7	130	5
8	375	13
9	114	4
10	116	4
11	195	7
12	109	4
13	107	4
14	99	4
15	44	2

11.4 Decanting

Decanting is an important tool needed to make efficient use of waste management resources which are often a limiting factor in contain and recover.

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.

The POWBONS Act; s. 8 allows for decanting for combating specific pollution incidents. Additionally, Annex 1 of MARPOL (Regulation 9) allows for decanting for 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 WA State waters this is DoT (as the Hazard Management Agency under the *Emergency Management Act* 2005) and in Commonwealth waters this is the Australian Maritime Safety Authority (AMSA).

11.5 Waste Storage and Transfer

In order to maximise the efficiency of offshore collection operations, existing storage capacities on vessels is required to be augmented primarily with on-deck storage. Waste containers and tanks are available through contract conditions with Santos WA's waste service provider (refer **Section 17**) and through AMOSC and AMSA (refer Error! Reference source not found.). In the event that decanting approval is not obtained through A MSA/DoT, the complete collected oil and water will remain in the collection tanks and all will be treated as collected waste. In this event, the duration of containment and recovery operations will be reduced due to restricted available sullage.

For an ongoing response, at-sea waste transfer from containment and recovery vessels to a larger waste collection vessels or barge, can occur through dynamic lifting of waste receptacles or on-water bunkering procedures (for liquid oil). This has the potential to increase operational time of containment and recovery vessels and reduce frequency of waste transfers to port. By reducing the requirement for containment and recovery vessels to frequently return to port this system reduces the risk of spreading contamination and the frequency of vessel decontamination activities.

For containment and recovery operations near the Ningaloo Vision operational area, the use of on water transfers of waste receptacles to secondary vessel or barge has been identified as a preferential strategy to reduce potential contamination issues associated with vessels unloading waste at Exmouth Harbour, which is a small multi-use boating facility. For an ongoing response the unloading of waste collection vessels at Dampier is considered a better option.

The collection, transport and final disposal of waste brought to port locations will be provided through Santos WA's waste service provider (refer **Section 17**).

11.6 Environmental Performance

Table 11-7 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 11-7: Environmental Performance – Containment and Recovery

Environmental Performance Outcome	Implement containment and recovery tactics to reduce the volume of surface hydrocarbons to reduce contact with protection priorities		
Response Strategy	**Control Measures**	**Performance Standard**	**Measurement Criteria**
Offshore Containment and Recovery	**Response Preparedness**		
	Access to containment and recovery equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to containment and recovery equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
	Waste service provider contract	Contract for access to waste oil tanks in place during the activity	Waste service provider contract
	Offshore waste transfer concept of operations (to help maximise waste storage availability for C&R vessels)	Develop waste transfer concept of operations procedure	Waste transfer concept of operations procedure
	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Offshore containment and recovery vessels	Maintenance of vessel specification for offshore containment and recovery vessels	Vessel specification
	Response Implementation		
	First strike resources	Minimum first strike resource requirements mobilised in accordance with **Table 11-5**	Incident Log

	Aerial surveillance reports (to direct operations to areas with greatest oil concentration)	Aerial surveillance reports communicated to C&R Team Leaders	Incident Log
	Decanting t(o free up liquid oil waste container storage)	Application for offshore decanting is made to AMSA (Commonwealth waters) or DoT (State waters). When approved decanting of water occurs back into boomed area.	Incident Log
	Spill response activities selected and reviewed on basis of a Net Environmental Benefit Analysis (NEBA)	Prepare operational NEBA to determine if containment and recovery is likely to result in a net environmental benefit	Incident Log
		Operational NEBA for containment and recovery is conducted each operational period and considers oil thickness and weather constraints to effectiveness.	IAP/Incident Log

12 Mechanical Dispersion Plan

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

Table 12-1: Mechanical Dispersion - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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

12.1 Overview

This response strategy assists with the natural dispersion process; creating mixing through physical agitation, 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 to create mixing in the water body; and
+ Spraying water from the fire hose of a vessel and moving the vessel through the water body to create additional mixing and breakup of the slick.

12.2 Implementation Guidance

Table 12-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 12-3** provides a list of resources that may be used to implement this strategy. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 12-2: Implementation Guidance – Mechanical Dispersion

Action		Consideration	Responsibility	Complete
Initial Actions	The Operational NEBA will confirm the suitability and environmental benefit of conducting mechanical dispersion at appropriate locations.	Water depth, sea state, possible impacts to sensitive shorelines and/or wildlife before spill naturally disperses. This activity is to be conducted during daylight hours only and once the safety plan has been developed	Operations Team Leader Environment Team Lead Planning Team Leader	❑
	Safety team lead to develop a safety plan for the activity with respect to potential dangerous gasses and VOC's (including applicable controls).		Operations Team Leader Safety Team Leader	❑
	Notify vessel based responders to trial mechanical dispersion		Operations Team Leader	❑
	Response personnel on vessels to evaluate the effectiveness of the use of mechanical dispersion operations to reduce the volume of oil on the water surface. Communicate the information to the IMT Operations Team Leader for inclusion in Operational NEBA		Vessel Master/s Santos WA AMOSC Core Group Responders	❑

Table 12-3: Mechanical Dispersion Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Vessels undertaking other activities	Santos contracted vessel providers	Varies – check through vessel contractors/ Santos WA vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability

12.3 Environmental Performance

Table 12-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 12-4: Environmental Performance – Mechanical Dispersion

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

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 Dispersants Application - Environmental Performance Outcome, 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	Notification of a Level 2/3 crude spills		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	X	✔	✔ (surface application only)
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

The application of dispersants is considered an applicable strategy for large (Level 2/3) spills of crude oil and HFO. Dispersants are chemicals that are sprayed onto floating oil slicks by vessels and/or aircraft; or injected subsea directly to the source of the spill (e.g. uncontrolled well leak). 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 rate of natural biodegradation; and
+ Reduce the quantity of waste created.

13.2 Surface Chemical Dispersants

Surface chemical dispersants are most effective on hydrocarbons that are at a thickness of 50-100g/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) (**Table 13-2**).

Table 13-2: Bonn Agreement Oil Agreement Appearance Codes (BAOAC)

Code	Description	Layer Thickness (μm)	Litres per km2
1	Silvery sheen	0.04 to 0.30	40 - 300
2	Rainbow sheen	0.30 to 5.00	300 – 5,000
3	Metallic	5 to 50	5,000 - 50,000
4	Discontinuous true oil colour	50 to 200	50,000 – 200,000
5	Continuous true oil colour	>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 aerial 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 4-5). Liaise with third party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available.	Planning Team Leader Environment Team 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	Logistics Team Leader	❑
	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 be manned with personnel trained in dispersant application (e.g. AMOSC staff, Santos WA 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 Team Leader	❑
	Mobilise vessel-based dispersant application equipment and dispersant shake test kits from the Santos WA storage locations in Exmouth (Exmouth Freight & Logistics) or Dampier Supply Base (2 x systems at each location) to the designated deployment port.	Exmouth Freight & Logistics to assist with local logistics and vessel loading of vessel spray systems and dispersant movement in Exmouth.	Logistics Team Leader	❑
	Mobilise AMOSC (Exmouth)/ AMSA (Karratha) dispersant stock to nominated vessel	Check up to date dispersant stockpile inventories can be accessed via ER Intranet – First Strike Resources	Logistics Team Leader	❑

Action		Consideration	Responsibility	Complete
	deployment location Exmouth and/or Dampier ports			
	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 Team Leader Operations Team Leader	❑
	Identify safety requirements and controls associated with spraying dispersants and working over oil		Safety Team Leader	❑
	First vessel onsite test spray oil - confirm effectiveness	Effectiveness to be recorded with photos:	Operations Team Leader	❑
	Confirm operational NEBA supports surface chemical dispersant application	Use forecast modelling, operational monitoring data and dispersant efficacy results in operational NEBA	Operations Team Leader Environmental Team Leader Planning Team Leader	❑
	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 10 km of water shallower than 20 m; + Within exclusion zones for offshore facilities; + Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone); and + Within State Waters.	Operations Team Leader Incident Commander Environmental Team Leader Planning Team Leader	❑

Action		Consideration	Responsibility	Complete
		The above applies unless justified otherwise by the Operational NEBA, noting that no application in Australian Marine Park (outside Multi-use zone) or State waters without relevant authority approval.		
Ongoing Actions	Reassess dispersant use, utilising the NEBA process for each operational period. Cease application if no net environmental benefit		Operations Team Leader Incident Commander Environmental Team Leader Planning Team Leader	❑
	Continue to mobilise additional chemical dispersant stocks from AMOSC and AMSA	Worst case requirements do not indicate OSRL dispersant stocks necessary but these are also available	Logistics Team Leader	❑
	Maintain operational zones and provide updates to Vessel Masters on most suitable locations for application		Operations Team Leader Environmental Team Leader Planning Team Leader	❑

Table 13-4: Vessel Dispersant Application - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Santos Vessel Dispersant Spray Systems	Santos WA owned	2 containers (each c/w 3 systems - dual arm, single arm & afedo head)	Exmouth (Exmouth Freight & Logistics) Dampier (Toll Supply Yard)	Within 12 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) 2 x Broome; 1 x Exmouth; 5 x Fremantle; 3 x Geelong 2) 1 x Exmouth; 3 x Geelong 3) 1 x Fremantle; 1 x Geelong 4) 1 x Fremantle	Response via duty officer within 15 minutes of first call-AMOSC personnel available within 1 hour of initial activation call. For equipment mobilisation timeframes refer to **Table 10-12**
AMSA Vessel Dispersant Spray System	AMSA	Ayles Fernie Boat Spray	2 x Karratha; 2 x Fremantle	Access to National Plan equipment through AMOSC.
Dispersant	AMOSC	75 m3 (Exmouth) Slikgone NS 14 m3 (Broome) Ardrox 35 m3 + 250 m3 (Freo) Slikgone & Corexit 139 m3 (Geelong) Slikgone & Corexit	Exmouth Broome Fremantle Geelong	Response via duty officer within 15 minutes of first call-AMOSC personnel available within 1 hour of initial activation call. For equipment mobilisation timeframes refer to **Table 10-12**
	AMSA	20 m3 (Dampier) 100 m3 (Freo) 250+ m3 (other stockpiles)	Dampier Fremantle Other Aus stockpiles	Access to National Plan equipment through AMOSC.

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Dispersant spray system vessels	Santos contracted vessel providers. Preference for vessels used in Santos deployment exercises	Varies – check through vessel contractors/ Santos WA vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability
Personnel (field responders)	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.

Santos

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)	<12 hours
Santos Offshore Core Group mobilised to deployment port (Exmouth and/or Dampier)	<12 hours
Vessel spray system equipment mobilised to deployment port	<12 hours
Dispersants mobilised to port	<12 hours
Vessel spray operation commenced at spill site (weather/daylight dependent)	<28 hours (weather/daylight dependent)
Minimum Resource Requirements	
• Suitable dispersant application vessel - refer Santos Offshore ER Intranet for vessel specification • 1x Vessel dispersant spray system • Dispersant (10 m^3) • 2x Santos Core Group or Industry Core Group responders • 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 (e.g. BAOAC 4-5). Liaise with third party providers (e.g. AMOSC) as part of operational NEBA. Evaluate oil spill trajectory modelling when available.	Planning Team Leader Environment Team Leader	❑
	Mobilise initial resources for aerial application: After initial AMOSC notifications are complete, contact AMOSC Duty Officer and confirm requirements for the following 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 WA); and + 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. Learmonth or Exmouth Airports), and arrange for pilots, Air-Attack Supervisors, observation aircraft (one per two attack planes) and trained observers.	Logistics Team Leader Operations Team Leader Aviation Superintendent	❑
	Finalise Fixed Wing Air Operations Plan and Air Operations Plan in consultation with AMOSC, AMSA, Aerotech First Response (AFR) and other stakeholders and AMSA	Ensure flight schedule in Air Operations Plan considers requirements for other activities such as aerial surveillance sorties	Operations Team Leader Aviation Superintendent Planning Team Leader	❑

Action		Consideration	Responsibility	Complete
	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 10 km of water shallower than 20 m; + Within exclusion zones for offshore facilities; + Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application considered in the Multiple Use Zone); and + Within State Waters. The above applies unless justified otherwise by the Operational NEBA, noting that no application in Australian Marine Park (outside Multi-use zone) or State waters without relevant authority approval	Operations Team Leader Planning Team Leader	❑
	Conduct aerial dispersant spraying reporting effectiveness to IMT.		Operations Team Leader Planning Team Leader	❑
Ongoing Actions	Conduct operational NEBA during each operational period to reassess effectiveness of application rates and dispersant efficacy		Environmental Team Leader Planning Team Leader	❑
	Maintain operational zones and provide updates to pilots on most suitable locations for aerial application		Operations Team Leader Planning Team Leader	❑

Santos

Table 13-7: Aerial Chemical Dispersants Application - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Aerotech First Response (AFR) Fixed wing aircraft, pilots and ground crew	AMOSC - Fixed Wing Aerial Dispersant Contract	6 under FWADC contract Additional aircraft potentially available through AFR	Operations from Learmonth or Onslow airbase Aircraft initially mobilised from 6 Bases around Australia: Jandakot (WA) Batchelor (NT) Parafield (SA) Scone (NSW) Ballarat (Vic) Emerald (QLD)	6 x air contractors to have wheels up in 4hrs from locations around Australia. Mobilisation times depend on the flight time from the location of the aircraft. Supporting equipment mobilisation (dispersants etc) as per equip mob timeframes (Table 10-12 Table 10-12).
Air attack (& SAR) helicopter	Santos contracted helicopter provider/s	2 (contracted) + additional subject to availability	Karratha (primary base) Learmonth Onslow	Wheels up within 1 hour for Emergency Response.
Dispersant	AMOSC	75 m3 (Exmouth) Slikgone NS 14 m3 (Broome) Ardrox 35 m3 + 250 m3 (Freo) Slikgone & Corexit 139 m3 (Geelong) Slikgone & Corexit	Exmouth Broome Fremantle Geelong	Response via duty officer within 15 minutes of first call- AMOSC personnel available within 1 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	20 m3 (Dampier) 100 m3 (Freo) 250+ m3 (other stockpiles)	Dampier Fremantle Other Aus stockpiles	Access to National Plan equipment through AMOSC.
FWADC operational personnel incl. Air Attack Supervisor and Dispersant Coordinator	AMOSC and subcontractors via Fixed Wing Aerial Dispersant Contract	8 AMOSC staff + contractors	AMOSC Fremantle x 2 AMOSC Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
SAR vessel (can be double use vessel)	Santos contracted vessel providers.	Varies – check through vessel contractors/ Santos WA vessel tracking system	Exmouth, Dampier, NW locations	Varies subject to location/ availability

Table 13-8: Aerial Dispersant Operations – First Strike Response Timeline

Task	Time from IMT call-out
IMT confirms applicability of strategy and activates Fixed Wing Aerial Dispersant Capability (FWADC)	<3 hours
AMOSC to mobilise Fixed Wing aircraft to nominated airbase	<12 hours
AMOSC to mobilise dispersants to nominated airbase	<24 hours
AMOSC to mobilise all FWADC capability personnel to nominated airbase	<48 hours
AMOSC/Santos WA to mobilise helicopter to nominated airbase to support air-attack surveillance	<48 hours
AMOSC/Santos WA to mobilise vessel to nominated port to provide SAR support	<48 hours
First FWADC test spray	<48 hours (weather/daylight dependent)
Minimum Resource Requirements	

• 1x Fixed wing aircraft (Aerotech First Response)
• 1x Helicopter
• 1x SAR vessel
• WA AMOSC dispersant stocks to deployment airbase
• AMOSC contracted FWADC capability personnel:
  ○ Pilots
  ○ Air Attack Supervisor
  ○ Aerial Observer
  ○ Airbase Manager
  ○ Dispersant Coordinator
  ○ Dispersant Loading Crew	

13.5 Subsea Dispersant Injection Operations

Subsea dispersant injection (SSDI) has been observed to break-up oil droplets forcing greater entrainment of the oil into the water column below the sea surface (Adams et. al., 2013). SSDI has additional benefits over surface dispersant application including its ability to reduce volatile organic compounds in the vicinity of a spill, making the area safer for responders. It typically requires smaller volumes of dispersant to be used as it has a higher encounter rate with the hydrocarbons than surface application. SSDI can also be used day and night; whereas surface application via vessel or aircraft can only occur during daylight hours. However, for the worst case production well leak scenario associated with Ningaloo Vision operations release rates are low and surface dispersant application which can be mobilised more rapidly is considered to be the primary strategy for applying dispersants.

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.

13.5.1 Implementation Guidance

Table 15-1 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 13-10**. 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
	Confirm operational NEBA supports subsea chemical dispersant injection	Subsea dispersant application has been identified as secondary strategy for well leak scenario only and NEBA should look at benefit of this technique over in relation to surface application. Use forecast modelling and any operational monitoring results in operational NEBA	Operations Team Leader Incident Commander Environmental Team Leader Planning Team Leader	❑
	Activate SFRT equipment Activate Oceaneering personnel for deployment	Separate contracts in place for SFRT (AMOSC) and Oceaneering	Designated call-out authority (Incident Commander) Source Control Team	❑
	Contract suitable vessel capable of deploying SFRT equipment and dispersant	Vessel capable of SFRT deployment are tracked	Logistics Team Leader Source Control Team Leader	❑
	Arrange road transport of SFRT from Jandakot to Dampier		Logistics Team Leader Source Control Team Leader	❑
	Arrange equipment to be loaded on to vessel once in Dampier and authorise transit to field		Logistics Team Leader Operations Team Leader Source Control Team Leader	❑
	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 Team Leader Source Control Team Leader	❑

Action		Consideration	Responsibility	Complete
	Commence dispersant subsea injection adjusting DOR based on real-time monitoring		Operations Team Leader Source Control Team Leader	❑
	Continue operational monitoring (including operational water quality monitoring and surveillance) near the release point to help determine dispersant effectiveness.	Consider using guidance provided in API Technical Report 1152 (API, 2013) to determine dispersant efficacy. Surveillance should have commenced prior to any dispersant being added to the release so that changes and efficacy can be determined. Once baseline data has been collated, commence injection to help determine DOR and modify accordingly	Source Control Team Leader Operations Team Leader	❑
	If dispersant application is shown to be effective and approved by the Incident Commander, continue operations		Source Control Team Leader Operations Team Leader Incident Commander	❑
Ongoing Action	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	Planning Team Leader Environmental Team Leader	❑

Table 13-10: Subsea Dispersant Injection – First Strike Response Timeline

Task	Time from IMT call-out
IMT Source Control Team activated	<24 hours
Suitable SFRT-dispersant injection vessel/s mobilised to Dampier	<10 days
Oceaneering to mobilise personnel to Dampier	<10 days
AMOSC to mobilise SFRT and dedicated dispersant to Dampier	<10 days
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 Efficacy Testing

Dispersant efficacy testing has been performed on Van Gogh, Coniston and Novara crude oil and indicates that available dispersants are effective in reducing the volume and concentration of surface oil (**Appendix A**). The actual effectiveness and environmental benefit of applying dispersants in a spill incident is to be reassessed throughout the incident using operational monitoring to evaluate the effectiveness and potential benefits and impacts. Effectiveness may vary depending upon the weathered state of the oil, the method of application and the prevailing environmental conditions. The environmental benefits associated with a decrease in the volume and concentration of surface oil may be negated by an increase in the concentration of oil dispersed under the sea surface which could potentially increase exposure of subsea receptors to dispersed oil and dispersants. In these circumstances, an operational NEBA will assist in assessing the exchange of risk from one receptor to another.

13.7 Dispersant Selection

Chemical dispersants listed as approved in the National Plan for Maritime Environmental Emergencies Register of Oil Spill Control Agents (OSCA) or assessed as acceptable using the Santos Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) prior to application, are to be used. FINASOL OSR 52 has been pre- assessed as low risk using the Santos Offshore Division Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) and are therefore designated as acceptable for use.

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

Where sufficient data is available, the chemical is risk assessed using the Offshore Chemical Notification Scheme (OCNS) CHARM or non-CHARM models depending on the model's applicability criteria. Chemicals that meet the selection criteria belonging to CHARM Colour-band Gold or Silver, or non-CHARM groups D or E are considered environmentally acceptable. According to the OCNS CHARM model, GOLD ranked chemicals have a maximum Hazard Quotient (HQ) of <1 and Silver, HQ ≥1 and <30. According to the OCNS non-CHARM model guidelines, the worst case initial OCNS grouping would be group B based on aquatic toxicity data of LC50 or EC50 > 1 to 10 ppm. To obtain a final OCNS grouping of D, the chemical would need to be readily biodegradable (>60% biodegradation in 28 days) and non-bioaccumulative (Log Pow <3 or BCF ≤100 and molecular weight ≥ 700). The best case initial OCNS grouping would be group E based on aquatic toxicity data of LC50/EC50 > 1000 ppm. The best case final OCNS grouping would remain E with the chemical readily biodegradable and non-bioaccumulative.

Where insufficient ecotoxicity data is available to assign a pseudo OCNS CHARM or non-CHARM group ranking; however, there is sufficient ecotoxicity data available to determine the environmental hazard of the chemical, environmental acceptability is based on volume/concentration, ultimate fate and ecotoxicity data (aquatic toxicity, biodegradability and/or bioaccumulation data where applicable i.e. biodegradation and bioaccumulation potential are not applicable to inorganic substances).

During a response, chemical dispersant shall be tested on the released oil at a laboratory as part of the initial oil characterisation (refer **Section 10.6**) as well as through field testing using vessel-based spray systems/ dispersant shake test kits. Santos WA has already characterised the dispersant efficacy of Van Gogh, Coniston and Novara Crude Oils as described in **Appendix A.**

13.8 Dispersant Effectiveness Monitoring

The ongoing effectiveness of dispersant operations will be assessed through operational monitoring. Visual observations may be taken by vessel and/or aircraft and will be used to assess whether dispersant application is successful in dispersing hydrocarbons. The effectiveness of the aerial based chemical dispersion strategy is communicated to the IMT Operations Team Leader via the Air-Attack Supervisors. The IMT assesses the effectiveness of continued surface dispersant use against a NEBA assessment.

Operational water quality monitoring, either through continuous fluorometry surveys or discrete water sampling (**Section 10.7**), is to be used to assess the presence, distribution and concentration of dispersed oil with and without dispersant addition.

Subsea dispersant application is considered a secondary strategy to surface dispersant application (refer to Table 6-7) . Prior to any application of subsea dispersants, an initial ROV survey would be conducted at the release point to determine the nature of the release. This information will inform the applicability of subsea chemical dispersion and initial choice of dispersant injection methods (e.g. number of nozzles, nozzle sizes) and DOR. In addition, subsea dispersant effectiveness monitoring should commence prior to the application of any dispersant, to ensure baseline data is captured. Subsea dispersant effectiveness will be monitored as part of the Operational Water Quality Monitoring Plan, which will inform the NEBA assessment.

13.9 Dispersant Application Area

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

+ Within 10 km of water shallower than 20 m;
+ Within exclusion zones for offshore facilities;
+ Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application permitted in the Multiple Use Zone); and
+ Within State Waters.

Dispersant efficacy testing indicates that efficacy on fresh Van Gogh, Coniston and Novara will be the same or better on fresh oil than weathered oil (Intertek 2012). Applying dispersant close to the source may also be beneficial in ensuring dispersants are applied efficiently, where oil is less broken into patches by wind and wave action.

13.10 Surface Dispersant Supply and Logistics Requirements

Deterministic oil spill modelling has been conducted to assess the effect of dispersants on worst case spill scenarios associated with Ningaloo Vision operations (**Section 6.5**). This work has been used to determine worst case dispersant supply requirements for each scenario.

<u>Instantaneous release dispersant requirements – vessel tank rupture</u>

For this scenario, modelling of simulated dispersant application at surface revealed a total dispersant application of 19.6 m^3 was required. Most of the dispersant application was achieved by one aircraft (15.5 m^3) and the remainder applied by two vessels. The oil slick thickness decreases quickly within ~48 hours for both mitigated and unmitigated cases. The availability of thick (>50 μm) surface oil treatment threshold is time limited as the 1-hour release yielded a pulse slick that was rapidly transported to the south out of the response zone within ~44 hours. Dispersant supply and application requirements are less than that for the production well leak as described below.

<u>Continuous release dispersant requirements – production well leak</u>

For this scenario, based on the deterministic dispersant application modelling a total of 1051m^3 of dispersant was required to be used by two aircraft and five vessels over 128 days of application. While dispersant use will vary depending on conditions and actionable oil approximately 10m^3 per day is considered appropriate amount for planning.

Sufficient dispersant stock is available for this operation through AMOSC (514m^3 across Fremantle, Broome, Exmouth and Geelong stockpiles), AMSA National Plan (254m^3), and OSRL Singapore (1400m^3) stockpiles. Based on the rate of application, current stock-pile locations and supply, arrangements are considered sufficient (refer as per below).

<u>Dispersant Supply and Logistics</u>

There is currently sufficient dispersant stocks in Exmouth (75m^3), Karratha (20m^3), Fremantle (285m^3) and Broome (15m^3) to cover dispersant requirements for the first two weeks of a spill. These are available via AMOSC membership or AMSA MoU and are available within 24 hours (Exmouth) or within 48 hours (all other locations). Santos WA can supply all required road logistics to meet these timeframes through its contracted logistics provider. Santos WA can also provide air logistics for all other stockpiles throughout Australia and internationally.

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

13.11 Subsea Dispersant Injection Logistics

If a production well leak 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 WA) and the Subsea First Response Toolkit (SFRT), 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 (500m^3 of Dasic Slickgone NS) and ancillary equipment (e.g. pumps, flying leads, coiled tubing head, dispersant wands).

The volumes of dispersant required will depend on the DOR used at the injection point. It has been assumed that the well leak would require a DOR of 1:100. To achieve a DOR of 1:100, IPIECA-IOGP (2015a) recommend for a flow rate of 20,000 bbl./day, a dispersant pump rate of 22L/min is required. The maximum credible flow rate for the Ningaloo Vision well leak is estimated to be 641.5~bbl./day (~102m^3/day), therefore a dispersant pump rate of ~1L/min (1.8m^3/day) is expected to be required. The SFRT stockpile in Fremantle is sufficient to sustain SSDI for this scenario.

If required, the equipment would be mobilised via road to Dampier. Suitable vessels would be contracted to move the SFRT to site, which may be sourced via the North West Shelf Region or Singapore. It is estimated that SSDI would commence by Day 8-12, depending on vessel availability. Santos WA tracks the availability of SFRT vessels via shipbroker reports.

13.12 Environmental Performance

Table 15-2 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 13-11: Environmental Performance – Surface 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**	**Response Strategy**	**Measurement Criteria**
Chemical Dispersant Application	**Response Preparedness**		
	Arrangements to enable access to surface dispersants, equipment and personnel	Maintenance of access to dispersant, application equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			AMOSC SFRT Participant
			OTA Agreement with Oceaneering
			OSRL Associate Member Contract and Global Dispersant Supply Supplementary Agreement
	Arrangements in place to monitor availability of vessels capable of transporting SFRT	Vessel availability shall be monitored regularly via Santos WA's contracted vessel broker	Shipbroker reports
	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Dispersant application vessels	Maintenance of vessel specification for dispersant application vessels	Vessel specification
	Nominated first-strike dispersant application vessel c/w trained crew, dispersant equipment and dispersants onboard (use of existing supply vessel servicing Exmouth FPSOs)	Complete feasibility review to determine if existing supply vessel can be equipped and used as nominated surface dispersant first strike response vessel (to be completed by end of 2020)	Correspondence records
	Response Implementation		
	Mobilisation of minimum resource requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 13-5**, **Table 13-8** and **Table 13-10**	Incident log

	Chemical Dispersant Application Plan	Only chemical dispersants that are listed as approved on the National Plan Oil Spill Control Agent (OSCA) list or are evaluated as acceptable as per the Operations Chemical Selection, Evaluation and Approval Procedure (EA-91-II-10001) are to be used	Incident Log
		Analysis of dispersant amenability provided to IMT within 24 hours of oil delivery to Laboratory	Incident Log
		If amenable to surface dispersants, and required oil volume can be collected, oil and dispersant samples to be sent immediately for laboratory ecotoxicity testing of oil and chemically dispersed oil	Incident Log
		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
		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
		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
		If dispersant application is approved by the Incident Commander for subsea injection, operational monitoring of dispersant efficacy will be conducted	Incident Log IAP

		Prepare operational NEBA to determine if chemical dispersant application is likely to result in a net environmental benefit. 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 • Operational monitoring results (surveillance and shoreline assessment) showing distribution of floating, stranded oil and location of sensitive fauna and habitats • Operational water quality monitoring results showing distribution and concentration of subsea oil (once available) • Scientific monitoring water sampling results (SMP1) (once available) • Consultation with DoT	Incident Log IAP
		NEBA undertaken each operational period by the relevant Control Agency to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP Incident Log
		Dispersant Application Area will be defined as	IAP

		part of the IAP. The base case for dispersant application is that no dispersants to be applied: + Within 10 km of water shallower than 20 m; + Within exclusion zones for offshore facilities; + Within a Habitat Protection Zone or National Park Zone of an Australian Marine Park (application permitted in the Multiple Use Zone); and + Within State Waters.	
		Surface dispersant will only be applied in the Dispersant Application Area and target oil above BAOAC 4 and 5	IAP Incident Log

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

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities		
Initiation criteria	+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities will potentially be contacted; and + Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	+ NEBA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s; and + Agreement is reached with Jurisdictional Authorities to terminate the response strategy		

14.1 Overview

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

The effectiveness of this response will be dependent on spill characteristics, hydrocarbon type, and the operating environment. 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 controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike protection and deflection activities as required. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline protection. Santos WA will provide all relevant information on shoreline character and oiling collected as part of surveillance activities carried out under its control (refer **Section 10**).

The information provided below is included for planning purposes and represents Santos WA's first-strike response for protection and deflection activities. In the event of a spill with the potential for shoreline contact, the ongoing response objectives, methodology, deployment locations and resource allocation will be controlled by DoT, as the Control Agency and therefore may differ from that included below.

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

Shoreline protection and deflection techniques include:

+ Nearshore booming, which can involve different booming arrangements including:
    - Exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
    - Diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
    - Deflection booming: booms deflect the spill away from an area requiring protection

- Berms, dams and dikes – uses sandbags or embankments to exclude oil from sensitive areas;
- Shoreside recovery – uses nearshore skimmers to collect oil corralled by nearshore booms (also used during shoreline clean-up);
- Passive recovery -uses sorbent booms or pads to collect oil and remove it from the environment. This can be used as a pre-impact tactic where sorbents are laid ahead of the spill making contact with the shoreline; and
- Non-oiled debris removal – removes debris from the shoreline before it is impacted to reduce overall waste volumes from shoreline clean-up.

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

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 directed otherwise by DoT, are listed in **Table 14-4**. The Incident Commander of the DoT's IMT (once the DoT assumes 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 14-2: Implementation Guidance – Shoreline Protection and Deflection

Action		Consideration	Responsibility	Complete
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to **Table 7-1** for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency for confirmation of priority protection areas and NEBA		Environment Team Leader Planning Team Leader	❑
	Where DoT have assumed roles as Control Agency actions undertaken by DoT may differ to those below.			
	Conduct Operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline assessments (**Section 10.8**) and any tactical response plans for the area.	Pre-existing TRPs exist for Ningaloo Coastline (including Muiron, Jurabi to Light House Bay Beaches, Mangrove Bay, Turquoise Bay and Yardie Creek) and Muiron Islands and are available on the Santos Offshore ER Intranet page.	Environment Team 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 (but not be limited to) and should reference any existing TRPs: + 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	Operations Team Leader Planning Team Leader Environment Team Leader	❑

Action		Consideration	Responsibility	Complete
		+ List of resources (personnel and equipment) required + Logistical arrangements (e.g. staging areas, accommodation, transport of personnel) + Timeframes to undertake deployment + Access locations from land or sea + Frequency of equipment inspections and maintenance (noting tidal cycles) + Waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes + No access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first)		
	If required identify vessels with relevant capabilities (e.g. shallow draft) for equipment deployment in consultation with Control Agency	Ensure vessels have shallow draft and/or a suitable tender (with adequate towing capacity and tie-points) if they are required to access shorelines	Operations Team Leader Logistics Team Leader	❑
	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 Team Leader On-scene Commander	❑
On goi ng Act	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing		Environment Team Leader	❑

Action		Consideration	Responsibility	Complete
	to conduct shoreline protection and deflection activities			
	Report to the Operations Team Leader on the effectiveness of the tactics employed		Shoreline Response Team Leader – AMOSC core group responder	❑
	Response teams to conduct daily inspections and maintenance of equipment	Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of DoT Response crews will be rotated on a roster basis, with new personnel procured on an as needs basis from existing human resource suppliers	Shoreline Response Team Leader	❑

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Table 14-3: Shoreline Protection and Deflection- Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
AMOSC nearshore boom and skimming equipment'	AMOSC	Beach Guardian (98x 25m lengths) Zoom Boom (199 x 25m lengths) HDB Boom (2x 200 m lengths) Curtain Boom (58 x 30 m lengths) Skimmers: Passive Weir GT 185 Desmi 250 Weir Ro-skim Weir boom	Broome x 4; Exmouth x 20; Fremantle x 23; Geelong x 51 Broome x 8; Exmouth x 20; Fremantle x 30; Geelong x 141 Broome x 2; Fremantle x 18; Geelong x 40 Exmouth x 1; Fremantle x 1; Geelong x 1 Exmouth x 1; Geelong x 1 Geelong x 1 Geelong x 2	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. For mobilisation timeframes refer Table 10-12
AMSA nearshore boom/skimmer equipment	AMSA	Canadyne inflatable Structureflex inflatable Versatech zoom inflatable Slickbar - solid buoyancy Structureflex - solid buoyancy Structureflex - land sea Skimmers:	Karratha x 5; Karratha x 10; Fremantle x 15 Karratha x 5; Fremantle x 13 Karratha x 2 Karratha x 3; Fremantle x 10 Karratha x 30; Fremantle x 30 other locations around Aust	Access to National Plan equipment through AMOSC. For mobilisation timeframes refer Table 10-12

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
		None for inshore HFO or heavy crude		
Santos owned nearshore boom/ skimming equipment	Santos WA	Beach Guardian (8x 25m lengths) Zoom Boom (16 x 25m lengths) 2x Desmi DBD16 brush skimmer	Varanus Island Varanus Island 1 ea Dampier and VI	Within 12 h for deployment by vessel from VI
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.

Table 14-4: Shoreline Protection and Deflection – First Strike Response Timeline

Task	Time from shoreline contact (predicted or observed)
IMT confirms shoreline contact prediction, confirm if protection of shoreline sensitivity/s is required and begins sourcing resources	<4 hours
Santos Offshore Core Group mobilised to protection site or deployment port location	<12 hours
Protection booming equipment mobilised to protection site or deployment port location	<12 hours
Waste storage equipment mobilised to protection site or deployment port location	<12 hours
Boom deployment vessel / remote island transfer vessel mobilised to protection site or deployment port location	<12 hours
AMOSC Staff and Industry Core Group mobilised to protection site or deployment port location	<24 hours
Protection/deflection operation deployed to protection location	<24 hours (weather/daylight dependent)
Minimum Resource Requirements	
NB: Resource requirements for protection and deflection will be situation/receptor specific. Tactical Response Plan (TRPs) if developed for the area/receptor will outline suggested resource requirements. TRPs are held by Santos and DoT and have been developed for Ningaloo Coastline and Muiron Islands amongst other locations. Indicative first strike resources for a single site protection area are: • 1x 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 (refer TRP if applicable) • 1x skimmer appropriate for oil type • Waste storage equipment • 1x Protection and Deflection Team (6x AMOSC Core Group members) • PPE	

14.3 Environmental Performance

Table 14-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 14-5: Environmental Performance – Shoreline Protection and Deflection

Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Protection and Deflection	**Response Preparedness**		
	Access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to protection and deflection equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract
			OSRL Associate Member Contract
	Small vessel providers for nearshore booming operations	Maintenance of a list of small vessel providers for Exmouth region	List of small vessel providers
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 14-4** unless directed otherwise by DoT	Incident log
	Shoreline Protection and Deflection Plan	Santos WA IMT to confirm protection priorities in consultation with DoT	IAP/Incident Log
		Prepare operational NEBA to determine if shoreline protection and deflection activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline protection and deflection activities commencing
		IAP Shoreline Protection and Deflection Sub-plan developed to provide oversight and management of shoreline protection and deflection operation	Records indicate IAP Shoreline Protection and Deflection Sub-plan prepared prior to shoreline protection and deflection operations commencing
		NEBA undertaken each operational period by the relevant Control Agency	IAP/Incident Log

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

15 Shoreline Clean-up Plan

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 priorities and facilitate habitat recovery		
Initiation criteria	+ Level 2 or Level 3 spills where shorelines with identified or potential protection priorities that will be , or have been, contacted; + NEBA indicates shoreline clean-up will benefit receptors; and + Approval has been obtained from DoT IC or delegate (as the Control Agency) to initiate response strategy		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	X	✔	✔
Termination criteria	+ As directed by DoT		

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 surveys to monitor the effectiveness of clean-up activities and assess if they are resulting in any adverse impacts.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Control Agency. Santos WA will undertake first-strike activations as triggered, until such time as DoT assume control. Upon assumption of Control Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline clean-up. The information obtained from Operational Monitoring (refer **Section 10**), will be used by the IMT in the development of the operational NEBA to inform the most effective clean-up tactics (if any) to apply to individual sites. Intrusive shoreline clean-up techniques have the potential to damage sensitive shorelines. The appropriateness of clean-up tactics will be assessed against natural attenuation for sensitive sites. Selection of shoreline clean-up methods and controls to prevent further damage from the clean-up activities are to be undertaken in consultation with the Control Agency and selected based on NEBA.

Spill modelling indicates if a worst-case spill were to occur as a result of Ningaloo Vision operations, shoreline contact would occur and therefore clean-up of shorelines is likely to be required.

Diesel 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 diesel spill shoreline response would be contaminated sand and debris.

Van Gogh crude is a Group IV heavy crude oil (**Appendix A**) with a relatively high persistence in the marine environment. Waste volumes from shoreline operations will depend on the degree of weathering and whether emulsions have formed. Emulsification potential has been shown to vary across Van Gogh crude oils (**Appendix A**).

Shoreline clean-up techniques include:

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

15.2 Implementation Guidance

Table 15-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy. **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 DoT, are listed in **Table 15-4**. The On-Scene Commander and/or Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 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 DoT as the Control Agency**			
	Initiate Shoreline and Coastal Habitat Assessment (if not already activated)	Refer to **Section 10.8** for additional information	Environment Team Leader	❑
	Using results from Shoreline and Coastal Habitat Assessment, conduct Operational NEBA to assess shoreline-clean up suitability and recommended tactics for each shoreline location	Shoreline and Coastal Habitat Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and make specific clean-up recommendations The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision making Engage a Heritage Advisor if spill response activities overlap with potential areas of cultural significance	Environmental Team Leader	❑
	If operational NEBA supports shoreline clean-up, prepare a Shoreline Clean-up Plan for inclusion in the IAP	Shoreline Clean-up Plan may include (but not be limited to): + Clean-up objectives + Clean-up end points (may be derived from Shoreline and Coastal Habitat Assessment) + Clean-up priorities (may be derived from Shoreline and Coastal Habitat 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	Environmental Team Leader Planning Team Leader Operations Team Leader	❑

Action		Consideration	Responsibility	Complete
		in comparison to the size of the coastal community) + Permits required (if applicable) + Chain of command for onsite personnel + List of resources (personnel, 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 (utilise existing roads and tracks first) Refer to IPEICA-IOGP (2015) for additional guidance on shoreline clean-up planning and implementation		
	In consultation with the Control Agency procure and mobilise resources to a designated port location for deployment, or directly to location via road transport		Logistics Team Leader Supply Team Leader Deputy Logistics Officer (DoT IMT)	❑
	Deploy shoreline clean-up response teams to each shoreline location to begin operations under direction of the Control Agency	Each clean-up team to be led by a Shoreline Response Team Lead, who could be an AMOSC Core Group Member or trained member of the	Operations Team Leader Logistics Team Leader	❑

Action		Consideration	Responsibility	Complete
		AMSA administered National Response Team (as per the MoU agreement between Santos WA and AMSA) Clean-up teams and equipment will be deployed and positioned as per those observations by the Shoreline and Coastal Habitat Assessment Teams in consultation with the DoT. Team members will verify the effectiveness of clean-up, modifying guidelines as needed if conditions change	Deputy Logistics Officer (DoT IMT)	
Ongoing Actions	Shoreline Response Team Lead shall communicate daily reports to the IMT Operations Team Leader to inform of effectiveness of existing tactics and any proposed tactics and required resources	Where possible, maintain some consistency in personnel within Shoreline Response Teams. If the same personnel are involved in Shoreline and Coastal Habitat Assessment and Clean-up they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end-points have been met	Shoreline Response Team Leader Operations Team Leader	❑
	The IMT Operations Team Leader shall work with the Planning Team Leader to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through the Supply and Logistics Team Leaders		Operations Team Leader Planning Team Leader	❑
	Monitor progress of clean-up efforts and report to the Control Agency		Operations Team Leader On-Scene Commander Deputy On-Scene Commander (DoT FOB)	❑

Table 15-3: Shoreline Clean-up - Resource Capability

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Manual clean-up tools (shovels, rakes, wheel barrows, bags etc)	AMOSC shoreline kits	shoreline support kits first strike	Fremantle x 1 Geelong x 1	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 (Table 10-12)
	Santos WA	1x shoreline clean-up Container	Varanus Island	Within 12 hour for deployment from VI
	Hardware suppliers	As available	Exmouth, Karratha, Perth	
Shoreline flushing (pumps/hoses)	AMOSC	Shoreline flushing kit Shoreline Impact lance kit	Fremantle x 1, Geelong x 1 Geelong x 1	Response via duty officer within 15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 10-12
Nearshore skimmers/hoses	AMOSC AMSA	See Protection and Deflection (**Table 14-3)**		

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
Decontamination/ staging site equipment	AMOSC	Decontamination station x 3	Fremantle x 1; Exmouth x 1; Geelong x 1	Response via duty officer within 15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 10-12
	AMSA	Decontamination station x 4	Karratha x 2; Fremantle x 2	Access to National Plan equipment through AMOSC
	Oil spill equipment provider (e.g. Global Spill., PPS)	As available	Perth	Subject to availability
Waste storage (including temporary storage and waste skips and tanks for transport)	AMOSC temporary storage	Fast tanks x 8 Vikotank (13000L)	Geelong x 4; Fremantle x 2; Exmouth x 2 Broome x 1	15 mins of first call - AMOSC personnel available within 1 hour of initial activation call. For mobilisation timeframes see Table 10-12
	AMSA temporary storage	Fast tanks	Karratha x 4; Fremantle x 4	Access to national Plan equipment through AMOSC

Equipment Type/Personnel Required	Organisation	Quantity Available	Location	Mobilisation Timeframe
	via North West Alliance contract	Refer **Table 17-3**	Perth, Karratha	24+ hours
Personnel (field responders) for OSR strategies	AMOSC Staff	8	Fremantle x 2 Geelong x 6	Response via duty officer within 15 minutes of first call. Timeframe for availability of AMOSC personnel dependent on location of spill and transport to site.
	AMOSC Core Group (Santos)	12	Perth/ NW Aus facilities x 10 Port Bonython (SA) x 2	12+ hours
	AMOSC Core Group (Industry)	As per monthly availability (minimum 84)	Office and facility location across Australia	Location dependent. Confirmed at time of activation.
	Santos WA 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 Offshore Core Group mobilised to site/ deployment port location	<24 hours
Clean-up equipment mobilised to site/ deployment port location	<24 hours
Waste storage equipment mobilised to site/ 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	<48 hours

Minimum Resource Requirements

NB: Resource requirements for shoreline clean-up will be situation/receptor specific. Tactical Response Plan (TRPs) if developed for the area/receptor will outline suggested resource requirements and shoreline assessments (as part of operational monitoring strategy) will be conducted prior to clean-up to confirm techniques. TRPs are held by Santos and DoT and have been developed for Ningaloo Coastline and Muiron Islands amongst other locations. Indicative minimum requirements for 1x 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
- 1x clean-up team includes:
  - 1x Team Leader (AMOSC staff, Industry Core Group or Santos Core Group)
  - 10-30 Shoreline Clean-up Responders (AMOSC Crore Group, Santos contracted labour hire personnel)

15.3 Shoreline Clean-up Resources

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

Shoreline clean-up personnel available to Santos WA is a combination of AMOSC Staff, AMOSC Core Group Responders (comprising AMOSC trained Santos WA and Industry personnel), OSRL responders, State Response Team members and National Response Team members. Personnel for manual clean-up and mobile plant operation can be accessed through Santos WA's 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. Once activated as Control Agency, deployment will be under the direction of DoT and the advice of shoreline clean-up specialists from AMOSC Core Group and National/State response teams. Shoreline Assessments (**Section 10**) will provide information to guide the clean-up strategy and deployment of resources.

Across all credible spill scenarios, modelling has indicated that the worst-case surface release of Van Gogh Crude (8,629m^3 from the FPSO) would result in the highest potential shoreline loading of oil. Further to this, Van Gogh Crude is the most persistent and viscous of hydrocarbons that could potentially be release during Ningaloo Vision operations and would likely require the greatest level of effort to respond to. Other potentially released oils are relatively light by comparison; physical removal of other oils such as diesel may not be possible or recommended due to the degree of infiltration into sediments that could occur.

Spill modelling indicates shoreline loading of up to a maximum of ~1,260 m^3 at Ningaloo Coast north (refer **Section 6.3**). Hydrocarbons could also load onto shorelines of the Muiron Islands (maximum ~310 m^3) and Ningaloo Coast South ((maximum ~260 m^3), noting that these worst case loadings come from different model simulations.

Shoreline clean-up can be effective technique for reducing the potential for it to remobilise to other locations. However, prolonged shoreline clean-up operations or large-scale operations involving large numbers of personnel may cause adverse environmental impacts, as the constant removal of oil through mechanical or manual techniques can result in a removal of substrate (e.g. sand, pebbles). If this process is conducted over a long period of time, this may result in geomorphological changes to the shoreline profile.

Many of the shorelines predicted to be contacted are important nesting/breeding sites with high conservation values, therefore intensive clean-up operations will potentially do more damage than the oil alone. For this reason, shoreline clean-up operations at sensitive locations will involve smaller teams for a longer period and may involve techniques such as passive recovery booms (sorbents) and flooding or flushing (depending on the degree or oiling and hydrocarbon type). 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 shoreline profile and will minimise physical impacts on the coastlines and their sensitive species.

To approximate the likely waste produced and time required to conduct a manual shoreline clean-up, a conservative bulking factor of 10x has been applied to the worst-case scenario. Using the ~1,260m^3 loading, a bulking factor of 10x would result in up to 12,600 m^3 of oily waste. An estimate of required resources for clean-up can be made by applying a removal rate of 1 m^3 per person per day for manual removal. For example, 30 small teams consisting of 6 personnel (including one trained responder per team) could theoretically remove a loading of 1,260 m^3 (12,600 m^3 oily waste) in roughly 70 days. This calculation assumes oil is accessible for removal (i.e. on accessible sections of coastline) and there would be a net benefit in removing all oil. Dependent on the nature of the oiling, habitat type, access constraints and environmental sensitivities nearby, larger teams of responders and mechanical aids can be employed to remove oil at a greater rate.

15.4 Shoreline Clean-up Decision Guides

A number of shoreline types are found within the EMBA associated with Ningaloo Vision operations, including:

+ Mangroves;
+ Rocky shores including cliffs, intertidal platforms and loose rocks;
+ Sandy beaches; and
+ Intertidal mudflats and sandflats.

The shoreline types are amenable in varying degrees to clean-up methods depending upon the type of hydrocarbon spilt. 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 DoT OSCP (2015) also provides guidance on shoreline clean-up techniques.

15.5 Environmental Performance

Table 15-5 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 15-5: Environmental Performance – Shoreline Clean-up

Environmental Performance Outcome	Implement shoreline clean-up tactics to remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Shoreline Clean-Up	**Response Preparedness**		
	Access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL	Maintenance of access to shoreline clean-up equipment and personnel through AMOSC, AMSA National Plan and OSRL throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Maintenance of MSAs with multiple vessel providers	Santos WA maintains MSAs with multiple vessel providers	MSAs with multiple vessel providers
	Vessels for offshore island response	Maintenance of vessel specification for resource transfer for offshore island response	Vessel specification
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Labour hire onboarding procedure (for low skilled shoreline clean-up personnel)	Development of onboarding procedure for oil spill response labour hire	Onboarding procedure
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 15-4** unless directed otherwise by DoT	Incident log
	Shoreline Clean-Up Plan	Santos WA IMT to confirm protection priorities in consultation with DoT	IAP Incident Log
		Prepare operational NEBA to determine if shoreline clean-up activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to shoreline clean-up activities commencing
		Ensure operational NEBA considers waste management, to ensure environmental benefit	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 priorities and facilitate habitat recovery.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		outweighs the environmental impact of strategy implementation which may include secondary contamination	
		IAP Shoreline Clean-up Sub-plan developed to provide oversight and management of shoreline clean-up operation	Records indicate IAP Shoreline Clean-up Sub-plan prepared prior to shoreline clean-up operations commencing
		Clean-up strategies will be implemented under the direction of DoT as the HMA	Incident Log
		Santos WA will make available AMOSC Core Group Responders for shoreline clean-up team positions to the Control Agency	Incident Log
		Santos WA will make available to the Control Agency equipment from Santos WA, AMOSC and OSRL stockpiles	Incident Log
		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
	Prioritise use of existing roads and tracts	Unless directed otherwise by the designated Control Agency (i.e. DoT) access plans for shoreline operations will prioritise use of existing roads and tracks	IAP demonstrates requirement is met.
	Soil profile assessment prior to earthworks	Unless directed otherwise by the designated Control Agency (i.e. DoT) a soil profile	Documented in IAP and Incident Log.

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

16 Oiled Wildlife Response Plan

Note: Department of Transport (DoT) is the Control Agency and Department of Biodiversity, Conservation and Attractions (DBCA) is the Jurisdictional Authority for oiled wildlife response within State waters. Santos WA is the Control Agency for oiled wildlife response within Commonwealth waters.

Table 16-1: Oiled Wildlife Response - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanase wildlife		
Initiation criteria	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	+ Oiling of wildlife have not been observed over a 48-hour period; and + Oiled wildlife have been successfully rehabilitated; and + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response		

16.1 Overview

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

The key plan for oiled wildlife response (OWR) in WA is the WA Oiled Wildlife Response Plan (WAOWRP). The WAOWRP has been developed by DBCA and AMOSC, on behalf of the petroleum industry, and DBCA to define the minimum standards for OWR in WA as a sub-plan to the State Hazard: MEE. The WA OWRP can also be used for guidance to OWR in Commonwealth waters adjacent to State waters, noting that OWR requirements in State waters are expected to be greater. The Pilbara Region OWRP, which sits under the WA OWRP provides operational guidance to respond to injured and oiled wildlife in the Pilbara region and covers the areas potentially contacted by a spill from Ningaloo Vision operations.

The sections below provide guidance to the Santos IMT on OWR stages of response and implementation. In some cases, the implementation guidance (**Table 16-5**) includes detail which is additional to what is provided in the WAOWRP. The information below should be used in conjunction with the WAOWRP.

16.2 OWR Stages of Response

The WAOWRP includes eight stages to an OWR, which are described in **Table 16-2**. If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 16-2: Oiled Wildlife Response Stages (adapted from WAOWRP)

Stage	Description
Stage 1: Initial wildlife assessment and notifications	Gather situational awareness on whether an OWR impact has occurred or is imminent and complete notifications to Jurisdictional Authorities and external support agencies
Stage 2: Mobilisation of wildlife resources	Mobilise initial preventative measures and/or mobilisation of resources to deal with incident in early stages of development.
Stage 3: Wildlife reconnaissance	Wildlife Reconnaissance for the OWR should occur as part of the implementation of surveys for the fauna related Operational Monitoring Plans (OMPs) undertaken to aid planning and decision making for executing spill response or clean-up operations. Wildlife Reconnaissance will be required for the duration of the wildlife response operations
Stage 4: IAP wildlife sub-plan development	The Wildlife Response Sub-plan should include the following operational components (relevant to the scale of the OWR): + Wildlife impact assessment + Reconnaissance and monitoring + Search and collection + Carcass collection and necropsy storage + Field stabilisation + Wildlife transport + Wildlife processing/admission + Wildlife intake and triage + Wildlife cleaning + Rehabilitation/conditioning + Release + Post-release monitoring + OWR termination and demobilisation. (It should be noted that separate strategies and protocols may be required for different species groups).
Stage 5: Wildlife rescue and staging	This includes commencing actions such as hazing, pre-emptive capture, administering first-aid and holding and/or transportation of wildlife to oiled wildlife facilities. If oiled birds or non–avian wildlife were to be observed at sea, on-water collection should be considered for the effective capture of oiled animals before they become so debilitated that their chance of survival is severely affected (IPIECA, 2017)
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the cleaning and rehabilitation of affected animals. A vessel-based ‘on-water’ facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring

Stage	Description
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

16.3 OWR Levels and Resourcing

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

Review of the worst-case spill modelling indicates that floating hydrocarbon concentrations above 10g/m2 may extend up to 250km from the spill location and have a maximum shoreline loading of 1320 m^3, at 100g/m^2, effecting 133 km along the Ningaloo Coast North. The Ningaloo Coast North includes biologically important areas for birds and major turtle nesting sites. Approximately 33 species of seabirds and shorebirds are found in the Ningaloo Marine Park (CALM and MPRA 2005). This area of coastline also includes biologically important areas for dugong breeding and foraging and whale shark foraging.

Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 6, as defined in the WAOWRP (2014). For a Level 6 response, it is expected that up to 122 personnel will be required, with a range of skill levels (**Table 16-4** – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WAOWRP). Personnel at skill levels OWR 2 - 4 and those with specialised skills (e.g. vets) are expected to be sourced through AMOSC, OSRL, DBCA, Universities and contractors.

Roles could be filled by the organisations listed above and through labour hire agencies that can provide field workers that undergo an induction and basic training. Basic training (over 1 day) for OWR personnel can be delivered as just-in-time training through an arrangement with DBCA.

Table 16-3: Indicative Oiled Wildlife Response Level (adapted from WA OWRP, 2014)

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

Table 16-4: Oiled Wildlife Response Level and Personnel Numbers

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

16.4 Implementation Guidance

Oiled wildlife response activities can be resource intensive and require additional personnel to be positioned within the IMT. The oiled wildlife response team will be managed according to the Wildlife Division outlined in the WAOWRP. The wildlife operations unit will contain all the field staff and activities, including oiled wildlife reconnaissance, who will work in close consultation with personnel undertaking relevant monitor and evaluate activities. The IAP Wildlife Response Sub-plan as outlined in **Table 16-2** will form the key management system which will provide control and oversight over the response.

Table 16-5 provides guidance to the IMT on the actions and responsibilities that should be considered when implementing OWR. These actions are provided as a guide and should be read in conjunction with the WAOWRP. In some cases, the Implementation Guidance (**Table 16-5**) will provide additional detail to the WAOWRP and has greater linkages to other aspects of the response operation and this OPEP (e.g. NEBA and aerial surveillance). Mobilisation times for the minimum resources that are required to commence initial oiled wildlife operations are listed in Table 16-6.

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

Information on resource capability for this strategy is shown in **Appendix M**.

Table 16-5: Implementation Guidance – Oiled Wildlife Response

	Action	Consideration	Responsibility	Complete
Stage 1: Initial wildlife assessment and notifications				
Initial Actions	Personnel conducting monitor and evaluate activities shall report wildlife sightings in or near the spill trajectory (including those contacted with hydrocarbons or at risk of contact) and report them to the IMT within 2 hours of detection	Record all reports of wildlife potentially impacted and impacted by spill. Record reports on: + Location + Access + Number + Species + Condition of impacted animals (if available)	Surveillance personnel	❑
	If wildlife are sighted and are at risk of contact (or have been contacted), initiate oiled wildlife response by contacting AMOSC Duty Manager and DCBA State Duty Officer (who will then activate their respective Oiled Wildlife Advisors)	Obtain approval from IC prior to activating AMOSC Oiled Wildlife Advisor and/or DCBA Oiled Wildlife Advisor DoT will be the Control Agency for OWR in State waters	Environmental Team Leader	❑
	Notify DAWE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance (MNES))	Refer to **Table 7-1** for reporting requirements. A list of MNES is provided in the Existing Environment Section of the EP	Environmental Team Leader	❑
	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected		Environmental Team Leader Wildlife Division Coordinator	❑
	Use information from initial assessments to prepare an Operational SIMA. Use this information to help determine: Initial OWR Response Level (1-6), as defined in the WA OWRP (**Table 16-3**)Review of the	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution alone. The Environmental Team Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether	Environmental Team Leader Wildlife Division Coordinator Wildlife Branch Director	❑

Action		Consideration	Responsibility	Complete
	worst-case spill modelling indicates that floating hydrocarbon concentrations above 10g/m2 may extend up to 250km from the spill location and have a maximum shoreline loading of 1320 m3, at 100g/m2, effecting 133 km along the Ningaloo Coast North. The Ningaloo Coast North includes biologically important areas for birds and major turtle nesting sites. Approximately 33 species of seabirds and shorebirds are found in the Ningaloo Marine Park (CALM and MPRA 2005). This area of coastline also includes biologically important areas for dugong breeding and foraging and whale shark foraging. Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 6, as defined in the WAOWRP (2014). For a Level 6 response, it is expected that up to 122 personnel will be required, with a range of skill levels (**Table 16-4** – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WAOWRP). Personnel at skill levels OWR 2 - 4 and those with specialised skills (e.g. vets) are expected to be sourced through AMOSC, OSRL, DBCA, Universities and contractors. Roles could be filled by the organisations listed above and through labour hire agencies that can provide field workers that undergo an induction and basic training. Basic training (over 1 day) for	capture and cleaning of oiled wildlife will result in a net environmental benefit. This may be done in consultation with the DCBA and AMOSC Oiled Wildlife Advisors and any SME's as relevant (if available, but an Operational NEBA should not be delayed if they are not immediately available)		

Action	Consideration	Responsibility	Complete
OWR personnel can be delivered as just-in-time training through an arrangement with DBCA.			
Stage 2: Mobilisation of wildlife resources			
Determine resources required to undertake Stage 3: Wildlife Reconnaissance and provide list to Logistics Section	Confirm best reconnaissance platform (e.g. vessel, aerial, shoreline). Consider ability to share resources (e.g. Shoreline Clean-up Assessment Teams, Monitor and Evaluate activities)	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA	❑
Determine number of Oiled Wildlife Responders and IMT Wildlife related positions required based on the likely number of oiled wildlife and arrange access to resources via AMOSC and DCBA	Refer to **Table 16-4** Consider need for veterinary care	Wildlife Division Coordinator Logistics Team Leader AMOSC OWA DBCA OWA	❑
Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s		Wildlife Logistics Officer	❑
Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR		Environmental Team Leader	❑
Stage 3: Wildlife reconnaissance			
Determine reconnaissance plan including survey locations, techniques and priority species	Consult local experts, if available	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA	❑

Action	Consideration	Responsibility	Complete
		DBCA OWA Planning Team Leader	
Conduct reconnaissance activities and upon completion, submit report detailing: + Area/s surveyed + Estimated number of animals oiled or at risk of being affected + Any deaths + Species affected		Wildlife Division Coordinator Wildlife Operations Officer Wildlife Reconnaissance Officer OWR field personnel Operations Team Leader	❑
Stage 4: IAP wildlife sub-plan development			
Develop Wildlife Response Sub-plan for inclusion in the IAP IAP should include options for wildlife rescue and rehabilitation, including: + Wildlife priorities for protection from hydrocarbons + Any deterrence/hazing measures + Anticipate number of oiled wildlife requiring rescue + Reassess Oiled Wildlife Level + Actions required for the collection, recovery, transport and treatment of oiled wildlife; including resourcing of equipment and personnel anticipated	Consider need for any permits to conduct activities	Wildlife Division Coordinator Wildlife Operations Officer AMOSC OWA DBCA OWA Environmental Team Leader	❑
Stage 5: Wildlife rescue and staging			
Implement Wildlife Response Sub-plan for deterrence/hazing, pre-emptive capture, relocation	Trained personnel required to handle wildlife	Wildlife Division Coordinator Wildlife Operations Officer Wildlife Rescue Officer AMOSC OWA	❑

Action	Consideration	Responsibility	Complete
		DBCA OWA OWR field personnel Operations Team Leader	
Establish staging site/s	Wildlife first aid/stabilisation may be required at staging site if OWR treatment facility is more than 2 hours away	Wildlife Operations Officer Wildlife Staging/Holding Officer OWR field personnel Operations Team Leader	❑
Stage 6: Establishment of an oiled wildlife facility			
Implement Wildlife Response Sub-plan for oiled wildlife facility	Utilise OWR containers where possible. One container/kit can treat up to 150 OWR units, so will be adequate to treat oiled wildlife from the worst-case spill. If insufficient, additional OWR containers can be requested via the IAP to AMSA Should oiled wildlife treatment be set up on vessels rather than onshore, the vessel needs to have adequate deck space to house the oiled wildlife equipment and be able to provide continuous hot water at constant pressure and temperature. The vessel must have the ability to properly contain and dispose of contaminated wastewater. Most Support Vessels are likely to be appropriate as they have mud and other tanks for water storage and oil-water systems for treating water	Wildlife Division Coordinator Wildlife Operations Officer Wildlife Facilities Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	❑
Stage 7: Wildlife rehabilitation			
Implement Wildlife Response Sub-plan for rehabilitation	Animals need to be stable to withstand stress of washing. Oiled animals, particularly birds, cannot thermoregulate and need to be kept indoors in a	Wildlife Division Coordinator Wildlife Veterinarian	❑

Action	Consideration	Responsibility	Complete
	temperature-controlled room. The room needs to be well ventilated to disperse the hydrocarbon fumes	Wildlife Rehabilitation Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	
Stage 8: Oiled wildlife response termination			
Liaise with Jurisdictional Authorities regarding OWR termination, using endpoints established in the IAP and supplementary Wildlife Response Sub-plan (Termination and Demobilisation section)		Wildlife Division Coordinator AMOSC OWA DBCA OWA Incident Commander	❑

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 and Shoreline Assessment Team 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. Indicative minimum resource requirements below align with personnel requirements for a Level 1 response as per the WA OWRP: 6x trained industry oiled wildlife response team personnel (AMOSC staff & contractors/ AMOSC Industry OWR group) 1x AMOSC OWR treatment container 1x AMOSC Oiled Wildlife Deterrence Kit	

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

Environmental Performance Outcome	Implement tactics in accordance with the Western Australian Oiled Wildlife Response Plan (WAOWRP) to prevent or reduce impacts, and to humanely treat, house, and release or euthanase wildlife.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Oiled Wildlife Response	**Response preparedness**		
	Maintenance of access to oiled wildlife response equipment and personnel	Maintenance of access to oiled wildlife response equipment and personnel through AMOSC, AMSA National Plan and Oil spill Response Limited (OSRL) throughout activity	MoU for access to National Plan resources through AMSA
			AMOSC Participating Member Contract.
			OSRL Associate Member Contract.
	Labour hire contract	Maintenance of contract with labour hire provider	Contract
	Labour hire onboarding procedure (for low skilled shoreline clean-up personnel)	Development of onboarding procedure for oil spill response labour hire	Onboarding procedure
	Santos WA Oiled Wildlife Response Framework	Development of a Santos WA Oiled Wildlife Response Framework (to be completed by end of 2020)	Santos WA Oiled Wildlife Response Framework
	Santos WA personnel trained on OWR	Additional Santos WA personnel trained in OWR during 2020	Training records
	Response Implementation		
	Mobilisation of minimum requirements for initial response operations	Minimum requirements mobilised in accordance with **Table 16-6** unless directed otherwise by DoT/ DBCA.	Incident log
	OWR managed in accordance with the WAOWRP	Prepare operational NEBA to help classify OWR level and determine if OWR activities are likely to result in a net environmental benefit	Records indicate operational NEBA completed prior to OWR operations commencing
		IAP Wildlife Response Sub-plan developed to provide oversight and management of OWR operation	Records indicate IAP Wildlife Response Sub-plan prepared prior to OWR operations commencing

17 Waste Management Plan

Table 17-1 provides the environmental performance outcome, initiation criteria and termination criteria for this strategy.

Table 17-1 : Waste Management – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Comply with waste treatment, transport and disposal regulations and prevent secondary contamination while reducing, reusing and recycling waste where possible		
Initiation criteria	Response activities that will be generating waste have been initiated		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	+ All waste generated from the oil spill response has been stored, transported and disposed as per the regulatory requirements; and + Agreement is reached with Jurisdictional Authorities to terminate the response		

17.1 Overview

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

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

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

17.2 Implementation Guidance

Table 17-2 provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this strategy. **Table 17-3** provides a list of resources that may be used to implement this strategy The Incident Commander is ultimately responsible for implementing the response, and may therefore determine that some tasks be varied, should not be implemented or be reassigned.

Table 17-2: 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 Contacts Directory (QE-00-ZF-00025.20) for contact details	Logistics Team Leader	❑
	Based on operational modelling and applicable response strategies communicate the type and quantity of empty liquid and solid waste receptacles required to support planned operations	It is better to overestimate volumes and scale back resources then to underestimate waste volumes	Logistics Team Leader Planning Team Leader	❑
	Using most recent monitor and evaluate data and any existing and future response activities, determine most suitable locations for waste receptacles to be positioned and for temporary storage locations to be established	Consideration would be given to positioning receptacles and locating temporary storage sites to ensure secondary contamination of sensitive receptors is avoided or minimised. The approval of temporary storage sites would be given through DWER	Logistics Team Leader Planning Team Leader Environmental Team Leader	❑
	For each receival location indicate the anticipated: + Material types; + Material generation rates; + Material generation quantities; + Commencement date/time; + Anticipated clean-up duration; + Receptacle types required; + Logistical support requirements; + Any approvals required from Ports, Local Governments, Landowners, State	Consider facilities for waste segregation at source	Logistics Team Leader Planning Team Leader	❑

	Action	Consideration	Responsibility	Complete
	Government Agencies (Refer to Oil Pollution Waste Management Plan (QE-91-IF-10053)).			
	Once the above information is obtained, ensure all necessary waste management information is included in the IAP	Waste management should be conducted in accordance with Santos WA's Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan	Logistics Team Leader (or delegate) Planning Team Leader Deputy Waste Management Coordinator (DoT IMT) WSP Location Responsible Person or Operations Supervisor	❑
	Mobilise waste management resources and services to agreed priority locations		WSP Location Responsible Person or Operations Supervisor Logistics Team Leader (or delegate) Deputy Waste Management Coordinator (DoT IMT)	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP	If DoT is the Control Agency, the Facilities Support Officer shall be the point of contact between DoT and the WSP	Deputy Waste Management Coordinator (DoT IMT) Logistics Team Leader	❑
	Ensure all waste handling, transport and disposal practices comply with legislative requirements	Alert Logistics Team Leader (or delegate)/ Deputy Logistics Officer (if DoT is the Control Agency) if any non-compliance is anticipated or detected Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos WA's Oil Pollution Waste Management	WSP Location Responsible Person or Operations Supervisor	❑

Action		Consideration	Responsibility	Complete
		Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan		
	Ensure records are maintained for all waste management activities, including but not limited to: + Waste movements (including types of receptacles, receival points, temporary storage points, final disposal locations); + Volumes generated at each site (including total volume and generation rates); + Types of waste generated at each site; + Approvals obtained (as required).		WSP Location Responsible Person or Operations Supervisor	❑

17.3 Waste approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos WA's Oil Pollution Waste Management Plan (QE-91-IF-10053); and where relevant, the DoT Waste Management Guidelines, and the respective Port, Port Operator and/or Ship Owner's waste management plan. In addition, regulatory approval may be required for the temporary storage, transport, disposal and treatment of waste, through the Department of Water and Environmental Regulation (DWER). DWER administers the *Environmental Protection Act* 1986 (WA) and is the relevant Regulatory Authority for waste management approvals. If required, DoT may establish an Operational Area Support Group (OASG), as defined in the State Hazard: MEE, to request support from relevant WA Government Agencies, including DWER, during a State waters spill response. The Santos WA's Oil Pollution Waste Management Plan (QE-91-IF-10053) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos WA's activities.

17.4 Waste Service Provider Capability

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

Key responsibilities of the waste service provider include:

+ Maintaining emergency response standby preparedness arrangements, including:
  - Access to personnel, equipment and vehicles required for a first strike and ongoing response commensurate to Santos WA worse case spill and waste requirements
  - Provide primary and secondary contact details for activation of spill response waste management services
  - Have suitably trained personnel for completing critical tasks in spill response waste management
  - Participation in exercising undertaken by Santos WA.
+ 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; and
+ Provide location specific Operations Supervisor/s to handle on-site operational aspects (management of personnel and equipment, reporting, liaison with relevant field-based spill responders)

17.5 Waste management resources

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

Table 17-3 provides waste service provider capability for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP.

Table 17-3 : NWA Vehicle and Equipment Availability

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m3)	NWA mobilisation schedule to meet estimated capacity			
						No. Sourced locally	No. Sourced State-wide and Nationally		
Waste removal						**48 hours**	**1 week**	**2 weeks**	**1 month**
Skip Lift Truck	12	Lift up to 15 Tonnes	Servicing of skip bins	7	1260	4	3	3	2
Front Lift Trucks	10	28 m^3 Body	Servicing of front lift bins	7	1960	4	3	2	1
Side Loading Truck	10	18 m^3 Body	Servicing of MGB's	7	1260	1	2	4	3
Hook Lift Truck	5	70 Tonne rated	Servicing of hook lift bins	7	2450	3	2	2	N/A
Flat Bed Truck	16	15 pallet spaces	Servicing of bins	7	840	3	6	4	N/A
Waste storage						**48 hours**	**1 week**	**2 weeks**	**1 month**
MGB's	500	240 litres	Mobile bins	2	240	200	300	N/A	N/A
Offshore 8 pack Lifting Cradle (MGB's)	2	16 x 240 litre MGB'S	Able to remove 16 x 240L MGB'S simultaneously	continuous		0	2	N/A	N/A

Plant and Equipment	No.	Capacity	Functionality	Uses per week	Indicative waste stored/shifted per week (m3)	NWA mobilisation schedule to meet estimated capacity			
						No. Sourced locally	No. Sourced State-wide and Nationally		
Waste storage						**48 hours**	**1 week**	**2 weeks**	**1 month**
Lidded Bins	6	1,100 litres	contain various waste streams	2	13	6	N/A	N/A	N/A
Front Lift Bins	50	3 m3	various waste streams	2	300	20	30	N/A	N/A
Front Lift Bins	25	4.5 m3	various waste streams	2	225	10	15	N/A	N/A
Offshore Rated Front Load Bins	100	3 m3	various waste streams	2	600	40	60	N/A	N/A
Offshore Rated Bins	45	7 m3	various waste streams	2	630	20	25	N/A	N/A
Marrell Skip Bins	60	6-9 m3	various waste streams	2	960	20	40	N/A	N/A
Hook Lift Bins	12	15-30 m3	various waste streams	25	6900	12	N/A	N/A	N/A
Forklift	4	4 tonne Forklift	All areas	continuous	N/A	4	N/A	N/A	N/A

17.6 Waste Management Environmental Performance

Table 17-4 indicates the environmental performance outcomes, controls and performance standards for this response strategy.

Table 17-4: Environmental Performance – Waste Management

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

18 Scientific Monitoring Plan

Table 18-1: Scientific Monitoring - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill or affected by spill response		
Initiation criteria	Refer to individual Receptor Scientific Monitoring Plans (SMPs) – **Appendix N**		
Applicable hydrocarbons	**Diesel**	**Crude**	**HFO**
	✔	✔	✔
Termination criteria	Refer to individual SMPs – **Appendix N**		

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

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

18.1 Objectives

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

Receptor-specific SMPs have different objectives as outlined in **Appendix N.**

18.2 Scope

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

18.3 Relationship to Operational Monitoring

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

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

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

18.4 Scientific Monitoring Plans

Owing to the diverse nature of sensitive receptors that could be contacted by an oil spill and the different techniques and skillsets required to monitor impact and recovery to these receptors, there are a number of Oil Spill Scientific Monitoring Plans relevant to Ningaloo Vision Operations **(Table 18-2).** These are detailed further in **Appendix N**; each SMP has corresponding objectives, initiation/termination criteria, methodologies, baseline data sources and analysis and reporting requirements, noting that in a response controlled by DoT methodology, termination criteria and analysis/reporting requirements may differ.

Table 18-2: Oil Spill Scientific Monitoring Plans relevant to Ningaloo Vision operations

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

18.5 Baseline Monitoring

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

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

Santos WA periodically review the status, availability and suitability of existing baseline data sources related to key environmental sensitivities in its areas of operations. **Appendix P** provides further information on Santos WA baseline data reviews and outlines a baseline date assessment conducted on high priority areas for scientific monitoring in the event of a Ningaloo Vision operations oil spill.

18.6 Monitoring Service Providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos WA by a contracted Monitoring Service Providers (MSPs) and applies to the implementation of SMPs 1-11 (Table 18-2). These services are provided by Astron Environmental Services (Astron) and primary sub-contractor (BMT).

For whale sharks, in addition to the monitoring that will be undertaken as part of SMP8 Marine Megafauna, additional scientific monitoring of whale sharks along the Ningaloo Coast will be undertaken (SMP12). Santos has historically and currently supports research on the behaviour, demography and migration patterns of whale sharks at Ningaloo Reef conducted by AIMS. In the event of a spill that could impact whale sharks, Santos will leverage off this long-term research program to assess potential impacts to whale sharks at, and migrating to-and-from, Ningaloo Reef. SMP12 is regarded as complementary to SMP8 which will detect potential impacts to whale sharks from visual surveys of whale sharks wherever they may occur in relation to a spill.

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

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

Appendix P provides an overview of Santos WA's processes in place to provide assurance that its oil spill scientific monitoring arrangements for SMPs 1-11 are fit for purpose to meet the worst case first-strike monitoring requirements associated with the Ningaloo Vision operations.

18.7 Activation

The SMP Activation Process is outlined in **Appendix O**. SMPs are activated as per the initiation criteria for each as outlined in **Appendix N**. The SMP Activation Form is available on the Santos WA Procedures Index and IMT Environment Team Leader folder.

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

This process will identify monitoring operational objectives and resourcing/ mobilisation requirements which the Environment Team Leader will feed back to the IMT for approval. Mobilisation times for the minimum resources that are required to commence initial scientific monitoring operations are listed in **Table 18-3**.

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

Table 18-3: Scientific Monitoring – First Strike Response Timeline

Task	Time from activation of SMP
Santos IMT approve initial monitoring plan	<24 hours
Santos to mobilise sampling platforms to deployment location	<96 hours (72 hours from monitoring plan approval)
SMP teams and monitoring equipment mobilised to deployment locations	<96 hours (72 hours from monitoring plan approval)
Minimum Resource Requirements	
Initial resourcing requirements will be dependent upon the number of SMPs activated and the requirement for post spill baseline data to be collected. First strike personnel requirements for scientific monitoring field teams at Protection Priority areas are presented in **Appendix P** • Suitable vessels for on-water monitoring or transfer of personnel to remotes areas/islands • Vehicle/s as required • Helicopter for aerial surveys as required • Scientific monitoring personnel for first strike teams (refer **Appendix P**) • Scientific monitoring equipment as detailed in the relevant SMP	

18.8 Scientific Monitoring Environmental Performance

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

Table 18-4: Environmental Performance – Scientific Monitoring

Environmental Performance Outcome	Implement monitoring programs to assess and report on the impact, extent, severity, persistence and recovery of sensitive receptors contacted by a spill		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement criteria**
Scientific Monitoring	**Response preparedness**		
	Maintenance of Monitoring Service Provider contract for scientific monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	Capability reports from Monitoring Service Provider	Obtain monthly capability reports from Monitoring Service Provider	Capability reports
	Conduct periodical review of existing baseline data sources across the Santos WA combined EMBA	Regular review of baseline data	Baseline data review report
	Water quality monitoring vessels	Maintenance of vessel specification for water quality monitoring vessels	Vessel specification
	Oil and water quality monitoring equipment	Oil and water quality monitoring kits pre-positioned at Exmouth, Dampier and Varanus Island (prior to end of 2020)	Evidence of deployment to site
	Response implementation		
	Activate Scientific Monitoring Plans	Initiation criteria of SMPs will be reviewed during the preparation of the initial Incident Action Plan (IAPs) and subsequent IAPs; and if any criteria are met, relevant SMPs will be activated	Incident Action Plan and Incident Log
		If any SMPs are activated, the subsequent activation of Monitoring Service Provider is to follow the process outlined in Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162)	Incident Log

		Monitoring Service Provider shall commence activation process within 30 mins of initial notification form being received from Santos WA	Monitoring Service Provider records
		Santos WA personnel to support Monitoring Service Provider through the provision of operational monitoring information and relative location of sensitive receptors to the spill	Incident Log and Monitoring Service Provider records
	Mobilisation of minimum requirements for initial scientific monitoring operations	Minimum requirements mobilised in accordance with **Table 18-3**	Incident log

19 Spill Response Termination

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

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

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

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

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

20 OPEP Administration

20.1 Document Review and Revision

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 WA Management of Change Procedure (EA-91-IQ-10001). This could include changes required in response to one or more of the following:

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

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

20.2 OPEP Custodian

The custodian of the OPEP is Santos WA Senior Adviser – Oil Spill Response

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Appendix A: Hydrocarbon Characteristics and Behaviour

Marine diesel

In the marine environment diesel will behave as follows:

+ Diesel will spread rapidly in the direction of the prevailing wind and waves;
+ In calm conditions evaporation is the dominant process contributing to the fate of spilled diesel from the sea surface and will account for 60 to 80% reduction of the net hydrocarbon balance;
+ As wind increases, and breaking waves form, entrainment of diesel below the surface increases;
+ The evaporation rate of diesel will increase in warmer air and sea temperatures such as those present around Ningaloo Vision; and
+ Diesel residues usually consist of heavy compounds that may persist longer and will tend to disperse as oil droplets into the upper layers of the water column.

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

For full details on the properties of marine diesel, refer to Section 7.4 of the *Ningaloo Vision Operations Environment Plan WA-35-L (TV-00-RI-00003).*

Table A1: Characteristics of diesel

Hydrocarbon	Initial density (kg/m^3)	Viscosity (cP) @ 25°C	Component	Volatiles (%)	Semi-volatiles (%)	Low volatility (%)	Residual (%)
			Boiling Points (°C)	<180	180–265	265–380	>380
Diesel	836.8	4.0	% of total	6	34.6	54.4	<5

Source: APASA (2013a)

Heavy fuel oil

Characteristics of HFO were extracted from the RPS Group oil database for similar operational temperatures to the North West Shelf (**Table A2**). HFO is a manufactured blend of hydrocarbons largely composed of low-volatile and persistent hydrocarbons to which a small proportion of higher volatility components are added. The oil has a low percentage of volatile and semi-volatile components (a total of < 6%). Approximately 11% of the volume has low volatility (boiling point between 265 and 380°C), that would require weeks to evaporate. A further 83% is composed of non-volatile components (boiling point greater than 380° C), which will not evaporate under typical environmental conditions that occur on the North West Shelf. The soluble aromatic hydrocarbons represent a low proportion of the volume of HFO, at approximately 2.2%.

HFO has high viscosity (> 3000 cSt) when fresh and the viscosity will rise through evaporation of lighter components and, consequently, will not spread as rapidly as less viscous oil types. Moreover, HFO can take up water at a ratio of 30-70% of the oil volume to form a water-in-oil emulsion (mousse), which will result in increased viscosity of the mixture. This emulsification process will inhibit evaporation rates for the oil and increase the volume of oily waste.

Table A2: Characteristics of HFO

Hydro-carbon	Initial density	Viscosity (cP) @ 25°C	Volatiles (%)	Volatiles (%)	Semi volatility (%)	Low volatility (%)	Residual (%)	Aromatics (%)

	(g/cm^3) @ 15ºC		Boiling Points (ºC)	<180	180–265	265–380	>380	Of whole oil < 380 °C BP
Heavy Fuel Oil	0.9749	3180	% of total	1.0	4.9	11.3	82.8	2.2
				Non-persistent			Persistent	

Source: APASA (2013b)

Hydraulic oils

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

Lubricating fluid

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

Oily water

Oily water can be mixture of any hydrocarbon used or stored on the vessel mixed with stormwater, ocean water, or process water. The concentrations of oil in the water are usually quite low; thereby the volumes of hydrocarbons released in a spill event are quite low and tend to dissipate quickly.

Van Gogh/Coniston /Novara crude oils

The Ningaloo Vision FPSO processes crude oil produced from the Van Gogh, Coniston and Novara fields. Credible oil spills associated with Ningaloo Vision operations could involve one of these oils separately or a blend of oils. A summary of Van Gogh, Coniston and Novara crude oil properties and a blend of these oils is provided in **Table A3** based on assay data.

Assay data shows the oils are highly biodegradable and contain a very small proportion of volatiles (<7%), a relatively low proportion of semi-volatile components (29-32.5%) and a high proportion of persistent compounds (60.7-67%). All oils have a negligible proportion of aromatic compounds (<1%) and wax content (<5%). Full assay results are available on the Emergency Response Intranet Page.

These oils can be categorised as heavy Group IV oils (AMSA, 2015). They are fluid at winter and summer sea temperatures and are relatively viscous with a persistent fraction of oil remaining during weathering. They have a high flash point that presents a low fire and explosion hazard when fresh.

Table A3: Summary of Van Gogh, Coniston and Novara crude oil properties

Hydrocarbon Type	Initial density (kg/m^3) @ 15°C	Viscosity (cSt)	Component by Volume (%)	Non-Persistent		Persistent		Aromatic content (v/v %)
				Volatiles (%)	Semi-volatiles (%)	Low Volatility	Residual (%)	
			BP (ºC)	IBP–260	260–360	360–540	>540	
Van Gogh crude oil	951	@ 40 ºC: 145.7	% of total	5.8	29.5	44.4	20.3	0.3
Coniston crude oil	961	@ 70ºC: 40.56	% of total	6.9	32.5	40.9	19.8	0.3
Novara crude oil	970	@ 60ºC: 123.4	% of total	3.9	29.0	42.6	24.4	0.2
Van Gogh, Coniston and Novara crude oil blend	952	@ 70ºC: 31.21	% of total	5.9	27.8	43.7	22.6	0.5

Source: Intertek (2009, 2010, 2012, 2016, 2019)

<u>Weathering characteristics</u>

RPS Group (2015) conducted an assessment on Van Gogh field crude oil (Theo-3 well) for weathering properties and applicable spill response strategies, drawing on assay data and a laboratory weathering study (Leeder Consulting, 2007a, b). Weathering and dispersant efficacy studies have also been conducted on Coniston and Novara oils separately (Intertek Geotech, 2012) and a blend of oils (Van Gogh and Coniston comingled; Intertek 2018). Key results are summarised below.

Oil appearance on water

Van Gogh, Coniston and Novara crude oils have a dark brown colour and would appear as dark brown to black slicks which may sit low near the water surface due to the relatively high viscosity and high density.

Although sheens may be visible spreading from thicker slicks initially, indicating the spread of lower density components, sheens will likely be absent after the oil has weathered for 6-12 hours.

Evaporation/flammability

All oils have a high flash point (> 110°C) with low representation by highly volatile components (<10%), indicating low risk of flammable vapour concentrations being generated. Evaporate will occur slowly and only partially with a high proportion of low volatility/residual compounds (60-70%). Based on laboratory weathering studies losses from evaporation over a period of 3 days are expected to be less than 50% although there were some differences observed among oils (**Table A4**). Results indicate Coniston and Novara oils would be more resistant to weathering than Van Gogh crude or a blend including Van Gogh crude. Laboratory studies show loses of <10% for Coniston/Novara oils. Across all studies losses through evaporation levelled within or at approximately 3 days.

Table A4 – Laboratory weathering results (% volume loss) for Van Gogh, Coniston and Novara oils

Oil	% volume loss after 24 hours		% volume loss after 3 days	
	Winter conditions[1]	Summer conditions[1]	Winter conditions[1]	Summer conditions[1]
Theo-3 (Van Gogh) (Leeder Consulting 2007a)	15	36	26	52
Coniston (Intertek Geotech, 2012)	3.9	5.4	6.8	7.1
Novara (Intertek Geotech, 2012)	1.9	1.9	1.9	1.9
Coniston and Van Gogh blend (Intertek, 2018)	21	Not tested	24	Not tested

[1] Representative air and water temperatures for Summer and Winter at Ningaloo Vision site were used – refer to reports for specific details.

Viscosity, pour point and density

All oils have low initial pour points (-18 – 4 °C) which after 3 days of weathering, under summer and winter conditions, remain low and under the ambient temperatures at the spill site indicating that oils will remain liquid during initial weathering (**Table A4**). The viscosity of oils when fresh and after 3 days weathering indicate high viscosity and low spreading rates will occur due to gravity and surface tension. Viscosity and pour point increases during weathering (**Table A4**). For very weathered residues of these oils, assay derived pour point data indicates that highly weathered residues may be solid at ambient sea and air temperatures given residue pour points are typically above 50 °C.

Density also increases with weathering for these oils (Table A3), but fresh and weathered oil densities are <1 and therefore oils should remain buoyant in sea water. Measurements of density of Theo-3 (Van Gogh) crude with weathering indicate stabilisation at around 0.985 kg/l, suggesting that the oil density would remain below seawater density (i.e. <1.025 kg/l) for weeks to months.

The high viscosity and lower density than seawater will also resist physical break-up and entrainment into the water column (as oil droplets). Consequently, the oil will tend to remain afloat as slicks of liquid oil on the water surface even under rough sea conditions, most likely separating into patches under rough conditions.

Exception to this expectation might occur if the oil gets churned by wave action along a sandy shoreline and suspended sediment binds with the oil to raise the density of the sediment/oil mixture above that of seawater. This might result in sinking of the oil/sediment mixture near shorelines.

Table A5 – Viscosity, Pour Point and Density of Van Gogh, Coniston and Novara oils during weathering

Oil	Season[2]	Viscosity[1] (Cst)			Pour point (°C)			Density @ 15° (mg/L)		
		0 h	24 h	3 d	0 h	24 h	3 d	0 h	24 h	3 d
Theo-3 (Van Gogh) (Leeder Consulting 2007a)	summer	48.5	248	885	-18	3	14	0.94	0.97	0.98
	winter	48.5	88.1	158	-18	-11	-4	0.94	0.97	0.98
Coniston (Intertek Geotech, 2012)	summer	234	337	334	-9	-1	-1	0.96	NR	NR
	winter	234	455	493	9	-1	-1	NR	NR	NR
Novara (Intertek Geotech, 2012)	summer	518	617	689	4	7	9	0.97	NR	NR
	winter	NR	NR	NR	4	7	7	NR	NR	NR
Coniston and Van Gogh blend (Intertek, 2018)	winter	181	203	NR	-12	-9	NR	0.96	0.96	NR

[1] Viscosity measured at 60°C for Theo-3 oil and 40°C for Coniston, Novara and Coniston/Van Gogh blend

[2] Representative air and water temperatures for Summer and Winter at Ningaloo Vision site were used – refer to reports for specific details.

NR=No results

Emulsification potential

Emulsification testing has been conducted on Theo-3 (Van Gogh) crude and a blend of Coniston and Van Gogh oil while observations have been made on the emulsification potential of Coniston and Novara oils. Laboratory results vary across these oils; laboratory testing (tumbling of oil sample and sea water) indicated no significant take up of water for Theo-3 oil but the same testing for a blend of Van Gogh and Coniston oils revealed the formation of stable emulsions which fully separated over a period of 7 days under low energy (calm) conditions. While the emulsion resulted in an increase in volume, the viscosity, density and pour point of the blend remained relatively stable with slight increases over a 7-day weathering period. Visual observations from weathering testing of Coniston and Novara oils indicted that both oils form emulsions too however stability was considered to be on a scale of hours rather than days (Intertek Geotech, 2012).

Adhesion

The relatively high viscosity of Van Gogh, Coniston and Novara crude oils suggests that the oil will be cohesive and would adhere to surfaces such as sediment, infrastructure and the feathers of sea birds. The adhesion rate of the oil to a steel surface was observed to increase on weathering, consistent with the rise in viscosity. This indicates that the oil could be more problematic, in terms of physical impacts on biota, and for response (removal from surfaces, pumping etc.) as the oil weathers.

Dissolution of soluble, toxic, components

Van Gogh, Coniston and Novara crude oils contain only a low proportion of soluble hydrocarbons. Where BTEX compounds (Benzene, Toluene, Ethylbenzene, Xylene) have been measured over weathering (Leeder, 2007a; Intertek, 2018), none of these compounds were detected above detection limits.

The high viscosity and tendency to remain as slicks instead of breaking up into droplets will also slow the rate of release of any soluble compounds that are present; by reducing the surface area available for exchange, indicating that soluble compounds that do leach from the oil would be widely spread, limiting concentrations that could occur.

Potential for oiled wildlife

The high viscosity of Van Gogh, Coniston and Novara crude oils indicate the potential for physical smothering of intertidal fauna and habitats. The high viscosity also indicates a high potential physical effect of the oil on seabirds that come into contact with the oil, physically restricting their flight and swimming movement and coating their feathers to cause matting of the feather structure and impairing the waterproofing and thermoregulation properties they provide. Preening by the birds in response would expose them to ingestion of oil.

Dispersant amenability

Dispersant amenability studies have been performed on Van Gogh (Theo-3) (Leeder, 2007b), Coniston and Novara oils (Intertek Geotech, 2012) and a blend of Van Gogh and Coniston oils (Intertek, 2018). Theo-3 oil was tested with Slickgone NS and Corexit 9527 dispersants. Coniston and Novara oils were tested with Slickgone NS and Corexit 9500. The blend of Van Gogh and Coniston oils was tested with Slickgone NS, Corexit 9500 and Finasol OSR 52. With the exception of Corexit 9527, these dispersants are currently available for Santos WA to use through its arrangements with AMOSC, OSRL and AMSA.

While the methodologies used were broadly consistent some variations were applied. The testing of Theo-3 oil involved six weathered states of the oil ranging from 4 hours to 10 days old. The testing of Coniston and Novara oils considered fresh and 24 hour weathered oil only while the study of the Van Gogh and Coniston blend considered fresh oil only. The Theo-3 oil testing looked at dispersant efficacy immediately and 15 minutes after dispersant was applied while the studies on Coniston, Novara and Van Gogh/Coniston blend looked at ongoing efficacy at six time-steps from 15 minutes to 24 hours following application of dispersant. Summer and winter conditions (sea and air temperature) indicative of the Ningaloo Vision location were used for dispersant tests of Theo-3 and Coniston and Novara oils while winter conditions only were used for the test of Van Gogh/Coniston blend.

Dispersant efficacy results from 15 minutes following dispersant application are summarised in **Table A6** below. More comprehensive results and description of methods are available in the testing reports available on the Santos WA Emergency Response Intranet Page.

Table A6: Dispersant efficacy results for Van Gogh, Coniston and Novara oils

Oil	Weathered state	Percentage of oil dispersed (%) by chemical dispersant at 15 mins			
		Corexit 9527	**Corexit 9500**	**Slickgone NS**	**Finasol OSR 52**
Theo-3 (Van Gogh) (Leeder Consulting 2007a)	Fresh	72 (s), 36 (w)	NR	45 (s), 28 (w)	NR
	24 h	38 (s), 25 (w)	NR	10 (s), 31 (w)	NR
Coniston (Intertek Geotech, 2012)	Fresh	NR	32 (s), 59 (w)	22 (s), 52 (w)	NR
	24 h	NR	67 (s), 47 (w)	34 (s), 39 (w)	NR
Novara (Intertek Geotech, 2012)	Fresh	NR	50 (s), 36 (w)	35 (s), 29 (w)	NR
	24 h	NR	40 (s), 23 (w)	25 (s), 47 (w)	NR
Coniston and Van Gogh blend (Intertek, 2018)	Fresh	NR	27 (w)	32 (w)	35 (w)

s= summer conditions, w=winter conditions. Refer to reports for details.
NR = No results

Dispersant efficacy results at 15 minutes after application ranged from 10% to 72% noting that the dispersant result of 72% dispersion of Theo-3 crude was with Corexit 9527 which is currently not available.

Efficacy of Theo-3 (Van Gogh crude oil) had the greatest range across testing (10 – 72%). For Corexit 9527 efficacy on Theo-3 crude ranged from 25 to 72% with greater efficacy in summer conditions and on fresh oil. For Slickgone NS, efficacy on Theo-3 crude ranged from 10 to 45% (**Table A6**) with better or equivalent efficacy on fresh oil than 24-hour weathered oil. Further testing on more weathered oils revealed that efficacy declined on oils weathered more than 24 hours under summer conditions; for oil weathered for 3 days efficacy had declined to 4-5% under these conditions (Leeder Consulting, 2007b). This effect was less noticeable under winter conditions; efficacy declined to 16 to 34% (Leeder Consulting, 2007b).

For Coniston oil, the efficacy of Corexit 9500 (32 to 67%) was generally higher than for Slickgone NS (22 to 52%). There was no clear trend in efficacy between fresh and 24 hour weathered oil. For Slickgone NS, efficacy was better under winter conditions.

For Novara oil, the efficacy of Corexit 9500 (23 to 50%) was similar to that of Slickgone NS (25 to 47%). Corexit 9500 was more effective on fresh oil and under summer conditions.

For Van Gogh/Coniston blend oil efficacy of the three dispersants after 15 minutes from application ranged from 27 to 35% (**Table A6**). The results indicate that for the Van Gogh crude oil, Finasol OSR 52 was the most effective with 35% of oil dispersed, followed by Slickgone NS with 32% oil dispersed, and Corexit 9500 was the least effective with 27.3% oil dispersed. Efficacy was highest within the first two hours of testing, followed by a decline across the following 48 hours. Finasol OSR 52 was the only dispersant to maintain a level of efficacy (24%) after 8 hours from application, whereas the efficacy of Corexit 9500 and Slickgone NS declined rapidly to 11% and 4.5% respectively after 8 hours.

This rapid decline in efficacy following application may be attributable to the dispersant behaviour, coalescence of oil droplets and gravitational separation over time, however this may be in part due to the experimental set-up. It is noted that in the open ocean the dilution of a dispersed oil can happen very quickly. However, this is highly dependent on environmental conditions such as wind and wave action. This dilution and transportation through the water column (both vertically and laterally) can have a significant effect on preventing re- coalescence and can offset the factors described above. The results discussed above do not factor in any dilution of the dispersed oil/emulsions and therefore should be treated accordingly.

Ecotoxicity testing

Santos WA commissioned Ecotox Services Australia (ESA) to undertake an ecotoxicity study using standard test species relevant to the tropical marine environment of the NWS (ESA, 2015). A full suite of toxicity testing (six tests – echinoderm, microalgae, fish, tiger prawn, copepod and bivalve mollusc) was performed. The dataset was used to generate species protection percentile curves using the BurrliOZ software to calculate trigger values (TV) for weathered Coniston and Novara crude oils, and the chemically-dispersed oils. Full ecotoxicity results are available on the Emergency Response Intranet Page.

The TVs were derived using the Total Recoverable Hydrocarbon (TRH) concentrations for the Coniston and Novara crude oils (weathered oil samples). Derived TVs for the 99% and 95% level of species protection for the weathered Coniston and Novara crude oils were similar (**Table A7**). These derived TVs provide an early warning indication that TRH concentrations are reaching a level of concern which will assist in directing response and further investigation in the unlikely event of an oil spill.

Ecotoxicity test termination criteria based on loading rates of oil were considered a more accurate representation of toxicity and TV derivation for the chemically-dispersed oils (weathered oil + dispersant samples). Expressing concentrations in terms of TRH (total of C6–C36) can only be done for those samples where TRH is the sole cause of toxicity i.e. crude oil only. As the dispersant contributes towards toxicity, and affects the amount of TPH, it is not recommended for reporting in terms of TRH. The TVs based on loading rates derived for the Coniston and Novara crude oils with or without the addition of dispersant were used to inform the NEBA as part of the OPEP.

These results demonstrate that the addition of dispersant to Coniston and Novara oils increases the level of toxicity (95% and 99% species protection levels) to test organisms (**Table A7**). However, the concentrations of oil with and without dispersants is relatively high (i.e. at 100s to 1000s ppm levels) (**Table A7**). These levels are orders of magnitude higher (less toxic) than high exposure levels for entrained (100 ppb) and dissolved (400 ppb) hydrocarbons cited in NOPSEMA's Environment Bulletin for Oil Spill Modelling (April, 2019) and used for risk assessment within the Ningaloo Vision Operations Environmentt Plan (TV-00-RI-00003.02). The exposure levels within NOPSEMA's Environment Bulletin for Oil Spill Modelling (April, 2019) can therefore be considered very conservative for Van Gogh, Coniston and Novara crude oils.

A key effect of dispersant to an oil's toxicity is considered to be due to the dispersant making the more water soluble oil compounds more bioavailable to organisms. However, Van Gogh, Coniston and Novara oils have inherently low proportions of soluble aromatics (e.g. BTEX) and therefore the toxicity of the dispersants alone may also therefore be a factor within these results.

This information should be considered during a Net Environmental Benefit Analysis (NEBA) for dispersant use together with an understanding of the likely or observed exposure of sensitive receptors to oil as predicted through spill trajectory modelling or monitored through water quality sampling. It should be noted that natural dispersive forces in the marine environment will act to reduce the concentration and exposure to receptors of chemically dispersed oil; which cannot be replicated through laboratory testing.

Table A7: Trigger values based on loading rates derived for Coniston and Novara crude oils with or without addition of dispersant

Hydrocarbon type	Dispersant application	Level of species protection	Trigger value (mg/L)
Coniston Crude (weathered 24 hrs)	None	**99%**	**1,566**
		95%	4,233
	Corexit 9500 (1:25)	**99%**	**408**
		95%	961
	Slickgone NS (1:25)	**99%**	**118**
		95%	648
Novara Crude (weathered 24 hrs)	None	**99%**	**1,479**
		95%	3,939
	Corexit 9500 (1:25)	**99%**	**193**
		95%	**588**
	Slickgone NS (1:25)	**99%**	**161**
		95%	769

Appendix B: Oil Spill Response ALARP Framework & Assessment

ALARP Assessment Framework

1. Rationale

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

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

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

2. Guidance Documents

Guidance documents used in the preparation of this framework include:

- Oil Spill Risk Assessment and Response Planning Procedure QE-91-II-20003;
- NOPSEMA Guidance Note ALARP N-04300-GN0166 Revision 6 June 2015;
- NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020;
- NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721 Revision 6 – November 2019;
- NOPSEMA Guidance Note Risk Assessment GN0165 Revision 5 May 2017; and
- NOPSEMA Oil Pollution Risk Management GN1488 Rev 2 February 2018

3. Overview

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

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

The ALARP Assessment Framework is shown in **Figure B1**.

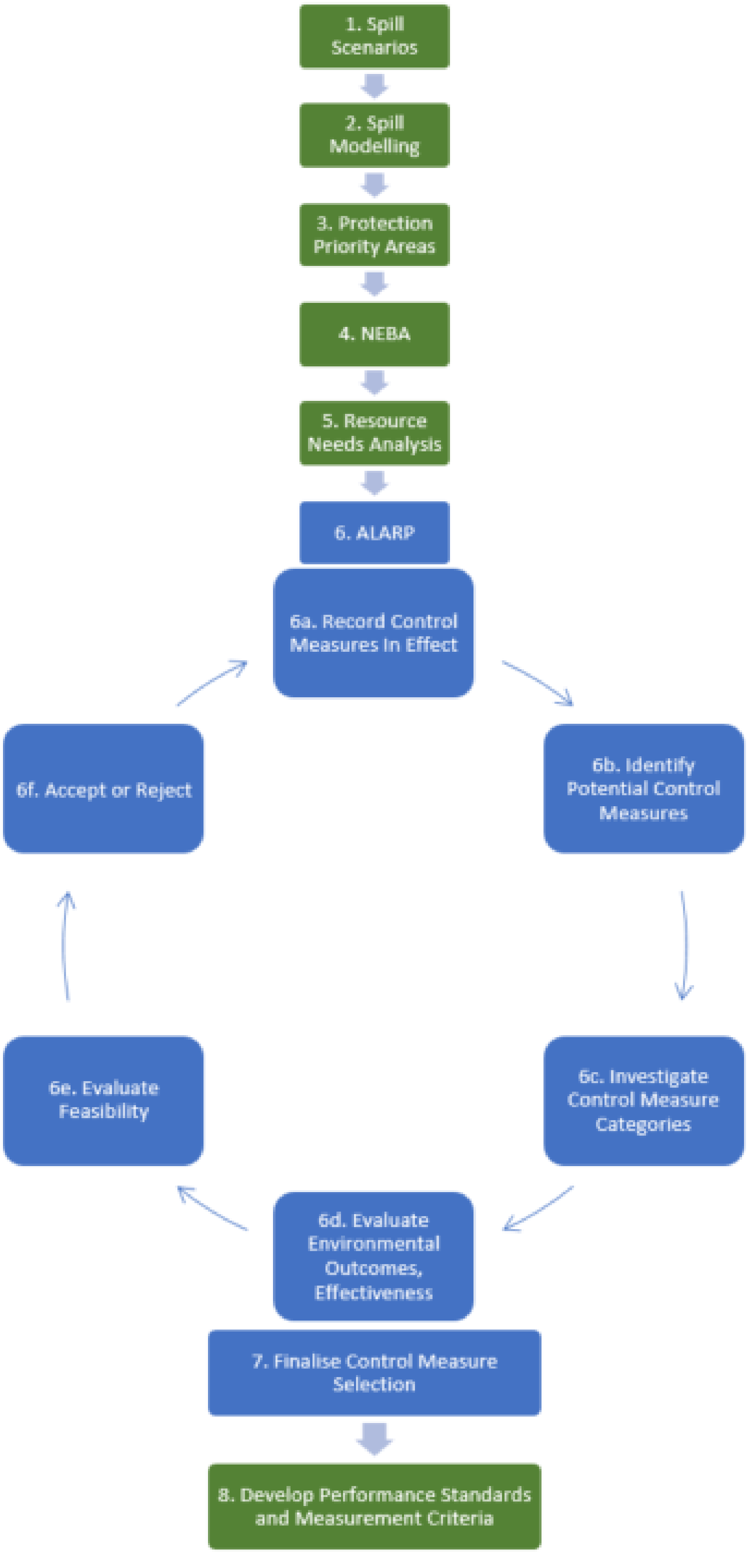


Figure B1: ALARP Assessment Framework

In **Figure B1**, Steps 1 to 5 (in GREEN) denote input information into the ALARP Assessment Framework. This information comprises:

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

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

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

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

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

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

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

In Figure B1, Steps 7 and 8 show the conclusion of the ALARP Assessment Framework:

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

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

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

4. Criteria and Definitions

Standardised criteria and definitions are used to bring consistency to the ALARP assessment across diverse activities and response strategies. Criteria and definitions are shown in **Table B1**.

Table B1: Criteria and Definitions of ALARP Assessment Framework

Column	Description
Strategy	Response Strategy
Control Measure	Aspect of Response Strategy being evaluated Description of the control measure that is In Effect or description of the potential control measure
In Effect, Alternative, Additional, Improved	In Effect control measures are already in place. Alternative control measures are evaluated as replacements for the control already in effect. Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures. Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures. Adapted from NOPSEMA Guideline Environment Plan Decision Making N-04750-GL1721 Revision 6 – November 2019
Control Measure Category	A range of different types of controls generally provide effective protection as they provide independence and multiple layers of protection. The OPGGS(S) regulations refer to technical and ‘other’ controls where technical control measures involve hardware like shutdown valves and alarms. ‘Other’ control measures include administrative and procedural control measures such as inductions, a drug and alcohol policy or an inspection regime. Industry practice has further developed this concept of a range of different types of controls based on a POiSTED framework to assess organisational capability: People – personnel System – organisation, information/communications, support facilities, training/ competency Equipment – equipment Procedures – doctrine Santos aims to implement a range of different types of controls where possible.
Environmental Outcomes	Assessment of environmental benefits, particularly those over and above those environmental benefits documented in the Control Measure that is in effect. Environmental impacts of the Control Measure are also considered here.
Effectiveness	The effectiveness of a Control Measure in reducing the risk to ALARP is evaluated using the following six criteria. <u>Functionality</u> The functional performance of a control measure is what it is required to do. How does the control perform in order to achieve the required risk reduction? <u>Availability</u> Probability that the control measure will be available when required and has not failed or is undergoing a maintenance or repair. <u>Reliability</u> The reliability of a control measure is the probability that at any point in time it will operate correctly for a further specified length of time. Reliability is all to do

Column	Description
	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 spil response control measures should have high survivability. However, some control measures, such as those involving equipment deployment from an FPSO would have low survivability in an incident that involves an FPSO explosion or fire. Dependency The dependency of the control measure is its degree of reliance on other systems in order for it to be able to perform its intended function. If several control measures can be disabled by one failure mechanism (common mode failure), or the failure of one control measure is likely to cause the failure of others, then the control measures are not independent and it may not be appropriate to count such measures as separate. Several control measures are reliant on equipment, people and vessels, hence have high dependence. Compatibility Whether or not a control measure is compatible takes into account how alternative control measures may interact with other controls and the rest of the facility, if introduced. Consideration should be given to whether new control measures are compatible with the facility and any other control measures already in use. Adapted from NOPSEMA Guidance Note Control Measures and Performance Standards N04300-GN0271 Revision No 4 Last Reviewed 2020
Feasibility	Feasibility describes the time, cost and/or effort required to implement the Control Measure.
Accept/ Reject	Outcome of assessment and key reasons for the decision

Ningaloo Vision Operations Oil Spill Response ALARP Assessment

ALARP Assessment Summary - Source Control (refer worksheet for further detail)
The Control Measures in place for relief well drilling represent industry best practice and are considered to reduce the timeframe for drilling a relief well to as low as reasonably practicable in the context of the risk of an uncontrolled well leak from a production well. Potential Control Measures were identified and assessed by the Santos WA Drilling & Completions Department representatives. The drilling of a relief well is considered to be an effective control and relief well planning conducted in the area has demonstrated that relief well drilling within 77 days can be implemented using MODUs, equipment and specialist personnel that Santos WA has arrangements to gain access to. Four potential additional Control Measures were identified and assessed. No additional Control Measures were accepted as reasonably practicable. Four Control Measures were rejected as grossly disproportionate. Rejected response strategies were: - Contract source control personnel through an alternative provider - Contract source control personnel through a provider in addition to existing arrangements - MODU on standby at activity location - Pre purchase of relief well drilling supplies Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in the OPEP. The key performance requirements for relief well drilling are the maintenance of MODU tracking, MODU access and relief well planning arrangements (during times of maintaining preparedness) and the timely mobilisation of resources (during a response). These key areas of effectiveness are reflected in the Performance Standards.
ALARP Assessment Summary - Monitor and Evaluate (refer worksheet for further detail)
Various, independent inputs from multiple service providers are used to build a detailed Common Operating Picture in the incident. Areas of improvement for monitor and evaluate activities were the availability of aerial observers and SCAT trained personnel in initial 24 hours of incident and availability of vessels for water quality monitoring. One potential Control Measure sought to make trained aerial observers available from Day 1 of a response, rather than Day 2, however an assessment of the Control Measure found that the cost was grossly disproportionate to the benefit. No potential Control Measures were identified to improve availability of SCAT trained personnel in the initial 24 hours of incident. A potential control measure to improve the availability of vessels for water quality monitoring by implementing more detailed vessel tracking parameters was evaluated and accepted. Six other potential Control Measures were also identified and assessed. Four were rejected as cost was grossly disproportionate to the reduction in risk , whilst two Control Measures around the provision of strategically located water quality monitoring kits and improved record keeping of service providers that could assist with fauna aerial observations were accepted as reasonably practicable. Eight additional potential Control Measures were identified and assessed. Three additional Control Measures were accepted as reasonably practicable. The accepted measures were: - Develop vessel specifications for operational water quality monitoring vessel - Purchase of First Strike Oil/Water quality monitoring kits to be positioned at Exmouth, VI and Dampier. - Maintain a list of providers that could assist with fauna aerial observations, eg whale shark spotting planes Five additional Control Measures were rejected as grossly disproportionate. Rejected response measures were: - Purchase of oil spill modelling system and internal personnel trained to use system - Additional satellite tracking buoys - Ensure trained aerial observers based at strategic locations such as Exmouth (North Ningaloo Coast, Muiron Islands) - Trained monitoring specialists on site - Ensure trained marine mammal/fauna observers based at strategic locations such as Exmouth (North Ningaloo Coast, Muiron Islands)

Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, focus on maintaining access to equipment and personnel through contractual arrangements with vessel providers, aircraft providers, aerial observers, UAV providers, tracking buoys, oil spill trajectory modelling providers, satellite imagery providers water quality monitoring providers and spill responders. Additional key areas for effectiveness during preparedness are following relevant procedures such as the Protected Marine Fauna Interaction and Sighting Procedure, and limiting environmental impacts from response activity through personnel and vehicle management. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence monitor and evaluate operations. These key areas of effectiveness have been represented in Performance Standards for monitor and evaluate operations.
ALARP Assessment Summary - Containment and Recovery (refer worksheet for further detail)
Santos WA, AMOSC and AMSA equipment is available in the northwest region and within WA (including stockpiles at Exmouth and Dampier) which includes offshore rated boom and skimmers suitable for heavy oil (Van Gogh Crude Oil and HFO). This containment and recovery equipment is not considered a limiting factor to containment and recovery operations; the quantity of equipment available to Santos WA 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 experienced and trained personnel required for offshore containment and recovery operations are considered to be the key constraints for this strategy given the ready access of suitable equipment and potentially limited window of effectiveness of the strategy for short duration oil spills (e.g. rapid vessel tank releases or rapid flowline releases). A review of Control Measures associated with personnel and vessels identified that improvement could be made with respect to the identification of suitable containment and recovery vessels (through development of a vessel specification) but no improvements could be made to the availability of personnel or vessels (above current arrangements) without the cost/effort being disproportional to the risk. Five additional potential Control Measures were identified and assessed. One additional Control Measure was accepted as reasonably practicable. The accepted control measures was: - Define containment and recovery vessel specifications and input this information to improve vessel tracking. Specifications may include crane, open transom, deck space for boom container, deck space for waste storage, separate additional vessel for towing boom. Four additional Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Purchase additional booms and ancillary equipment to be owned by Santos WA - Access to additional vessels by contracting vessels to remain on standby for containment and recovery - Train additional Santos personnel for spill response teams - Contract for staff from an alternative oil spill personnel provider Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to 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 concentration is at its highest (particularly applicable for spills of limited duration). 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 inform areas of operation 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 waste water from liquid oil waste storage tanks onboard vessels. These key areas of effectiveness have been represented in Performance Standards for containment and recovery operations.
ALARP Assessment Summary - Mechanical Dispersion (refer worksheet for further detail)

Mechanical dispersion is a secondary strategy that could be undertaken by vessels undertaking primary response strategies without the requirement for additional equipment, and no areas of improvement were identified. The use of mechanical dispersion in a response would be assessed as part of an operational NEBA. No potential additional Control Measures were identified and assessed. Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures during a response are around the development of an operational NEBA to confirm suitability and environmental benefit, and the mobilisation of vessels. These key areas of effectiveness are reflected in the Performance Standards.
ALARP Assessment Summary - Subsea Dispersants (refer worksheet for further detail)
Subsea dispersant application is a secondary strategy that would be complementary to surface dispersant application but has unknown effectiveness on low flow leaks. 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 considerably longer to mobilise (7-10 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 volumes available within WA and Australia and the mobilisation of these stocks exceed worse case requirements, hence dispersant is not a limiting factor to the operation. Four additional potential Control Measures were identified and assessed. No additional Control Measures were accepted as reasonably practicable. Four additional Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Purchase of Santos SFRT to be located at Exmouth of Dampier - Relocate AMOSC SFRT to Dampier - Enable improved vessel access by contracting a suitable, dedicated vessel on standby - Access to additional dispersant stockpiles owned by Santos Performance Standards and Measurement Criteria that have been developed for the in effect Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around the maintenance of contracts for the SFRT equipment, dispersants and deployment personnel and the tracking of suitable SFRT vessels. In the event of a response, the key areas for ensuring effectiveness are the mobilisation of requirements to commence subsea dispersant operations, the subsea monitoring of dispersant efficacy by ROV and the consideration of this information together with other operational monitoring information within an operational NEBA for the activity. These key areas of effectiveness are reflected in the performance standards.
ALARP Assessment Summary - Surface Dispersants (refer worksheet for further detail)
Vessel based dispersant spray systems are available from Santos WA, AMOSC and AMSA in the region (including stockpiles at Exmouth and Dampier) and within WA. These spray systems are not considered a limiting factor to surface dispersant operations; the quantity of equipment available to Santos 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 are considered to be the key constraints for this strategy given potentially limited window of effectiveness of the strategy for short duration oil spills. A review of control measures associated with personnel and vessels identified that improvement could be made with respect to the identification of suitable surface dispersant vessels (through development of a vessel specification) but no improvements could be made to the availability of personnel without the cost/effort being disproportional to the risk. Aerial based dispersant application is available to Santos WA through national and international resources via contractual arrangements. Mobilisation times for these resources are considered to be in line with industry best practice. No potential Control Measures were identified that could improve mobilisation times for aerial dispersant application. Dispersant stocks are not a limiting factor to these operations, as dispersant volumes available within WA and Australia and the mobilisation times of these stocks exceed worst case requirements. Ten additional potential Control Measures were identified and assessed.

One additional Control Measure was accepted as reasonably practicable. The accepted control measure was: - Define spray vessel specifications and input this information to improve vessel tracking One additional Control Measure was considered potentially practicable and requires further review: Access to additional vessel (with trained personnel, equipment and dispersant onboard) by using an already contracted supply vessel servicing Offshore Exmouth FPSOs and sharing cost/effort with another operator. A commitment and performance standard has been added to the OPEP to complete review of feasibility by end of 2020. Nine Control Measures were rejected as grossly disproportionate. Rejected response strategies were: - Access to additional spray systems stored on the FPSO - Access to additional spray systems stored on Varanus Island - Access to additional spray systems stored in Exmouth or Dampier - Access to additional spray systems with dispersant stored on vessels - Access to additional vessel (with trained personnel, equipment and dispersant onboard) by contracting a dedicated vessel to remain on standby for chemical dispersion - Faster access to response personnel via Santos employment of local personnel - Santos WA to contract personnel from Exmouth freight and logistics to deploy and operate vessel spray systems - Access to aircraft via additional service provider - 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 the OPEP. 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 as soon as possible and evaluating dispersant efficacy using test sprays and operational monitoring. Information on dispersant efficacy then feeds into the development of the operational NEBA. These key areas of effectiveness are reflected in the performance standards.
ALARP Assessment Summary - Protect and Deflect (refer worksheet for further detail)
Large quantities of various types of nearshore booms and skimmers from Exmouth, Dampier and Fremantle ensures that equipment is in place to implement this response strategy within 24 hrs in a wide range of metocean conditions. Trained regional Santos WA personnel can be quickly mobilised to appropriate locations using helo services, 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. Five additional potential Control Measures were identified and assessed. Four additional Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Santos WA to purchase additional shoreline and nearshore booms and ancillary equipment - Access to additional shallow draft boom tow vessels owned by Santos WA - Ensure trained personnel based at strategic locations such as Exmouth - Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations An additional Control Measures was accepted - to develop list of small vessel providers in Exmouth region Performance Standards and Measurement Criteria that have been developed for the in-effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, a key area for ensuring effectiveness is the mobilisation of requirements in order to commence protection and deflection operations and the preparation of an operational NEBA for each operational period that takes into account protection priorities and the ongoing effectiveness of the response strategy. These key areas of effectiveness have been represented in Performance Standards for protection and deflection operations.
ALARP Assessment Summary - Shoreline Clean-up (refer worksheet for further detail)

Regional and Fremantle stockpiles and locally available supplies provide a range of shoreline clean-up equipment can be accessed to suit most beach types / required clean-up operations. Trained regional Santos WA personnel can be quickly mobilised to appropriate locations using helo services, followed by AMOSC staff and AMOSC Core Group from Perth. Equipment and trained personnel are not expected to be limiting factors for this response strategy. The availability of labour hire personnel for initial stages of a response was identified as an area of improvement. Control Measures that were evaluated to improve the availability of labour hire was either not feasible or the cost was grossly disproportionate to the reduction in risk. The availability of shallow draft vessels in initial stages of a response was also identified as an area for improvement. Waste management may be a limiting factor for ongoing shoreline clean-up operations and further information is shown in the ALARP assessment for Waste. Eight additional potential Control Measures were identified and assessed. Two additional Control Measure were accepted as reasonably practicable. They were: - Develop vessel specification for shallow draft transfer vessels for remote island clean-up - Develop labour hire onboarding procedure for spill response to clarify the labour hire process for the Santos WA IMT Six Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Mechanical mobile plant equipment for clean-up pre purchased and positioned at strategic locations (Exmouth) - Pre-purchase and storage of additional equipment (decontamination/ staging equipment, clean-up and flushing, PPE) at strategic locations (Exmouth) - Access to additional shallow draft vessels owned by Santos WA to transport personnel to key sensitive areas on offshore islands such as Muiron Islands - Access to additional team leaders that are locally based at strategic locations (Exmouth) or can be mobilised within short time frames - Faster access to clean-up personnel via Santos employment of local personnel - Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. 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, shoreline assessments conducted as part of operational monitoring and preparation of a Shoreline Clean-up Subplan and NEBA to ensure that impacts from response activities are minimised and operations are conducted in accordance with protection priorities as confirmed by the Control Agency.
ALARP Assessment Summary - Oiled Wildlife (refer worksheet for further detail)
Oiled wildlife equipment including first strike kits and containers can be mobilised from regional locations and Perth. Further equipment is available through national or international resources to implement a timely and sustained response adequate for the scale of worst case oiled wildlife operations identified in the OPEP. The availability of trained personnel in the initial stages of an incident is a limiting factor for this response strategy. Control Measures around the provision of trained personnel were reviewed to identify that trained Santos WA personnel could be based not just in the Perth Office but also at VI and DC facilities. Potential Control Measures around additional responders through pre-hiring or contracts with additional service providers were investigated but were found to be not beneficial and/or the cost was grossly disproportionate to risk reduction. An additional area of improvement is clarity for how Santos WA will integrate with Control Agencies OWR. It has been identified that additional planning captured in a Santos WA Oiled Wildlife Response Framework is a practicable control measure to ensure that resources are deployed in a coordinated approach. Five additional potential Control Measures were identified and assessed. Three Control Measures were accepted as reasonably practicable. The accepted control measures were: - Development of a Santos WA Oiled Wildlife Response Framework which will set the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response - Additional Santos WA OWR trained personnel positioned at VI and Perth - Develop labour hire onboarding procedure for spill response to clarify the labour hire process for the Santos WA IMT

Two Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Pre-hire and/or prepositioning of staging areas and responders - Direct contracts with service providers Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to equipment and personnel through contractual arrangements. During response, the mobilisation of requirements for initial oiled wildlife response operations and the management of the oiled wildlife response in accordance with the WA Oiled Wildlife Response Plan are both key elements for achieving this strategy and they are represented as a Performance Standards.
ALARP Assessment Summary – Waste (refer worksheet for further detail)
The Santos WA contract with the waste service provider has provisions for waste management operations of the scale estimated to be required in worst case scenarios detailed in the OPEP. Further detail is captured in the Waste Management Plan - Oil Spill Response Support (QE-91-IF-10053). The waste service provider can mobilise waste receptacles to Exmouth from Karratha within 12 hrs. Given the waste service provider arrangements and preplanning already undertaken, waste storage facilities, road transport and logistics are not expected to be limiting factors in the response. For these components, potential Control Measures were identified and evaluated but were found to either make no improvement in capability or cost was grossly disproportionate. An area of improvement is the availability of vessels required for waste transport at sea. One potential Control Measure to address this area of improvement was identified and assessed but cost was grossly disproportionate to risk. No other potential control measures were identified. Four potential additional Control Measures were identified and assessed. One additional Control Measure ws accepted as reasonably practicable: Develop offshore waste transfer concept of operations procedure for IMT Three Control Measures were rejected as grossly disproportionate. Rejected control measures were: - Maintain contracts with multiple service providers - Procure temporary waste storage for Santos stockpile - Contract additional vessels on standby for waste transport Performance Standards and Measurement Criteria that have been developed for the in-effect Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to waste management equipment and services through contractual arrangements. During response, a key area for increasing effectiveness is the timely mobilisation of requirements for initial response operations and defining critical management and reporting services to be provided by the waste service provider. These key areas of effectiveness are captured in the Performance Standards.
ALARP Assessment Summary - Scientific Monitoring (refer worksheet for further detail)
Oil spill scientific monitoring will be conducted on behalf of Santos WA by a contracted monitoring service provider as detailed in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and the relevant Scientific Monitoring Programs. An area of improvement is the availability of vessels in the initial stages of response. To address this area of improvement, a potential Control Measure around more detailed vessel tracking was assessed and accepted. Additionally, three potential Control Measures were identified and assessed. A potential Control Measure on the purchase and standby of scientific monitoring resources was found to be grossly disproportionate in cost in comparison to the reduction in risk. Two potential Control Measures on improved record keeping for scientific monitoring consumable requirements and suppliers and the provision of water quality sampling kits to be located at strategic regional locations were both found to be reasonable practicable. Four additional potential Control Measures were identified and assessed. Two additional Control Measure were accepted as reasonably practicable. The accepted control measures were: - Purchase of oil/water quality sample kits in 2020 for scientific monitoring personnel to be positioned at Varanus Is., Exmouth and Dampier - Determine required vessel specifications required for Scientific Monitoring implementation One Control Measure was rejected as grossly disproportionate. Rejected control measure was: - Scientific monitoring personnel, plant and equipment on standby at the operational location Performance Standards and Measurement Criteria that have been developed for the in effect and accepted Control Measures are shown in the OPEP. The key areas of effectiveness for the identified Control Measures, during times of preparedness, are around maintaining access to

equipment and personnel through contractual arrangements, regular reviews of monitoring service provider capability and reviews of existing baseline data. During response, a key area for effectiveness is the mobilisation of requirements to commence scientific monitoring, and ensuring that relevant approved manuals and plans are followed. These key areas of effectiveness are reflected in the Performance Standards.

Strategy	Control Measure	Alternative, Additional,	Control Measure	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Relief well drilling for production well leak	Santos WA Drilling and Completions Source Control Team mobilised within 24 hours. Well Control Specialists mobilised within 72 hours. Contract/ MOUs for source control personnel. APPEA MoU for mutual assistance for relief well drilling.	In effect	People	Controlling flow of hydrocarbons as quickly as possible will reduce environmental impacts.	This control measure provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Cost of contracts/ MOUs	In effect
	Contract source control personnel through an alternative provider	Alternative	People	No environmental benefit if both service providers are adequate to fulfil requirements.	Provides functionality, availability, reliability, survivability, compatibility and independence	Time and cost involved in reviewing and renegotiating contract outside of regular review period	Reject No environmental benefit in moving to alternative service provider
	Contract source control personnel through a provider in addition to existing arrangements	Additional	People	No environmental benefit if additional services are surplus to requirements	Improved availability and reliability	Significant additional cost in maintaining two contracts for the same service	Reject No environmental benefit in having access to personnel surplus to requirements
	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process top follow in the planning and mobilisation for relief well drilling by Santos WA Source Control Team thereby reducing the timeframe and increasing the effectiveness of relief well drilling.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort in updating and maintaining document	In effect
	MODU Capability Register is monitored monthly	In effect	Procedure	By monitoring MODU, it will be possible to gain an understanding of which MODU may be rapidly available for relief well operations. This could reduce mobilisation times for MODU thus reducing volume of hydrocarbon released to the environment.	Provides functionality, availability, reliability, survivability, compatibility and independence	Effort spent monitoring	In effect
	MODU on standby at activity location	Improved	Equipment	reduce mobilisation times of MODU to drill relief well thus reducing hydrocarbon released to the environment. Instead of base timeframe for the drilling of a relief well of 77 days, relief well potentially could be drilled in 43 days (77 days less the 34 days required for mobilisation).	Improved availability	The cost of having a MODU on standby is approximately $600,000 per day. If adopted this cost is paid regardless if there is a loss of containment or not.	Reject Likelihood of LOWC is considered rare and the cost of having a second MODU on standby at location is considered grossly disproportionate to the environmental benefit.
	Pre purchase of relief well drilling supplies	Improved	Equipment	Relief well drilling supplies such as casings and well head equipment could potentially reduce relief well drilling times	Increase in availability	Cost of purchase, maintenance and storage of supplies	Reject Time required to source supplies would occur simultaneously with MODU mobilisations, so relief well drilling times are not expected to improve. Supply requirements are specific to the well and conditions so prepurchased supplies may not be suited to the job.

reduce release - spills from refuelling, cargo loading or FPSO topside equipment failure	Refer to Ningaloo Vision Operations Environment Plan (TV-00-RI-00003.01) - Section 7.8.3. for an evaluation of Control Measures for refuelling, cargo loading and FPSO topside equipment failure. This includes the following Control Measures which work to control the volume of hydrocarbon released during an incident: *Offtake Operations and Pilotage Procedure (NV-91-IG-10010.03) (NV-CM-77) *Testing of ESD and blowdown systems (NV-CM-63) *Blowdown and flare system (NV-CM-64) *Blowdown, pressure safety valves (NV-CM-78) *Ningaloo Vision Incident Response Plan (TV-22-IF-00005) (NV-CM-66)						
reduce release from hydrocarbon storage or fuel tank rupture	Refer to Ningaloo Vision Operations Environment Plan (TV-00-RI-00003.01) - Sections 7.8.3., 7.9.3 and 7.10.3 for an evaluation of Control Measures for a vessel storage/fuel tank rupture. This includes the following Control Measures which work to control the volume of hydrocarbon released to the environment during an incident: *Hull integrity (NV-CM-75) *Vessel spill response plan (SOPEP/SMPEP) (NV-CM-58)						
reduce release from subsea flowline rupture	Refer to Ningaloo Vision Operations Environment Plan (TV-00-RI-00003.01) - Section 7.7.3. for an evaluation of Control Measures for a subsea flowline release. This includes the following Control Measures which work to control the volume of hydrocarbon released during an incident: *Testing of ESD and blowdown systems (NV-CM-63) *Blowdown and flare system (NV-CM-64) *Blowdown, pressure safety valves (NV-CM-78) *Ningaloo Vision Incident Response Plan (TV-22-IF-00005) (NV-CM-66)						

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

Aerial surveillance - aircraft and crew	Maintain contract with service provider for dedicated aerial platform operating out of Karratha. (Helicopter services available through Santos WA's primary contracted supplier. Activation of aerial surveillance using helicopter pilots will occur in 3 hours of notification of the spill. Helicopter on site for surveillance within 6 hrs. Surveillance and recording using helicopter pilots is considered adequate for situational awareness.)	In effect	System	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of contract	In effect
Aerial surveillance - observers	Level 1: Trained Santos observers will be available from Day 2 of the incident, following activation	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of aerial observers in initial 24 hours of incident	Cost of training and maintaining trained staff	In effect
	Level 2: Access to additional aerial observers through AMOSC Staff and Industry Mutual Aid Core Group Responders	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of AMOSC membership	In effect
	Level 3 : Access to additional aerial observers through OSRL (18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
	Ensure trained aerial observers based at strategic locations such as Exmouth	Additional	People	Current capability meets need and therefore environmental benefit would be incremental. Having trained observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1 (current arrangements are that the pilot would provide the initial observations and recording on Day 1 with trained aerial observers from Perth and VI mobilised and operational by Day 2).	Improved availability and reliability	Costs associated with staff employment and training	Reject Cost is considered disproportionate to the incremental benefit given surveillance on Day 1 by pilots is considered sufficient
Aerial surveillance - unmanned aerial vehicles	Level 2: Unmanned Aerial Vehicles for aerial surveillance available through AMOSC (UAVs and pilots can be accessed through AMOSC with a mobilisation time of 12+ hours)	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3: Unmanned Aerial Vehicles for aerial surveillance available through OSRL	In effect	System	Use of UAVs may provide an environmental benefit compared to alternative options (such as helicopters and fixed wing aircraft) given shorter deployment time and ability to assess difficult areas.	Provides functionality and availability Area of improvement; none identified	Cost of membership with OSRL	In effect

Vessel surveillance	Level 1: vessels in use by Santos WA and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. could be used for surveillance purposes in the event of a spill. (Vessel surveillance will be activated within 90 minutes for available on-site vessels. Santos has access to on-hire vessels supporting Santos WA's VI and NV facilities. Santos WA Vessel Monitoring System has access to automatic identification system live-vessel tracking portal to establish vessel availability.)	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of existing contracts with vessel providers	In effect
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System.	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Knowledge of the spill, provided in a short-time frame, will inform the IMT decisions with the aim of reducing and mitigating environmental impact. In comparison to aerial surveillance, vessel surveillance provided limited information.	Improves availability and reliability Area of improvement; none identified	Cost of contracts at the time of requirement.	In effect
Water Quality Monitoring (operational and scientific)	Maintain of monitoring service provider contract for water quality monitoring services. Water quality monitoring personnel, equipment and vessel deployed to spill site within 72 hrs.	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of contracts	In effect
	Access to additional water quality monitoring services through OSRL	In effect	System	This monitoring will confirm the distribution and concentration of oil, validating spill trajectory modelling and inform the IMT decisions with the aim of reducing and mitigating environmental impact	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; availability of vessels	Cost of OSRL membership	In effect
	Determine required vessel specifications and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Improved availability and reliability	Cost to determine vessel specifications	Accept
	Purchase of First Strike Oil/Water quality monitoring kits to be positioned at Exmouth, VI and Dampier. Development of technical procedure for sample collection by untrained personnel	Additional	Equipment, procedure	Will enable Oil fingerprinting, and initial measurements of oil concentrations	Improve function, availability, survivability and compatibility	Cost of purchasing equipment and developing procedure	Accept
	Trained monitoring specialists on site	Additional	People	Ensure sampling is conducted correctly	Improves reliability	Costs associated with staff employment	Reject This is not necessary as a good procedure for sample collection is in place
Satellite Imagery	Maintain membership with AMOSC provider to enable access and analysis of satellite imagery.	In effect	Systems	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Maintain membership with OSRL to enable access to and analysis of satellite imagery	In effect	System	Satellite imagery is considered a supplementary source of information that can improve awareness but is not critical to the response and usage is at the discretion of the IMT	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect

Shoreline Assessment	Level 1: WA-based AMOSC staff and core group operations personnel (Santos WA has arrangements through AMOSC to mobilise WA-based AMOSC staff and Core Group personnel to site 24 hours following initiation)	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of AMOSC membership	In effect
	Level 3: Maintain membership with OSRL to access SCAT trained responders (OSRL, 18 people). OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People, procedures	To assist in determining which response methods are most appropriate for shorelines, it is necessary to obtain information about shoreline character, degree and distribution of oiling (if present), presence of sensitive receptors (habitats, fauna etc.) and information on shoreline processes and access routes that could aid or hamper response efforts	Provides additional functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of OSRL membership	In effect
Wildlife Reconnaissance (aerial/ vessel surveillance. Shoreline and coastal habitat assessment)	Maintain contract with scientific monitoring service provider for access to fauna aerial observers and personnel experienced in conducting relevant fauna surveys.	In effect	People, procedures	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Provides functionality, availability and compatibility Area for improvement; availability - reduce time to mobilise personnel to strategic locations	Cost of contract	In effect
	Maintain a list of providers that could assist with fauna aerial observations, eg whale shark spotting planes	Additional	People	Wildlife reconnaissance aids the IMT to plan and make decisions for executing an oiled wildlife response and for minimising impacts to wildlife associated with the clean-up response	Improves availability and reliability Area of improvement; none identified	Cost of developing and maintaining list	Accept
	Ensure trained marine mammal/fauna observers based at strategic locations such as Exmouth (North Ningaloo Coast, Murion Islands)	Additional	People	Having trained marine mammal/fauna observers living locally and on short notice to mobilise would result in trained aerial observers available from Day 1	Improved availability and reliability	Costs associated with staff employment and training	Reject Maintaining trained fauna observers at location is considered grossly disproportionate as they are required only for the initial stages of the response until observers from scientific monitoring provider can be mobilised.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Containment and recovery - booms, ancillary equipment	Level 1: Booms, ancillary equipment from Exmouth (AMOSC, 2*200m boom), Varanus Is. (Santos WA, 4*200m boom, 1 skimmer), Dampier/Karratha (Santos WA, 2*200m boom, 1 skimmer; AMSA, 6 lengths boom, 5 skimmers), Fremantle (AMOSC, 6*200m boom, 3 skimmers; AMSA, 6 boom lengths, 5 skimmers). Deployable from Varanus Is., Exmouth, Dampier, Fremantle within 24 hours. Transit times (vessel): Exmouth to Ningaloo Vision = 3 hrs, Dampier to Ningaloo Vision = ~15 hrs Varanus Is. to Ningaloo Vision =~15 hrs Transit times (road) Fremantle to Exmouth = ~24 hrs Broome to Exmouth = 16 hrs	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence. Functionality is attained through access to various equipment types that may be used according to nature of hydrocarbon and metocean conditions. reliability is attained through maintenance contracts. Area of improvement; none identified.	Cost of equipment purchase and maintenance for Santos stockpile. Cost of membership, MOUs in place for AMOSC and AMSA.	In effect
	Level 2/3: Booms, ancillary equipment from Geelong (AMOSC, 7*200m boom, 3 skimmers); Singapore (OSRL, 20 boom lengths, 6 skimmers with additional booms and skimmers at global stockpiles). Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of contracts, MOUs in place for AMOSC, AMSA and OSRL	In effect
	Purchase additional booms and ancillary equipment to be owned by Santos WA	Additional	Equipment	Greater capacity for containment and recovery in the initial 2-5 days of response	Improved availability and reliability	Cost of equipment purchase and maintenance	Reject Equipment available within rapid timeframes under current arrangements for Exmouth, Varanus Is. or Dampier deployment
Containment and recovery - liquid oil waste tanks	Liquid waste storage tanks (e.g. Isotanks) available through Santos WA contracted waste service provider	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; increasing the functionality of liquid waste storage tanks through decanting operations approved by DoT or AMSA.	Cost and effort in maintaining contract	In effect
Containment and recovery- vessels	Level 1: vessels in use by Santos WA and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. Suitable boom vessels mobilised to deployment port within 12 hrs. Suitable collection 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; availability of tow vessels.	Cost of existing contracts with vessel providers	In effect
	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of 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	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of contracts at the time of requirement.	In effect

	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 2-5 days of response	Improved availability and reliability	Cost of vessel to be on standby when not required for oil spill operations	Reject Santos monitors vessel availability through Santos WA Vessel Monitoring System. Regularly contracted vessels could be supplemented with vessels of opportunity
	Define containment and recovery vessel specifications and input this information to improve vessel tracking. Specifications may include crane, open transom, deck space for boom container, deck space for waste storage, separate additional vessel for towing boom.	Improved	System	More accurate vessel tracking may lead to faster mobilisation times, potential for response operations at more locations	Improved availability and reliability.	Cost and effort to gather and input data	Accept Cost is proportionate to benefit
Containment and recovery-personnel	Level 2: Spill responders from Varanus Is., Devil Creek, Perth (Santos WA, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos WA resources in place to commence operations within 2–12 hrs. AMOSC Staff and AMOSC Core Group mobilised to deployment port within 24 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.	Employment and training of Santos staff. Cost of contracts in place for AMOSC staff	In effect
	Level 3: Spill responders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	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.	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 spill response teams	Additional	Personnel	Greater capacity for containment and recovery in the initial 2-5 days of response	Improved availability and reliability	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	Time and cost of contractual management	Reject AMSA, AMOSC and AMOSC Core Group and OSRL have sufficient numbers of personnel with the appropriate skill set

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

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Subsea dispersant injection - SFRT	Subsea dispersant injection via AMOSC Subsea First Response Toolkit (SFRT). AMOSC SFRT stored at Oceaneering yard in Jandakot and can be transported to Dampier/Exmouth within 48 hrs.	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 - 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 of 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 Potential benefits of quicker deployment do not outweigh costs
	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 unable to alter storage location of SFRT as this could negatively impact other members	Reject not feasible
Subsea dispersant injection - planning	Source Control Planning and Response Guideline (DR-00-OZ-20001).	In effect	Procedure	Provides a set process top follow for the mobilisation of SFRT and suitable vessel by Santos WA 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 1: Suitable vessel sourced through Santos contractors. Vessel requirements outlined in Santos Source Control Planning and Response Guideline (DR-00-ZF-1001).	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of existing contracts with vessel providers	In effect
	Level 2: Suitable vessel sourced through any regional contractors and monitored through Santos WA Vessel Tracking System.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	Level 3: Suitable vessel sourced as Vessels of Opportunity.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; early vessel availability	Cost of contracts at the time of requirement.	In effect
	Enable improved vessel access by contracting a suitable, dedicated vessel on standby	Improved	Equipment	Vessel with SFRT will be on site earlier given vessel availability is the limiting factor. Provided subsea dispersants are effective on the low flow leak this will improve the efficiency of dispersant application over surface dispersant application.	Improved availability and reliability	Costs associated with vessel contract	Reject Dedicated vessel may be identified and contracted ahead of time however time saved is not proportionate to expense. Santos tracks suitable vessels to expedite identification and selection
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, 500m3 Dasic Slickgone NS). Additional dispersant stocks stored at Exmouth (AMOSC, 75 m Slickgone NS); Dampier (AMSA, 20m3); Broome (AMOSC, 15m3 Ardrox), Fremantle (AMOSC, 35m3 Corexit, 250m3 Slickgone NS) (AMSA, 100m3). Available within 24 hours.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contracts, MOU with AMOSC, AMSA	In effect
	Level 3: Dispersant stocks stored at national stockpiles (AMOSC, 139m3) (AMSA, 250m3) OSRL dispersant stocks available in Singapore (50% of 700m3 as SLA and 5000m3 as a subscriber to the Global Dispersant Stockpile) Mobilisation times depend on location.	In effect	Equipment	Enhance subsea dispersion and biodegradation of hydrocarbons. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability exceeds requirements	Costs of contracts, MOUs with AMOSC, AMSA, OSRL	In effect

	Access to additional dispersant stockpiles owned by Santos	Additional	Equipment	No additional environmental benefit if surplus to requirements	Improved availability and reliability	Additional cost for purchase and maintenance of stockpiles	Reject Analysis indicates that dispersant supplies sufficient. Santos is already subscribing to OSRL stockpiles in excess of 5,000m3.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Vessel based surface chemical dispersant application- spray systems	Level 2: Vessel spray systems from Exmouth (Santos WA, 3*Afedo; AMOSC, 1*Afedo, 1*Vikospray), Dampier/ Karratha (Santos WA, 3*Afedo; AMSA, 2*Ayles Fernie), Broome (AMOSC, 2*Afedo) Fremantle (AMOSC, 5*Afedo, 1*Global) Vessel spray system equipment mobilised to deployment port within 12 hrs. Transit times (vessel): Exmouth to Ningaloo Vision = 3 hrs, Dampier to Ningaloo Vision = ~15 hrs Varanus Is. to Ningaloo Vision =~15 hrs Transit times (road) Fremantle to Exmouth = ~24 hrs Broome to Exmouth = 16 hrs	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - equipment is not lacking in terms of quantity. Improving mobilsiation time of equipment will provide the greatest benefit.	Cost of equipment purchase and maintenance Costs of membership and MOUs with AMOSC, AMSA	In effect
	Level 3: Vessel spray systems from 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 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
	Store additional spray systems on the FPSO	Additional	Equipment	Potentially allows dispersant operation to occur more quickly as eqipment is onsite.	Dispersant application from the FPSO is considered to have limited applicability and functionality due to the height above water and limited mobility. Transfer from FPSO to a suport vessel would allow greater functionality but support vessel would require trained personnel and dispersants onboard so limited benefit over mobilising response from Exmouth.	Additional cost for purchase and maintenance of vessel spray systems and dispersant stocks. Very limited deck space on FPSO for storage.	Reject Mobilisation time still relies on suitable vessel and trained personnel being available since FPSO spraying is not considered effective. Limited benefit vs cost over deployment from Exmouth.
	Store spray systems and dispersants on Varanus Island	Additional	Equipment	Potentially improves mobilisation time given Santos has contracted field vessels at Varanus Island and core group members on VI	Improved availability and reliability	Additional cost for purchase and maintenance of vessel spray systems and dispersant stocks at VI	Reject Mobilisation time would be approx. 14 hours from VI. Limited benefit vs cost when compared to Santos NW core group responders mobilising to Exmouth by helicopter and meeting vessels, equipment and dispersants at Exmouth
	Access to additional spray systems stored in Exmouth or Dampier	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 and not considered limiting when compared to vessels and personnel. Mobilisation time for spray systems from Fremantle is less than 48 hours
Vessel based surface chemical dispersant application- vessels	Level 1: vessels in use by Santos WA and located at (or in transit to) Ningaloo Vision, Exmouth, Dampier or Varanus Is. Suitable Dispersant Vessels mobilised to nearest deployment port (Exmouth and/or Dampier) within 12 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to 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 Santos WA Vessel Monitoring System	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to 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 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
	Define spray vessel specifications and input this information to improve vessel tracking	Improved	System	More accurate vessel tracking may lead to faster mobilisation times could improve dispersant efficacy.	Improved functionality, availability and reliability	Cost and effort to gather and input data	Accept Cost is proportionate to benefit
	Pre-equipped support vessel with spray systems, dispersant and trained crew. Either: a) dedicated onsite vessel or b) multi-tasked supply vessel	Additional	Equipment	a) Dedicted vessel (with all necessary equipment and trained personnel) on standby would allow quicker mobilisation to site and earlier spraying b) Multi-tasked supply vessel would potentially (dependent on location and activity at time) allow quicker spraying	Improved availability and reliability	a) Significant costs with having a dedicted vessel, equipment, dispersant and crew on standby. b) Lower costs if using an already contracted supply vessel - i.e. no standby vessel costs but costs in mainatining equipment, dispersants and providing training to vessel crew. Potential to shared cost with other operator/s if using same supply vessel.	a) Reject (dedicated vessel) Cost prohibitive vs risk if using a vessel on standby. b) Under review (multi-tasked supply vessel) cost/effort may be acceptable if resource can be shared with other operator/s
Vessel based surface chemical dispersant application-personnel	Level 2: Spill responders from Varanus Is., Devil Creek, Perth (Santos WA, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to deployment port (Exmouth and/or Dampier) within 12 hrs.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - Santos 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, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to 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 dedicated local personnel for dispersant application	Improved	People	May improve mobilisation time	Improved availability and reliability	Costs associated with personnel employment and training. Santos WA opportunisatically exercises with local Exmouth vessel crew which provides a broad base of competency within local crew but does not have dedicted personnel on standy in Exmouth to lead disperant spraying oeprations.	Reject Cost of permanently employing personnel is grossly disproportionate to benefits of availability. Santos Core group trained personnel from regional facilities (Varanus Is., Devil Creek) can lead dispersant operations and can be quickly transported by helicopter.

	Santos WA 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 EF&L personnel are better used a resource for local logistics and would be used for logistics requirments in Exmouth for all aspects of the response. Personnel from regional facilities (Varanus Is., Devil Creek) can be quickly transported by helicopter.
Aerial based surface chemical dispersant application-aircraft	Level 2: Access to Fixed Wing Aerial Dispersant Aircraft equipment and personnel through AMOSC under 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 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 is Karratha or Learmonth within 23 hrs.	In effect	Equipment, people, system	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to 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	Alternate	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 based application based on a ramp up to 2 FWADC aircraft from 48 hours followed by additional OSRL aircraft if required, which is considered achievable based on resourcing arrangements.
Aerial based surface chemical dispersant application-personnel	Level 2: Aerial Attack Supervisor sourced by AMOSC. 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 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, 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 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
Dispersant stocks	Level 2: Dispersant stocks from Exmouth (AMOSC, 75 m Slickgone NS); Dampier (AMSA, 20m3); Broome (AMOSC, 15m3 Ardrox), Fremantle (AMOSC, 35m3 Corexit, 250m3 Slickgone NS; AMSA, 100m3). Dispersants mobilised to deployment port within 12 hrs.	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to harmful impacts of chemical dispersants	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, 139m3) (AMSA, 250m3) and Singapore (OSRL, 350m3 (50% of 700m3) as SLA and 5000m3 as a subscriber to the Global Dispersant Stockpile). Transit time (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days UK or other OSRL bases to Karratha = 7-10 days	In effect	Equipment	Enhance biodegradation of hydrocarbons and reduce the impact of surface hydrocarbons on protection priorities. Consideration given to 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	Improved availability and reliability	Additional cost for purchase and maintenance of stockpiles	Reject Resource Needs Analysis indicates that dispersant supplies sufficient for worst case oil treatment can be met through Australian stockpiles within required timeframes. International stockpiles also available.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Protection and deflection- booms and ancillary equipment	Level 2: Shoreline and nearshore booms plus ancillary equipment from Varanus Is. (Santos WA, 8*Beach Guardian, 16*25m Zoom Boom, 2*skimmer), Exmouth (AMOSC, 20*25m Beach Guardian, 20*25m Zoom Boom, 2 skimmers), Dampier (Santos WA, 1*skimmer; AMSA, 5* Canadyne Inflatable, 10* Structureflex Inflatable, 5* Versatech Zoom Inflatable, 2 Slickbar Solid Buoyancy, 3*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Fremantle (AMOSC, 23*35m Beach Guardian, 30*25m Zoom Boom, 18* Curtain Boom, 1*skimmer; AMSA, 15*Structureflex Inflatable, 13*Versatech Zoom Inflatable, 10*Structureflex Solid Buoyancy, 30* Structureflex Land Sea), Broome (AMOSC, various equipment). Vehicles sourced from local hire companies. Transit times (vessel): Varanus Is. to Exmouth = 18 hrs, Transit times (road) Fremantle to Exmouth = ~24 hrs Dampier/ Karratha to Exmouth = 7 hrs Exmouth to North West Cape = 0.5 hr. Protection booming equipment mobilised to FOB location within 12 hrs.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs with AMOSC and AMSA	In effect
	Level 3: Shoreline and nearshore booms plus ancillary equipment from Geelong (AMOSC), interstate (AMSA) and Singapore (OSRL). Transit times (road/ air) Geelong or Singapore to Exmouth or Karratha = 3–5 days. These resources in place to commence protection and deflection within 3-10 days.	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs associated with equipment purchase and maintenance Costs of contracts, MOUs Costs associated with staff training	In effect
	Santos WA to purchase additional shoreline and nearshore booms and ancillary equipment	Additional	Equipment	Enable more protection and deflection operations to occur simultaneously to protect more key areas	Improved availability and reliability	Costs associated with equipment purchase and maintenance	Reject Sufficient quantities of equipment located in the region.
Protection and deflection- vessels	Small shallow draft vessels sourced through Master Service Agreement, located in region	In effect	Equipment	Reduce hydrocarbon contact with coastal protection priorities. Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; vessel availability	Cost of vessel monitoring. Cost of contracts at the time of requirement.	In effect
	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; tracking providers of shallow draft vessels	Cost of contracts at the time of requirement.	In effect
	To aid in timeliness of sourcing small shallow draft vessels develop list of providers for Exmouth	Improved	Equipment	Reduce time required to source vessels and crew in initial phase of response. Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Time involved in providing vessel specifications and liaising with existing suppliers	Accept

Protection and deflection-personnel	Level 2: Spill responders from Varanus Is., Devil Creek, Perth (Santos WA, 13 people), Fremantle (AMOSC staff, 2 people), Perth (AMOSC Core Group, up to 60 people). Santos Offshore Core Group mobilised to Exmouth within 12 hrs. AMOSC Staff and Industry Core Group mobilised to FOB within 24 hrs.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Availability - Santos WA access to helo services ensures that regional personnel can be quickly mobilised to the appropriate location. Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA Costs associated with staff training	In effect
Protection and deflection-personnel	Level 3: Spill responders from Geelong (AMOSC staff, 6 people), interstate (AMOSC Core Group, up to 60 people; AMSA, unspecified) and international (OSRL, 18 people). Interstate staff available from 2 to 3 days. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	Personnel	Reduce hydrocarbon contact with coastal protection priorities Consideration given to harmful impacts of boom, vessels, vehicles and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement; none identified	Costs of contracts, MOUs with AMOSC, AMSA, OSRL Costs associated with staff training	In effect
	Ensure trained personnel based at strategic locations such as Exmouth	Improved	Personnel	Faster response times to facilitate protection of key sensitive areas	Improved availability and reliability	Costs associated with staff employment and training	Reject No Santos personnel currently based at Exmouth so employment costs would be significant and not justified given that helicopters enable rapid transportation of Santos WA staff within the region.
Protection and deflection-planning	Ningaloo Coast shoreline sensitivity and access data/maps and Tactical Response Plans	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	Cost of document preparation and maintenance	In effect
	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.

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

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

	Hire and deployment of low skill clean-up labour personnel through employment agency	In effect	People	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Costs of labour hire through existing service provider	In effect
	Faster access to clean-up personnel via pre-employment of local personnel	Improved	People	Improve mobilisation time, potential for response operations at more locations	Improved availability and reliability	Costs associated with personnel employment and training	Reject Cost of permanently employing personnel is grossly disproportionate to benefits of availability in initial
Shoreline Clean-up - planning	Shoreline sensitivity mapping and Tactical Response Plans	In effect	Procedures	Remove stranded hydrocarbons from shorelines in order to reduce impact on coastal protection priorities and facilitate habitat recovery. Consideration given to negative impacts of equipment and personnel on sensitive coastal ecology	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation in initial 48 hours of incident	Cost associated with development and maintenance of mapping and Tactical Response Plans	In effect
	Develop labour hire onboarding procedure for spill response to clarify the labour hire process for the Santos WA IMT	Additional	Procedures	Improve mobilisation time of shoreline clean-up personne and reduce IMT effort	Improved availability and reliability	Cost and effort associated with development and socialisation fo procedure with IMT	Accept
	Review of shoreline sensitivity mapping. Review of Tactical Response Plans (TRPs) and development of additional TRPs for key locations	Improved, additional	Procedures	Improved level of response planning to streamline resourcing and logistics and effect a better response	Improved functionality	Cost involved in revision of sensitivity mapping and tactical response plans and preparation of additional tactical response plans	Reject Current maps/plans are adequate to initiate an effective response. Plans will have to be reassessed at the time of the incident, to take into account variables such as weather and tides.

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Oiled wildlife response - planning	Implementation of the Western Australian Oiled Wildlife Response Plan (WAOWRP) and Pilbara Region Oiled Wildlife Response Plan	In effect	Procedure	Working within the guidelines of the WAOWRP and Pilbara regional plan will ensure a coordinated response and that the expectations of the Control Agency are met with the overall aim to increase the likelihood of success of the OWR (success in terms of wildlife survivorship and rates for release back into the wild).	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement- framework for how Santos will integrate with Control Agencies for OWR	Effort and time involved in developing OWR implementation plan within OPEP based on guidance from WAOWRP and Pilbara Regional Plan	In effect
	Development of a Santos WA Oiled Wildlife Response Framework which will set the corporate guidance for OWR preparedness and response and define how Santos will integrate with Control Agencies to provide a coordinated response	Additional	Procedure	The framework will be complementary to the WAOWRP and Pilbara Regional Plan and will facilitate a rapid coordinated response, and the provision of resources by Santos in order to increase the likelihood of success of the OWR.	Improved functionality and reliability.	Cost of document development and maintenance	Accept
	Develop labour hire onboarding procedure for spill response to clarify the labour hire process for the Santos WA IMT	Additional	Procedures	Improve mobilisation time of low skill OW response personnel and reduce IMT effort	Improved availability and reliability	Cost and effort associated with development and socialisation of procedure with IMT	Accept
Oiled wildlife response - equipment	Level 2 OWR kits and containers available from AMOSC, AMSA, DBCA or DoT in Exmouth, Darwin, Broome, Karratha, Fremantle, or Kensington. WA equipment (OWR containers) mobilised to Exmouth region within 24 hrs.	In effect	Equipment	Timely access to appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with AMOSC	In effect
	Level 3 OWR equipment available from OSRL. Transit times (road/ air) Singapore to Karratha = 3–5 days.	In effect	Equipment	Appropriate equipment is needed for the effective treatment of wildlife in order to increase the likelihood of success of the OWR	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
Oiled wildlife response - personnel	Level 1/2 Santos WA personnel trained in OWR. OWR trained personnel mobilised to Exmouth region within 24 hrs.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; ensure personnel are based not just in the Perth Office but also at VI and DC facilities	Cost of training and maintaining training	In effect
	Level 2 OWR personnel from AMOSC, AMOSC-activated Wildlife Response contractors, and Industry Mutual Aid. Mobilisation of OWR personnel to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife.	In effect	People	Timely access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area for improvement - availability - rapid mobilisation of personnel in initial 48 hours of incident	Cost of membership with AMOSC	In effect
	Level 3 OWR personnel available through OSRL. OSRL staff initial 5 technical advisors available from 2 to 3 days, remaining personnel available from 4 to 5 days, subject to approvals/ clearances.	In effect	People	Access to skilled personnel will enhance the likelihood of success of an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of membership with OSRL	In effect
	Maintain labour hire arrangements for access to untrained personnel. Untrained personnel accessed through labour-hire arrangements would receive an induction, on-the-job training and work under the supervision of an experienced supervisor.	In effect	People	During a large scale OWR the ability to access large numbers of personnel through labour hire arrangements is imperative in terms of capability for conducting an OWR.	Provides functionality, availability, reliability, survivability, compatibility and independence	Cost of labour hire at time of incident	In effect
	Additional Santos WA OWR trained personnel positioned at VI and Perth	Additional	People	Additional personnel trained in OWR and whom are located at facilities will enhance the first strike capability of Santos WA and therefore enhance the likelihood of success of the OWR, particularly for those instances where oil is ashore within 48 hours	Improved functionality, availability, reliability and independence.	Cost of training staff	Accept

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

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcome	Effectiveness	Feasibility	Accept/ Reject
Waste Management - System	Waste management sourced through contract with waste service provider. Contract with waste service provider to be maintained and periodically reviewed. Arrangements outlined in Oil Spill Response Waste Management Plan Waste service provider waste receptacles can be mobilised to Exmouth from Karratha within 24 hrs for containment and recovery, and shoreline clean-up response strategies.	In effect	System	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Cost of contract	In effect
	Maintain contracts with multiple service providers	Additional	System	Contract with additional waste service provider will not provide an additional environmental benefit as there are two major service providers in the region and reciprocal arrangements facilitate access to equipment of both.	Provides functionality, availability, reliability, survivability, compatibility and independence.	Significant additional cost in maintaining two contracts for the same service	Reject
Waste Management - Equipment	Temporary waste storage capacity available through waste service provider, AMOSC, AMSA, OSRL stockpiles	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability, compatibility and independence. Area of improvement; none identified	Costs of contracts, MOU with waste service provider, AMOSC, AMSA and OSRL	In effect
	Procure temporary waste storage for Santos stockpile	Additional	Equipment	Additional storage available if required. Tanks may be stored in geographic locations that may reduce mobilisation times and allow faster collection and storage of waste. Additional storage may facilitate continuous collection operations to occur.	Provides functionality, availability, reliability, survivability, compatibility and independence	Additional cost in purchase and maintenance of tanks	Reject Purchasing this equipment for Santos stockpile is surplus to Santos requirements as AMOSC, AMSA, OSRL provides this equipment in strategic locations. Reduced mobilisation time is not an advantage, as waste storage can be mobilised at the same time as collection response strategies, and no waste needs to be stored prior to collection commenced.
	Vessels for waste transport through Santos contracted providers.	In effect	Equipment	Timely and efficient handling of waste will reduce environmental impacts of waste and waste management. Consideration given to risks of secondary contamination.	Provides functionality, availability, reliability, survivability and compatibility. Area of improvement; dependence and availability of vessels	Contract with vessel contractors to be maintained and periodically reviewed	In effect
	Contract additional vessels on standby for waste transport	Additional	Equipment	Reduce delays in transportation of waste, particularly greater capacity for containment and recovery in the initial 2-	Provides functionality, availability, reliability, survivability, compatibility and dependence	Cost in contracting vessels to remain on standby for incident waste requirements	Reject Expense of maintaining vessels on standby that are surplus to day to day
Waste Management - Procedure	Develop offshore waste transfer concept of operations procedure for IMT	In effect	Procedure	Provide options that may improve efficiency of offshore waste transfer operations and extend C&R operational hours thereby increasing volume of oil collected	Provides functionality, availability, reliability, survivability, compatibility and independence.	Cost of documentation development, implementation, maintenance and exercising	Accept

Strategy	Control Measure	Alternative, Additional, Improved	Control Measure Category	Environmental Outcomes	Effectiveness	Feasibility	Accept/ Reject
Scientific Monitoring - monitoring service provider and equipment	Maintenance of Monitoring Service Provider contract for scientific monitoring services and annual review of standby manual. SMP provider and monitoring equipment mobilised to site within 72 hrs.	In effect	System	This is the main tool for determining the extent, severity and persistence of environmental impacts from an oil spill and allows operators to determine whether their environmental protection outcomes have been met (via scientific monitoring activities). It is used to inform areas requiring rehabilitation. This strategy also evaluates the recovery from the spill.	Provides functionality, availability, reliability, survivability, compatibility and independence Area of improvement; none identified	Cost of contract with Scientific Monitoring Service Provider	In effect
	Regular capability reports from Monitoring Service Provider shows personnel availability and annual reviews of standby manual	In effect	System	This ensures the Monitoring Service Provider has the capability to undertake Scientific Monitoring, including, post-spill preimpact surveys within the EMBA of receptors with deficient baseline data	Improves functionality, availability and reliability	Cost of contract with Scientific Monitoring Service Provider	In effect
	Conduct periodical review of existing baseline data sources across the Santos WA combined EMBA	In effect	System	This ensures that receptors within the EMBA with deficient baseline data are identified	Improves functionality and provides compatibility	Cost of contract with Scientific Monitoring Service Provider	In effect
	Scientific monitoring personnel, plant and equipment on standby at the operational location	Additional	People, equipment	Improve mobilisation time	Improved availability and reliability	Cost would be in excess of $1 mil annually	Reject- cost of control measure is disproportionate to the environmental benefit
	Purchase of oil/water quality sample kits in 2020 for scientific monitoring personnel to be positioned at Varanus Is., Exmouth and Dampier	Improved	Equipment	Improve response time	Improved availability and reliability	Cost associated with purchase of equipment and maintenance	Accept
Scientific Monitoring - vessels	Level 2: vessels sourced through Master Service Agreement, located in region and tracked by Santos WA Vessel Monitoring System. Santos to mobilise monitoring vessels to	In effect	Equipment	Improve response time	Provides availability and reliability	Effort associated with maintaining MSA	In effect
	Level 3: vessels sourced without existing contracts from any location	In effect	Equipment	Reduce the volume of surface hydrocarbons to reduce contact with protection priorities.	Provides survivability, compatibility and independence. Area of improvement; functionality, availability and reliability of tow vessels.	Cost of contracts at the time of requirement.	In effect
	Determine required vessel specifications required for Scientific Monitoring implementation and improve accuracy of Vessel Tracking System	Improved	Procedure	Improve mobilisation time	Increase in availability and reliability	Effort to determine vessel specifications and improve tracking	Accept

Appendix C: POLREP

Department of
Transport

Marine Pollution Report (POLREP)

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

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

INCIDENT DETAILS

Date of Incident:_________________Time of Incident *(24 hr format)*: _______________

Location name/description: ____________________

____

Incident Coordinates Latitude of spill ______________________________ **Longitude of spill** ____________________________________

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

Description of Incident: ____________________

____

____

____

____

POLLUTION SOURCE

☐ Vessel ☐ Land *(Specify)* __________________________ ☐ Other *(Specify)* ______________________________ ☐ Unknown

Vessel type *(if known)* ☐ Tanker ☐ Container ☐ Bulk ☐ Cargo

☐ Fishing ☐ Defence ☐ Recreational ☐ Other *(Specify)*________________________

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

POLLUTANT

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

☐ **Chemical** Name: ____MARPOL cat / UN Nos: ___________________

☐ **Garbage** Details/description: ____________________

☐ **Packaged** Details/description: ____________________

☐ **Sewage** Details/description: ____________________

☐ **Other** Details/description: ____________________

EXTENT

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

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

Has the discharge stopped? ☐ Yes ☐ No ☐ Unknown

Weather conditions at site: ____________________

____

____

☐ **Photos taken** Details: ______________________________held by: ______________________

☐ **Video taken** Details: ______________________________held by: ______________________

☐ **Samples taken** Description:______________________________held by: ______________________

☐ **Items retrieved** Description:______________________________held by: ______________________

ADDITIONAL INFORMATION

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

Equipment used? ☐ AMSA ☐ State / NT ☐ Industry

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

ORIGINAL REPORT SOURCE

Name:__________ Position: __________ Phone: __________

Combat agency:__________ Statutory agency: __________

SENDER DETAILS

Name:__________ Agency: __________ Date:__________

Phone: __________ Fax: __________ Email:__________

PRIVACY STATEMENT

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

Once you have completed the form please check that all relevant fields have been filled with accurate data.
To post the form please click on the "POST" button opposite.

POST **Reset Form**

Appendix D: SITREP

Marine Pollution Situation Report (SITREP)

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

MARINE POLLUTION SITUATION REPORT (SITREP)

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

This form is transmitted to all relevant agencies including:

- Jurisdictional Authority
- Support Agencies

Incident Name: ______________________________ **Ref. No.** ______________

Priority ☐ Urgent ☐ Immediate ☐ Standard

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

Date: ______________________ **Time:** ______________

POLREP Reference: ______________________________

Incident location Latitude ______________ Longitude ______________

Brief description of incident and impact: ______________________________

Overall weather conditions: ______________________________

Summary of response actions to date: ______________________________

Current Strategies:

Summary of resources available/deployed:

Expected developments:

Other Information:

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

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

POST

RESET

MEP_Sitrep_1114

Appendix E: Vessel Surveillance Observer Log

Santos

Vessel Surveillance Observer Log – Oil Spill

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

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

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

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

Timeline of observations:

Time	Description

Appendix F: Aerial Surveillance Observer Log

Santos

Aerial Surveillance Observer Log – Oil Spill

Survey Details				
Date:	Start time:	End Time:	Observer/s:	
Incident:			Area of Survey:	
Aircraft type:	Call sign:		Average Altitude:	Remote sensing used:

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

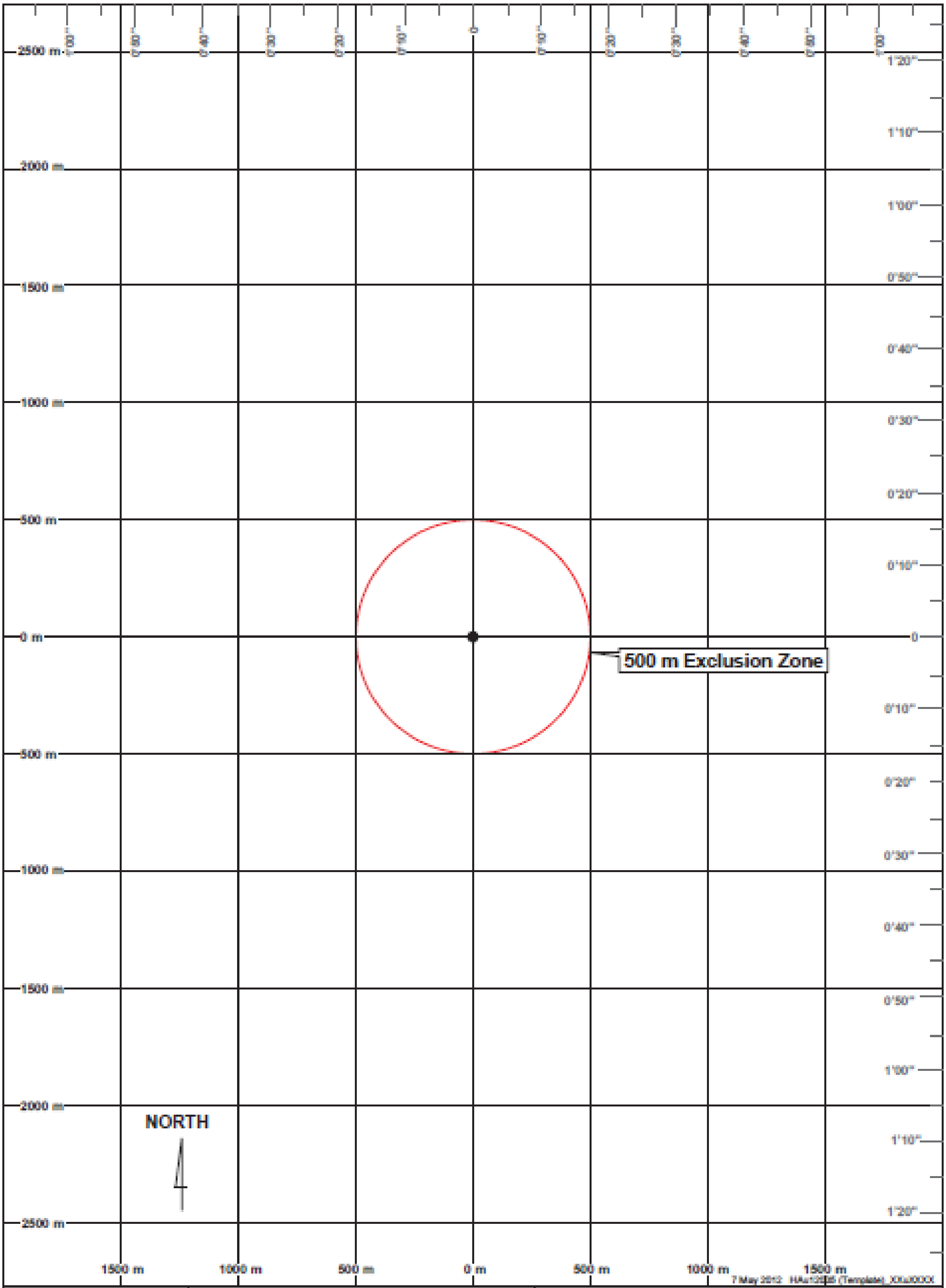
Santos

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

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

Appendix G: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



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

Appendix H: Aerial Surveillance Marine Fauna Sighting Record

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

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

MARINE FAUNA ID GUIDE


○ Humpback whale


○ Blue whale


○ Minke whale


○ Sperm whale


○ Killer whale


○ Bryde's whale

○ Whale species unknown


○ Whale shark


○ Dugong


○ Hawksbill turtle


○ Loggerhead turtle


○ Green turtle


○ Flatback turtle


○ Bottlenose dolphin


○ Spinner dolphin

○ Dolphin species unknown


○ Leatherback turtle

○ Turtle species unknown

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

Santos

Other details for each observation location

WEATHER DETAILS

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

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

OBSERVER DETAILS

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

Appendix I: Aerial Surveillance Shoreline Observation Log

Santos

Aerial Surveillance Reconnaissance Log – Oil Spill

Survey Details					
Incident:	Date:	Start time:	End Time:	Observer/s:	
Area of Survey					
Start GPS LATITUDE: LONGITUDE:			End GPS LATITUDE: LONGITUDE:		
Aircraft type	Call sign		Average Altitude	Remote sensing used (if any)	
Weather Conditions					
Sun/Cloud/Rain/Windy		Visibility		Tide Height L/M/H	
Time high water		Time low water		Other	

Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present					
	Rocky Cliffs		Boulder and cobble beaches		Sheltered tidal flats
	Exposed artificial structures		Riprap		Mixed sand and gravel beaches
	Inter-tidal platforms		Exposed tidal flats		Fine-Medium sand grained beaches
	Mangroves		Sheltered rocky shores		Other
	Wetlands		Sheltered artificial structures		
Operational Features (tick appropriate box)					
	Direct backshore access		Alongshore access		Suitable backshore staging
Other					

Appendix J: Shoreline Clean-up Equipment

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

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

	Inflatable Tent 9 square metres	1

Equipment list for a decontamination unit for Beach Clean Up Team

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

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

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

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

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

Appendix K: Shoreline Response Strategy Guidance

Shoreline Response Strategy Guidelines

Guidance on response methods for sensitive coastal habitats is provided in **Table 1**.

Guidance on applicable shoreline clean-up techniques based on shoreline substrate and degree of oiling are presented in **Figure 1** to **Figure 4**.

Table 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.	-
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.	-

Sensitive Receptors	Strategy Guidance	
Turtle nesting beaches during or near nesting season	- All efforts should be mounted to prevent any oil from moving towards this area by using booms to divert the oil away from this area. - However, if oil is expected to move into this area, booms can be deployed along the reserve to prevent/minimise oiling.	-
Fringing coral reef communities (Note: submerged coral reef communities are less susceptible to oiling)	- Little can be done to protect coral reef beds along exposed sections of shoreline. - Floating oil would potentially coat living reef communities, which are usually slightly elevated and are consequently exposed at low tide. - Natural recovery with a close monitoring program is the preferred clean-up technique. Clean-up of the reef itself by natural processes is expected to be rapid. - As much as practicable, oil should be removed from adjacent intertidal areas to prevent chronic exposure of the corals to oil leaching from these sites. - Use of sorbents should be limited to those that can be contained and recovered.	-
Macroalgal and seagrass beds	- All efforts should focus on deflecting oil away from this area, dispersing the oil offshore, or using booms to divert the oil away from this area. - Extreme care should be taken not to disturb the sediments during clean-up operations in the vicinity of macroalgal and seagrass beds, which could result in total loss of the macroalgal and seagrass beds. - Removal of oiled parts of the macroalgal and seagrass beds should only be considered when it can be demonstrated that special species are at significant risk of injury from contact or grazing on the macroalgal and seagrass beds. - Otherwise, the best strategy for oiled seaweed is to allow natural recovery.	-

Sensitive Receptors	Strategy Guidance	
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.	-

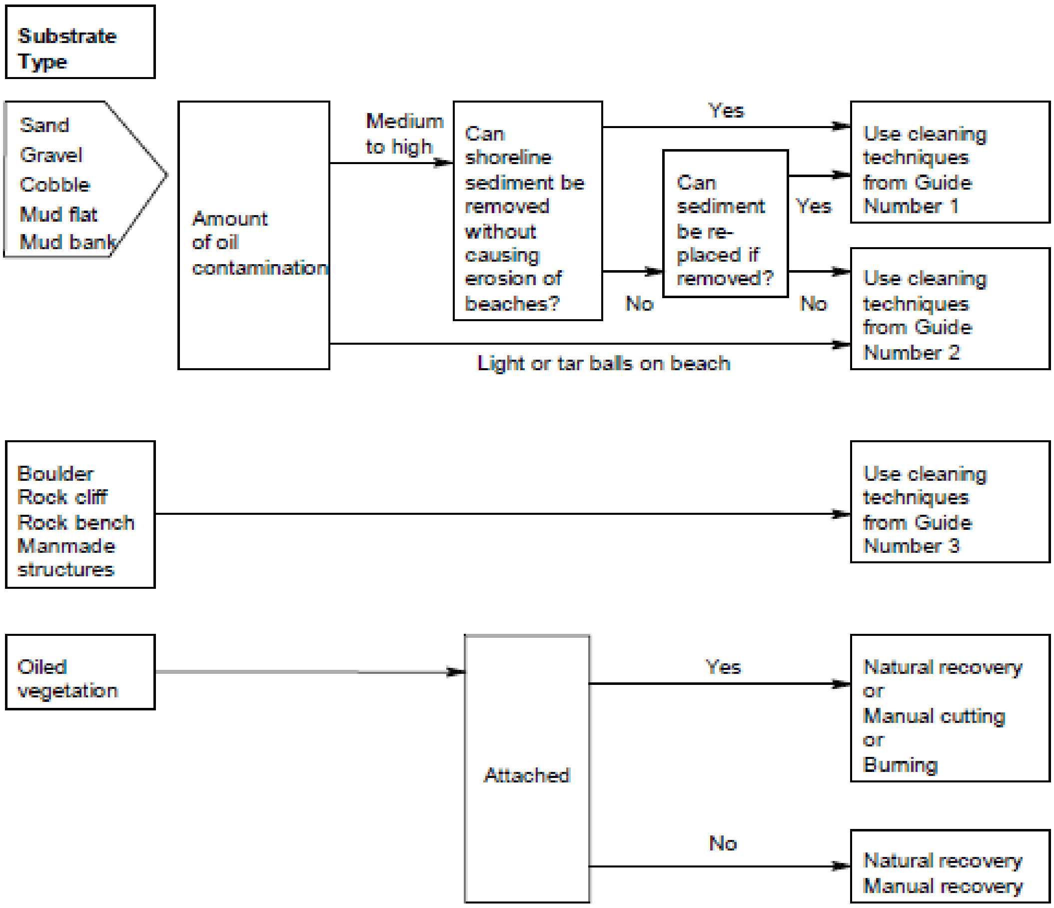


Figure 1: Shoreline Clean-up Master Decision Guide

Shoreline Cleanup Decision Guide Number 1

TRAFFICABILITY		SUBSTRATE TYPE	DEPTH OF OIL PENETRATION	CLEANUP TECHNIQUES IN ORDER OF PREFERENCE	ACCESS
1. Can rubber-tyred equipment operate on beach?	Yes	Sand, Gravel, Mud	Less than 3cm	Motor Grader and Elevated Scraper Combination. Elevated Scraper. Motor-Grader and Front-End Loader (Rubber-Tyred) Combination.	**3.** Is there access to beach for heavy equipment or can access be constructed?
			Greater than 3cm	Elevated Scraper. Front-End Loader (Rubber-Tyred). Bulldozer and Front-End Loader (Rubber-Tyred) Combination.	
		Cobble	Less than 30cm	Front-End Loader (Rubber-Tyred).	
			Greater than 30cm	Bulldozer and Front-End Loader (Rubber-Tyred) Combination. Front-End Loader (Rubber-Tyred).	
		Mud Bank	Not applicable	Backhoe. Front-End Loader (Rubber-Tyred).	
No					
2. Can tracked equipment operate on beach?	Yes	Sand, Gravel, Mud, Cobble	Less than 30cm	Front-End Loader (Tracked). Bulldozer and Front-End Loader (Tracked) Combination.	
			Greater than 30cm	Bulldozer and Front-End Loader (Tracked) Combination. Front-End Loader (Tracked).	

Yes (3): Select most preferable technique

No (2): Use dragline or hydraulic grader or leave to natural recovery.

No (3): Go to next figure, Decision Guide Number 2, Question 4.

Figure 2: Shoreline Clean-Up Decision Guide 1

Shoreline Cleanup Decision Guide Number 2

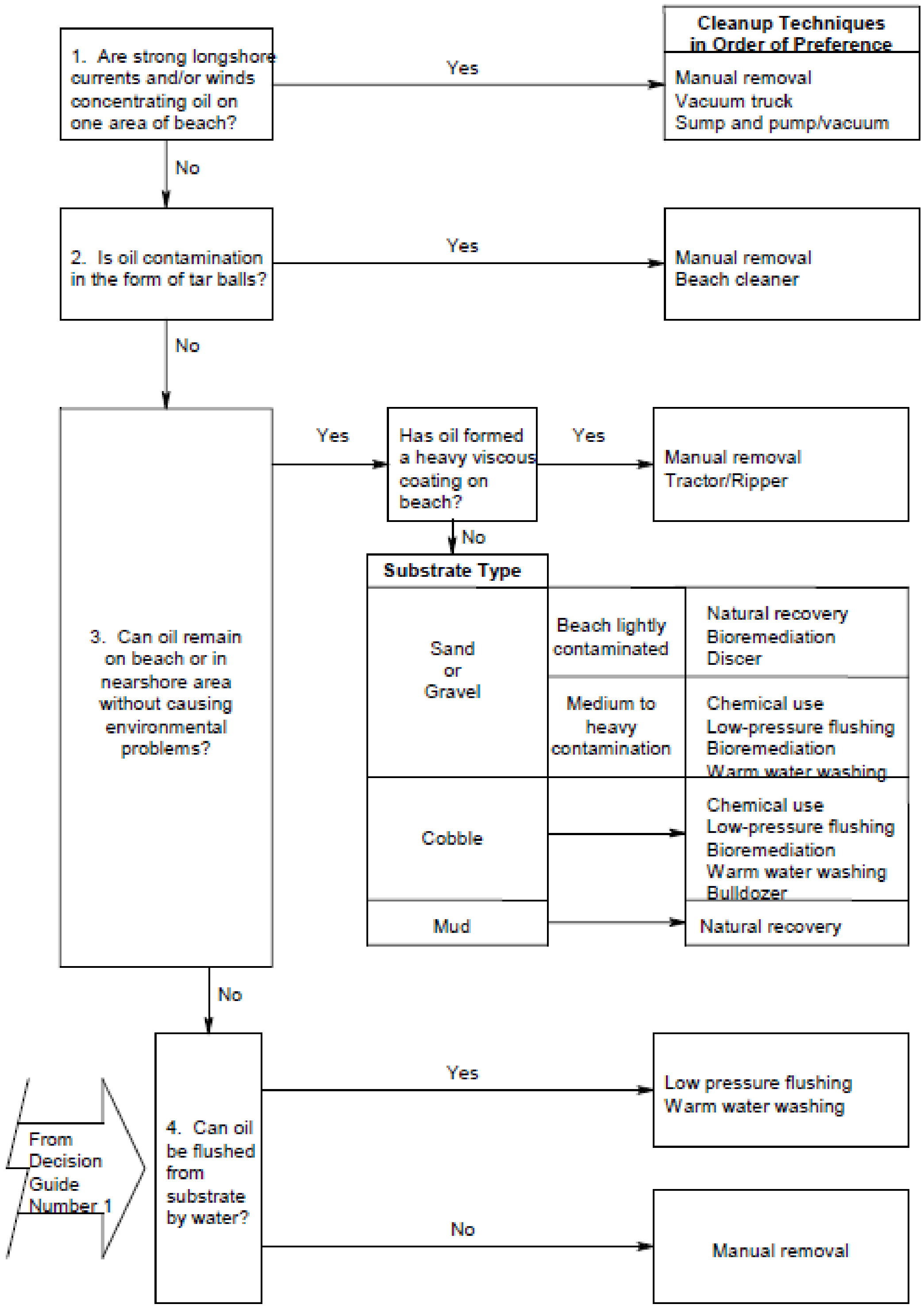


Figure 3: Shoreline Clean-Up Decision Guide 2

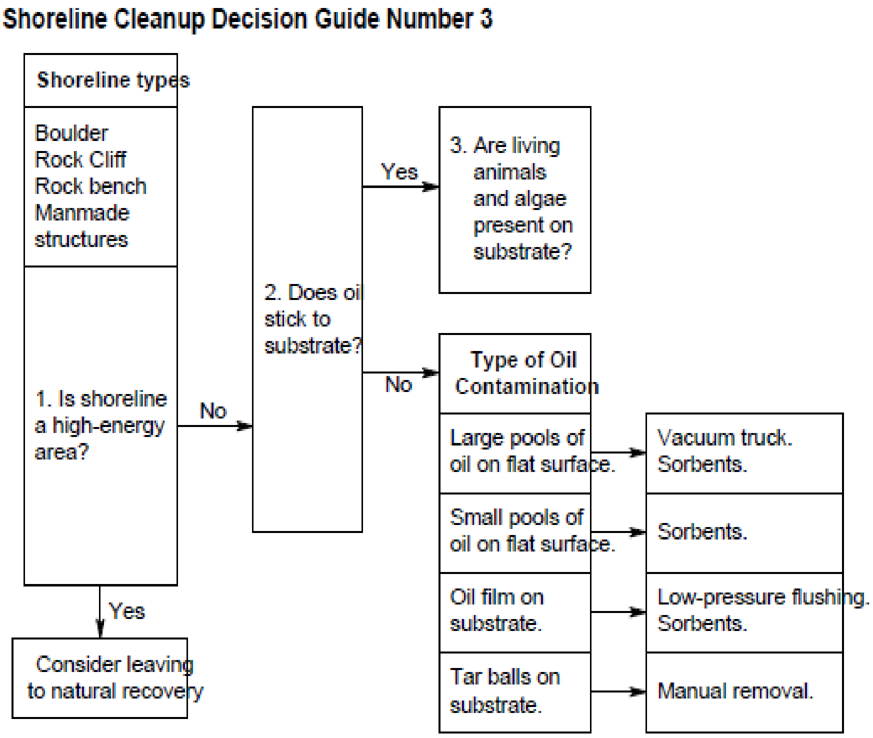


Figure 4: Shoreline Clean-Up decision Guide 3

Appendix L: Operational Guidelines for Shoreline Response

Operational Guidelines for Shoreline Clean-up activities

1.1.1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
    - Provide an extinguisher for each cabin
    - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
✓ Plastic liners, geotextiles	✓ Bins, barrels, skips, tanks
✓ Barrier tape and stakes	✓ Hot and cold beverages Welfare)
✓ Signposting equipment	✓ 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:
    - o Staging areas
    - o Pits if necessary
    - o Platform within earth berms
    - o Platform for bagged solids and liquids in tank.
- ✓ Protect areas using watertight plastic liners
- ✓ Lay fine gravel or sand at the base of the storage area to protect the membranes
- ✓ Prepare rain water or effluent management
- ✓ Ensure correct labelling of the containers to avoid mixing the different types of waste (liquid, solid, non-biodegradable – oiled plastics, contaminated cleanup equipment, biodegradable – oiled seaweed, faunal)
- ✓ Control access to the cleanup sites and protect access routes using lining and/or geotextiles

BASE CAMP/REST AREA

The rest area (base camp) should at least consist of:

- ✓ Changing rooms;
- ✓ Toilets; and
- ✓ A rest area.

At base camp, operators must be provided with:

- ✓ A first aid kit; and
- ✓ Hot and cold beverages, meals.

Selection of the rest area must meet certain criteria:

- ✓ Close proximity to the clean-up site;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally sensitive areas.

Equipment

- ✓ Shelter/rest area (tent, temporary building;
- ✓ Portable toilets (at least one for men and one for women);
- ✓ Locker rooms;
- ✓ First aid kit;
- ✓ Fire extinguisher; and
- ✓ Communication equipment.

STORAGE AREA FOR EQUIPMENT AND MACHINERY

This area consists of and equipped repair and maintenance site.

In order to avoid incidents and clean-up equipment failures, equipment should only be used by trained personnel and all equipment should regularly be checked for conformity with standard operating procedures and safety.

- ✓ Check and adjust daily levels of gasoline, diesel, oil, water and other fluids
- ✓ Regularly maintain the machines (pumps, pressure washers...)
- ✓ Equipment must be checked, counted by the person in charge of logistics and stored daily at the end of the work day
- ✓ Some pieces of equipment must be washed or at least rinsed daily, with proper recovery of cleaning effluent, other kinds of equipment should be washed weekly or at the end of operations
- ✓ Set up a systematic maintenance-cleaning-repair operation at the end of each week
- ✓ Small tools and equipment and even detachable parts of all equipment remaining outside should be securely stored away (eg stainless steel bucket of small sand screeners)
- ✓ In case of interruption of operations, large pieces of equipment should be moved to a supervised site
- ✓ Regularly check equipment for conformity and safety

The storage area for equipment and machinery must meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Easy access; and
- ✓ A flat area with enough space away from environmentally-sensitive areas.

Equipment

- ✓ Cabins;
- ✓ Hut;
- ✓ Maintenance equipment and tools; and
- ✓ Cleaning equipment.

1.1.2 Manual clean-up guidelines

Oil, polluted sediment and debris are removed by hand or with the help of manual tools and then stored for disposal.

Conditions of use

- ✓ Pollution : all types ; most often scattered pollution; on large spills, if implementation of other techniques is impossible;
- ✓ Pollutant : all types;
- ✓ Substrate : all types; sufficient load bearing capacity for pedestrians and light equipment; and
- ✓ Site: all types sufficiently accessible and which tolerate intensive traffic.

Equipment

Basic Equipment:

- ✓ Scrapers (paint scrapers, long handle scrapers...), rakes, brushes, forks; and
- ✓ Landing nets, shovels, trowels.

Extra Equipment:

- ✓ Waste containers, big bags, bins, plastic bags; and
- ✓ Front-end loader (for disposal).

PPE: At least protective clothing: overalls, boots, gloves, etc. depending on the nature of the pollutant, expose and responder activity.

- ✓ Divide the response personnel among three functions:
  - o Collection/scraping/gathering
  - o Placing in bags/waste containers
  - o Disposal
- ✓ Rotate the teams among the three functions;
- ✓ The waste can be disposed of manually or with the use of mechanical means if possible;
- ✓ Don't overfill bins, plastic bags; and
- ✓ Don't remove excessive quantities of sediments.

Impact

- ✓ Impact insignificant to heavy, depending on the type of substrate. Risk of destroying the structure of the substrate in marshes. Erosion;
- ✓ Potentially destructive effects on vegetation (dunes, marshland);
- ✓ Deconstruction and destabilisation of the foot of the dune (upper end of beach); erosion, destruction of the dune and the associated vegetation, decrease in biodiversity and fertility by reduction of the low water mark; and
- ✓ Can tend to fragment the oil in certain conditions.

Performance

This is a highly selective technique, but requires a lot of time and personnel. If not done correctly, there is a risk of removal of large quantities of clean sediment.

1.1.3 Mechanical clean-up guidelines

This technique consists of collecting the oil in order to facilitate its removal from the beach. Collection is carried out using a tractor, ATV or earthmoving vehicle or earthmoving equipment.

Conditions of use

- ✓ Pollution : heavy pollution, continuous slick;
- ✓ Pollutant : slightly to very viscous oil;
- ✓ Substrate : vast, flat foreshore with wet fine-grain sand (very damp to saturated) and a good load-bearing capacity, without ripple marks; and
- ✓ Site: accessible and sufficient load bearing capacity for earthmoving equipment, sufficiently large to allow vehicles to manoeuvre.

Equipment

Basic equipment:

- ✓ Backhoe loader;
- ✓ Grader/bulldozer;
- ✓ Tractor or loader with front blade; and
- ✓ Front-end loader or lorry (for removal).

PPE: At least suitable for heavy machinery operation

Impact

- ✓ Normally only removes the oil, but some sediment may also be taken with it (if the operator is poorly supervised or inexperienced), especially if used on light pollution or an unsuitable site;
- ✓ High risk of disturbance due to traffic and mixing of oil with sediment; and
- ✓ May lead to reduction of beach stability and beach erosion/loss of beach area.

Minimum workforce required: 2 people per vehicle (1 drive + 1 assistant)

Waste: oil mixed with a varying quantity of sediment; but can rapidly become unselective if scraping is carried out on moderate pollution (should be avoided)

- ✓ Consists of bringing the oil together in order to facilitate its removal from the beach. Scraping is carried out using a tractor or earthmoving equipment fitted with a front end blade in an oblique position. According to the viscosity of the oil, two options are available:
  - o (case 1) fluid oil: radial or converging scraping towards a collection point on the foreshore; removal by pumping
  - o (case 2) more viscous oil /solids: concentration to form windrows, by successive slightly curing passes parallel to the water line; subsequent removal of windrows
- ✓ Should only be carried out on heavy pollution; do not use on moderate to light pollution
- ✓ Inform and supervise operators; use experienced operators
- ✓ Work methodically
- ✓ Set up traffic lanes on the beach in order to reduce oil and sediment mixing

- ✓ Don’t remove excessive amounts of non-contaminated materials
- ✓ Don’t fill the bucket of loader more than 2/3 capacity
- ✓ Don’t drive on polluted materials

1.1.5 Shoreline vessel access guidelines

There are numerous landing craft vessels available in the North West Shelf area. These vessels are capable of grounding out; therefore the vessels can access a contacted area on high tide, ground out, unload equipment and personnel, reload with waste oil then depart on the next high tide. Landing craft vessels are supplied through Quadrant Energy existing vessel suppliers.

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

For shoreline clean-up of remote islands the following guidelines will be considered so as to minimise the secondary impacts of high numbers of spill response personnel on shorelines:

Vessels are to be mobilised to the designated deployment Port to mobilise shoreline clean-up teams by water. The shoreline clean-up will be undertaken through on-water deployment to the defined shorelines in 4 stages:

(1) Drop off of 6-person clean-up containers (refer below) to shoreline contact locations defined by IMT through observation data;

(2) Deployment of marine and environmental specialists to demarcate the clean-up zones with barrier posts and tape to prevent secondary impacts to flora and fauna by the clean-up teams;

(3) Deployment of small clean-up teams with a trained/competent shoreline responder as a Team Leader to conduct clean-up methods (flushing, bag and retrieve, etc.) with all waste being bagged and stored in temporary bunding made of HDPE above the high-high tide mark; and

(4) Deployment of the waste pickup barges to retrieve collected wastes from the temporary bunding and to complete the shoreline clean-up and final polishing.

Appendix M: Oiled Wildlife Response Personnel and Equipment

In the event of a spill impacting wildlife, Santos WA will commence arrangements to mobilise personnel and equipment to fill responder positions as identified in the WAOWRP. An overview of sources of personnel is provided in Table 1 and an overview of ‘first-strike’ equipment for initial deployment is provided in Table 2**.**

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

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

Table 1: Sources of Oiled Wildlife Response Personnel

<table>
<tr><th colspan="2">AMOSC / INDUSTRY RESPONDERS</th><th>Activated through</th><th>Capability</th></tr>
<tr><td colspan="2">AMOSC Technical Advisor – Oiled Wildlife – assistant in IMT (as industry OWA if required)</td><td rowspan="3">AMOSC Duty Officer</td><td>1*</td></tr>
<tr><td colspan="2">AMOSC OWR Industry Team– Level 2-4 responders (DBCA training)</td><td>18*</td></tr>
<tr><td colspan="2">WA Petroleum industry personnel – Trained by individual petroleum industry companies – activated via mutual aid</td><td>~50*</td></tr>
<tr><th colspan="2">AUSTRALIAN OWR EXPERTISE</th><th>Activated through</th><th>Capability</th></tr>
<tr><td colspan="2">Blue Planet Marine (ACT and WA) – Oiled Wildlife Responders</td><td rowspan="3">AMOSC Duty Officer</td><td>10-20*</td></tr>
<tr><td colspan="2">Phillip Island National Parks (VIC) – Oiled Wildlife Responders</td><td>~70 staff
~45 volunteers*</td></tr>
<tr><td colspan="2">NatPlan Mutual Aid</td><td>50-100*</td></tr>
<tr><td></td><td>Wildlife care and rehabilitation</td><td colspan="2">Personnel potentially available to petroleum industry (currently there is no formal arrangement)</td></tr>
</table>

Perth Zoo – Duty Veterinarian	advice, expertise and management Links to wildlife rehabilitation networks		
OWA		DBCA State Duty Officer –	1 per shift
Personnel			
DBCA staff with wildlife and emergency management skill set who currently operate in fire preparedness and response			
INTERNATIONAL OWR EXPERTISE		Activated through	Capability
DwyerTECH NZ - Facilities Management Personnel Call-off contract)		AMOSC Duty Officer	2*
Wild base, Massey University (NZ) - Oiled Wildlife Responders			4-6*
International Bird Rescue (USA)- Oiled Wildlife Responders			4*
Sea Alarm (Belgium) – Expert assistance with organisational set-up and global OWR resourcing		OSRL Duty Officer	2/3** (Sea Alarm) + additional OWR responders accessed through global network

* As per AMOSC Capacity Statement 25 Jun 2020

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

Table 2: First Strike Deployment-Ready OWR Equipment

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

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

* As per AMOSC Capacity Statement 25 June 2020

** As per OSRL SLA Equipment Report 4 May 2020.

Appendix N: Scientific Monitoring Plans

1 Scientific Monitoring Principles

1.1 Monitoring Design

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

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

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

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

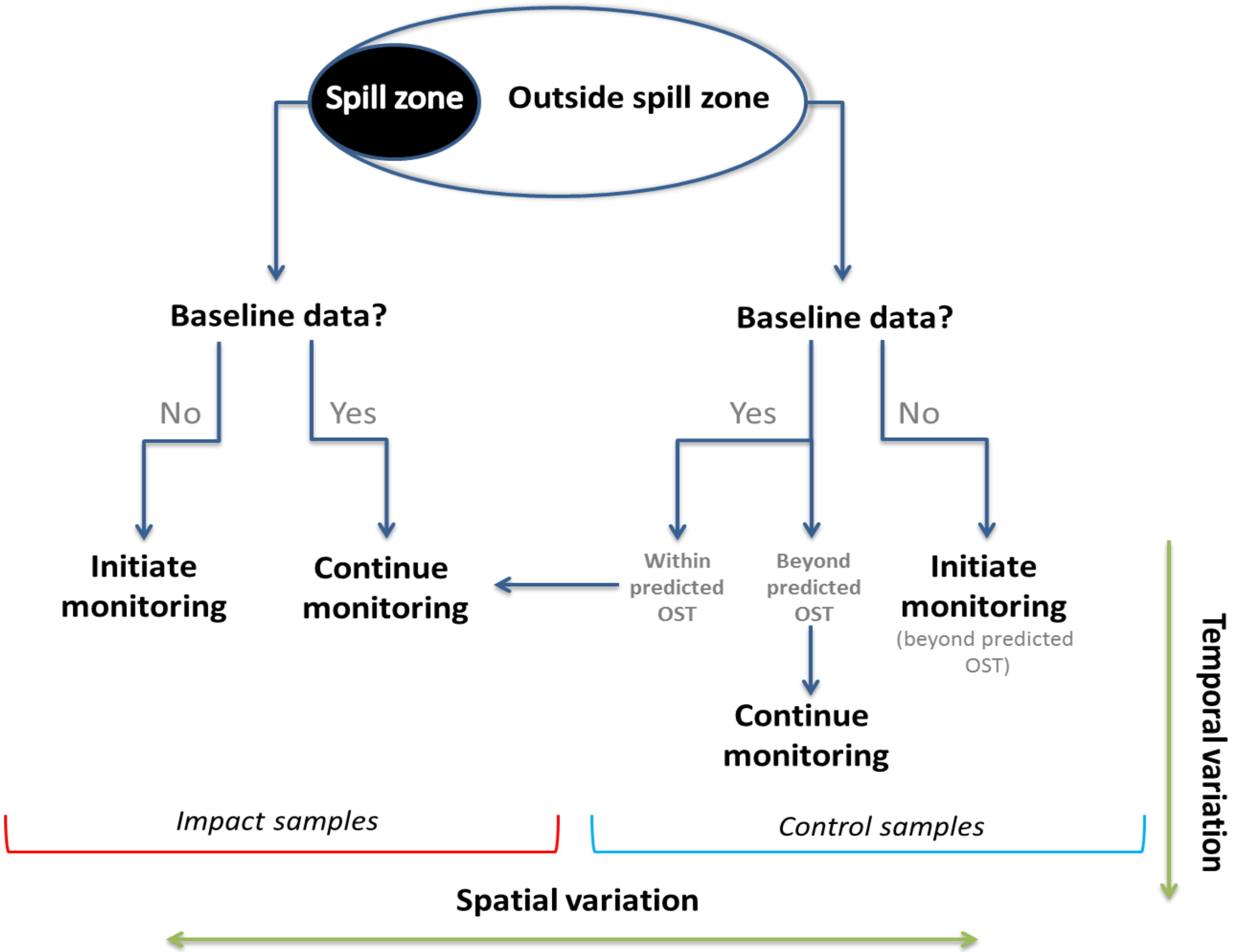


Figure 1: Structured decision making process based on Gregory et al. (2012) in reference to monitoring programs, the availability of baseline data, and oil spill trajectory. In an ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

1.2 Data Analysis

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

Table 2: Summary of data analysis techniques.

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

2 Scientific Monitoring Plans by Receptor

2.1 SMP1 Marine Water Quality

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

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

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

2.2 SMP2 Sediment Quality

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

<table>
<tr><th colspan="2">SMP2 - Sediment Quality</th></tr>
<tr><td>Termination criteria</td><td>Concentrations of hydrocarbons in marine benthic and shoreline sediments, attributable to the released hydrocarbon, are not significantly higher than baseline or similar non-impact sites.

In the absence of baseline or similar non-impact sites data, concentrations are below marine sediment quality interim guideline levels within the ANZG (2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower.

For infauna assemblages, abundance and species diversity/richness/composition are not significantly different from baseline (where baseline data exists) or are not statistically significantly different from comparable non-impacted benthic infauna assemblages.

Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.</td></tr>
<tr><td>Receptor impact</td><td>Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in:
• Taxonomic diversity
• Assemblage composition
• Abundance of indicator species.

Other pressures to these states are:
• Discharge of other toxicants
• Physical disturbance including dredging
• Sedimentation
• Introduction of marine pests
• Shading from marine infrastructure
• Climate change</td></tr>
</table>

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

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

2.3 SMP3 Sandy Beaches and Rocky Shores

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

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

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

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

2.4 SMP4 Mangrove Communities

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

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

2.5 SMP5 Intertidal Mudflats

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

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

2.6 SMP6 Benthic Habitats

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

<table>
<tr><th colspan="2">SMP6 - Benthic Habitats</th></tr>
<tr><td>Termination criteria</td><td><u>Benthic habitat cover and composition</u>

Cover and composition of benthic habitats are not statistically significantly different from that of their baseline state (where baseline data exists) or are not statistically significantly different from comparable non-impacted assemblages.

<u>Coral health and reproduction</u>

Hydrocarbon concentration in corals, reproductive state and settlement indices are not statistically different from the baseline state (where baseline data exists) or from comparable non-impacted assemblages.</td></tr>
<tr><td>Receptor impact</td><td>Impact to benthic habitats from pressures including hydrocarbons is measured through change in:
• Species diversity
• Assemblage composition
• Percent cover.

Other pressures to these states are:
• Physical disturbance
• Discharge of toxicants
• Introduction of marine pests
• Shading
• Climate change.</td></tr>
</table>

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

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

2.7 SMP7 Seabirds and Shorebirds

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

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

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

2.8 SMP8 Marine Megafauna

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

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

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

2.9 SMP9 Marine Reptiles

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

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

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

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

2.10 SMP10 Seafood Quality

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

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

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

2.11 SMP11 Fish, Fisheries and Aquaculture

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

<table>
<tr><th colspan="2">SMP11- Fish, Fisheries and Aquaculture</th></tr>
<tr><td>Receptor impact</td><td>Impact to fish, fisheries and aquaculture from pressures including hydrocarbon concentrations is measured through change in:

• Species diversity
• Abundance of indicator taxa
• Assemblage structure
• Health.

Other pressures to these states are:

• Accidental chemical spillage
• Over fishing
• Introduction of marine pests
• Habitat disturbance
• Climate change.</td></tr>
<tr><td>Methodological approach</td><td>Fish assemblages will be assessed using the stereo-baited remote underwater videos (BRUVs) following Shortis et al. (2009). Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas.

Sampling design for fish assemblages will be as follows:

• Where long-term baseline data sites are contacted a control chart (time-series) design will be applied.
• Where appropriately matched baseline data sites are impacted and non-impacted, a BACI approach to monitoring will be applied.
• If baseline data is not available, a gradient approach to quantifying impacts will be applied (See Figure 1).

Where relevant, data available from DPIRD, including catch/effort data, will be assessed to determine potential changes from baseline levels in fishing grounds potentially affected by an oil spill compared to after the event.

For fish and aquaculture species potentially exposed to an oil spill, species will be sampled across the contamination gradient as per Gagnon and Rawson (2012).

Hydrocarbon concentrations (particularly PAH) within tissues of fish and aquaculture species will be determined. Exposure to hydrocarbons on fish health will also be determine through analysis of physiological indices and biochemical markers following Gagnon and Rawson (2012).

If fish kills are observed, whole specimens will be obtained and preserved (frozen) for necropsy to determine the cause of death.</td></tr>
<tr><td>Scope of works</td><td>Prepared by monitoring provider for issue within 24 hours of this SMP being activated.</td></tr>
<tr><td>Implementation</td><td>Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site).

Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.</td></tr>
</table>

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

2.12 SMP12 Whale Shark

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

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

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

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Appendix O: SMP Activation Process

Oil Spill Scientific Monitoring Activation and Response Process

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

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

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

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

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

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

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

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

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

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

Abbreviations

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

Appendix P: Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

Assurance arrangements

Astron Environmental Services (Astron) is currently Santos WA's primary Monitoring Service Provider for the implementation of SMPs 1-11. A contractual arrangement exists with Astron to maintain standby arrangements as per the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) and have the resourcing capability to implement a first-strike response at all times. Astron maintains a relationship with a primary sub-contractor (BMT) for the provision of scientific monitoring for those SMPs where Astron does not have the required capability. Between Astron and BMT, capability exists to deliver first strike resourcing against SMPs 1-11.

Assurance on the continued maintenance of capability is provided through the delivery of monthly capability reports. These reports are generated by the Astron and BMT Planning and Logistics Officers and delivered to the Santos Spill Response Adviser along with a summary of any changes in resourcing or, and if required, how gaps in resourcing have been managed. Since the establishment of the scientific monitoring contract in 2015 Astron has always demonstrated through this process that it has the required capability to meet first strike resourcing as per the standby services contract.

Santos ensures that Astron/BMT standby arrangements are adequate through its exercise and auditing program. Santos regularly conducts exercises and tests with Astron and BMT to ensure that Santos IMT roles and Astron/BMT monitoring roles are familiar with the SMP activation arrangements while providing spot checks on resource availability. Santo WA has also recently undertaken a Tier 2 audit of Astron (December 2018) against its Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162). Assurance activities to date have demonstrated a high degree of compliance with standby service requirements.

Continuous improvement

Santos WA is committed to further improving its oil spill scientific monitoring capability. To that end, Santos is participating in a Joint Industry Operational and Scientific Monitoring Plans (OSMP) project, governed through an APPEA-Industry Steering Committee. This project, being progressed throughout 2020, is working towards a joint-industry capability for implementing a common suite of oil spill operational and scientific monitoring plans. The project aims to deliver efficiencies in implementing and testing oil spill scientific monitoring arrangements while increasing the level of resourcing and capability available to participating companies.

Baseline Data and Capability Assessment

Santos WA is currently committed to undertaking a review of the status, availability, currency and suitability of existing baseline data for oil spill scientific monitoring sources every 2 years. The latest review was undertaken in March 2019 by Astron (Baseline Data Review document QE-00-BI-20001) and looked at all high biodiversity value receptors in the Santos WA EMBA. Following this an additional assessment was undertaken in September 2019 (DC-40-RI-20017) to determine whether existing baseline data is sufficient and accessible for sensitive receptors that could be impacted from worst case Commonwealth waters spills scenarios associated with operational activities at or around Devil Creek pipeline/Reindeer platform, Varanus Island and Ningaloo Vision facilities. This study concentrated on sensitive receptor areas with minimum hydrocarbon contact times of less than seven days as indicated by stochastic spill modelling; it is considered that contact within seven days would require an enhanced understanding of available baseline data to ensure a timely response.

The assessment of baseline data included:

1. A review of the following parameters for each program identified:
   - IMCRA
   - Custodian- contact point for data
   - Spatial extent

- Variables available for monitoring
- Methods applied to monitoring
- Year of most recent data capture
- Total duration of monitoring program
- Data completeness (number of years monitored as proportion of program duration)
- How often data is captured
- Appropriateness of variables (Judgement as to whether variables are appropriate for future oil spill monitoring)
- Is there any clear indication that the monitoring will continue?

2. The quality of the following parameters were then ranked as high, medium, low or unknown:
   I. Year of most recent capture:
      - 2015-2018 (if a single data capture has occurred in the last two years, then the overall program can be considered of high quality) = high
      - 2009-2014 = medium
      - <2009 = low
   II. Duration:
      - >4 years = high
      - 2-4 years = medium
      - 1 year = low
   III. Data completeness:
      - 100% = high
      - 75-99% = medium
      - <75% = low
   IV. Frequency of capture
      - Annually = high
      - Bi-annually = medium
      - <Bi-annually = low
   V. Appropriateness of parameters
      - High/medium/low

      Appropriateness of parameters was based on reference to the Scientific Monitoring Plan's targeted states for each receptor and considering whether the monitoring parameters were sufficient to compare against these states. Parameters were considered highly appropriate if all targeted states for a receptor could be quantified, of medium appropriateness if only some states could be quantified and low if the monitored parameters had little relevance to the targeted states of an individual receptor.

3. An overall assessment of each study program was then made as follows:
   - All parameters rated high = overall 'good'
   - At least one parameter rated medium = overall 'fair'
   - At least one parameter rated low = overall 'poor'
   - Unknown = overall not enough data to rate

The above assessment process was also performed across monitoring programs which specified at least one of the priority protection areas within their monitoring sites. For Priority protection areas, the above assessment was then used to determine if 1) the baseline data available could be used to detect change in the state in the event of a significant impact - Classified as "good" in the above assessment (ie., data was current, of reasonable duration and frequency, and employed appropriate methodologies) or 2) the existing baseline data is unlikely to be suitable to detect change in state – classified as "fair" or "poor" by the above assessment (ie., the data was dated, infrequent, of limited duration and/or relied on inappropriate methodologies). Following this assessment a Protection Priority Area by SMP matrix summarising recommendations on baseline data status and recommendations for further action was developed (Table 1) based on three categories:

- Not applicable – SMP is not applicable to the priority protection area as sensitive receptor does not occur.
- Survey - current monitoring/knowledge is considered sufficient (i.e. could be used to detect change in state in the event of a significant impact) and is considered a lower priority for post-spill pre-impact data collection.
- Priority survey – current monitoring is not in place or not practicable; post-spill pre-impact baseline data collection should be prioritised.

The assessment determined for the majority of sensitive receptors within the priority protection areas (Montebello Islands, Barrow Island, Lowendal Islands, Ningaloo, Muiron Islands and Dampier Archipelago) post-spill pre-impact monitoring should be prioritised, noting that alternative approaches exist for detecting impacts where it is not feasible to conduct first-strike pre-impact baseline surveys, for example, impact versus multiple control sites and/or a gradient approach. These experimental design approaches are described within the Oil Spill Scientific Monitoring Plan (EA-00-RI-10099).

Table 1: Summary of recommendations for further action based on review of available baseline data.

SMP	Priority Protection Areas					
	Montebello Islands	Barrow Island	Lowendal Islands	Ningaloo	Muiron Islands	Dampier Archipelago
Water Quality (SMP1)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sediment Quality (SMP2)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Mangroves (SMP4)	Survey	Survey	Survey	Survey	Not applicable	Survey
Intertidal Mudflats (SMP5)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Benthic Habitats (SMP6)	Priority survey	Survey	Priority survey	Survey	Survey	Priority survey
Seabirds/ shorebirds (SMP7)	Priority survey	Survey	Survey	Survey	Survey	Priority survey
Marine megafauna (SMP8)	Survey	Survey	Priority survey	Survey	Survey	Survey
Marine reptiles (SMP9)	Priority survey	Survey	Survey	Survey	Survey	Survey
Seafood Quality (SMP10)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey	Priority survey
Whale sharks (SMP12)	Not applicable	Not applicable	Not applicable	Survey	Not applicable	Not applicable

Based on the assessment of priority survey areas/receptors outlined in **Table 1** a capability assessment was undertaken to understand whether existing scientific monitoring capability would be sufficient to mount a first-strike monitoring program to gather baseline data within a short-timeframe (<7 days), noting that in the event of very short contact timeframes mobilisation of scientific monitoring teams to priority receptor sites may not be possible within contact timeframes and experimental designs not relying on pre-impact baseline would have to be employed.

Given that **Table 1** lists Protection Priority areas that could be contacted within 7 days based on stochastic modelling data (i.e. the outcomes of 100s of spill modelling simulations rather than a single spill event) it was not considered appropriate or credible that baseline monitoring would have to occur at all areas over this timeframe. For the purposes of the assessment it was considered credible that only one of the three broad regions: 1) Barrow/ Montebello/ Lowendal Islands; 2) Ningaloo Coast/ Muiron Islands or; 3) Dampier Archipelago would potentially require priority baseline monitoring within the 7 day time period.

Table 2 outlines the required scientific monitoring capability for rapid response in Scenario 2 (Ningaloo Coast/Muiron Islands), and Astron's actual capability. When determining actual team capability, personnel were only allocated to a single SMP team, unless otherwise stated.

The results of the Baseline Data Review document (QE-00-BI-20001) and subsequent baseline and capability assessment of protection priority areas summarised herein (but detailed further in DC-40-RI-20017) has been provided within the Environment Functional Team Folder on the Emergency Response Intranet page so that this information is accessible to guide Santos IMT Environmental roles and monitoring provider roles in the event of activating oil spill scientific monitoring.

Table 2: Scenario 2 capability assessment for rapid sampling of Ningaloo Coast and Muiron Islands area within seven days.

Receptors	Priority Protection Areas		Required capability for rapid response (per Priority Protection Area)	Actual Team Capability
	Ningaloo	Muiron Islands		
Water Quality (SMP1)	Priority survey	Priority survey	1 teams of 2 personnel • at least one member in each team to have experience in water sampling • at least one member in each team to have experience in deep sea sediment sampling	3 teams of 2 personnel
Sediment Quality (SMP2)	Priority survey	Priority survey		
Sandy Beaches/Rocky Shorelines (SMP3)	Priority survey	Priority survey	1 teams of 2 personnel • at least one team member with experience in shoreline macrofauna/infauna assessment	3 teams of 2 personnel
Intertidal Mudflats (SMP5)	Priority survey	Priority survey		
Mangroves (SMP4)	Survey	Survey	Not required[2]	Not required
Benthic Habitats (SMP6)	Survey	Survey	Rapid priority response not required	2 teams of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers
Seabirds/ shorebirds (SMP7)	Survey	Survey	Rapid priority response not required	4 teams of 2 personnel • at least one member of each team is an experienced ornithologist)

Receptors	Priority Protection Areas		Required capability for rapid response (per Priority Protection Area)	Actual Team Capability
	Ningaloo	Muiron Islands		
Marine megafauna (SMP8)	Survey	Survey	Rapid priority response not required	2 teams of 2 personnel (aerial)[1] • both experienced wildlife observers 2 teams of 2 personnel (vessel)[1] • both experienced wildlife observers
Marine reptiles (SMP9)	Survey	Survey	Rapid priority response not required	2 teams of 2 personnel (aerial)[3] • both experienced wildlife observers 3 teams of 2 available (vessel)[3] • both experienced wildlife observers 3 teams of 2 personnel (ground-based)[4] • at least one member with experience in turtle survey techniques
Seafood Quality (SMP10)	Priority survey	Priority survey		

Receptors	Priority Protection Areas		Required capability for rapid response (per Priority Protection Area)	Actual Team Capability
	Ningaloo	Muiron Islands		
Fish, Fisheries & Aquaculture (SMP11)	Priority survey	Priority survey	1 teams of 3 personnel • at least one member to have experience in fish identification and necropsy • at least one member to have BRUV experience	3 teams of 3 personnel
Whale sharks (SMP12)	Survey	Not applicable	Not required due to ongoing research along the Ningaloo coast	Not required due to ongoing research along the Ningaloo coast

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

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

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

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

Appendix Q: Forward Operations Guidance

Forward Operating Base (FOB)

For a Ningaloo Vision operation spill response Santos WA will establish a FOB at Harold E Holt (HEH) Military Base through the HEH Facilities Manager or Exmouth SES Incident Command Centre for a local FOB through the Exmouth Shire CEO.

For an ongoing response, a FOB may also be set-up in Santos WA 's Dampier facilities leased from Toll. These facilities are located in Toll 's Yard 1 and Yard 2 on Streckfuus Road Dampier; the facilities consist of a conference room and multiple offices that could be used as break-out rooms.

The IMT will develop a communication strategy to support the FOB/s and forward staging areas.

Local facilities with operational value for response uses are listed **Table 1**.

Table 1: Exmouth facilities with operational value for response

Facility	Owner / Operator	Potential Uses
Harold E. Holt Naval Base	Australian Government Department of Defence	Forward Operations Base Storage of oil spill response equipment Vessel loading for spill response equipment and waste management
Exmouth Marina	Shire of Exmouth	Staging area for vessel loading for spill response equipment and waste management
Learmonth Airport	Australian Government Department of Defence	Air freight spill response equipment. Dispersant operations base
Exmouth light airstrip	Exmouth council	Air freight spill response equipment. Dispersant operations base
Logistic Services Yard	Exmouth Freight Services	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Response equipment storage
Tantabiddi/ Bundegi Boat Ramp areas	Shire of Exmouth	Staging / storage area Load out for near-shore marine based operations Boat launching
Bhagwan / Jetwave / Base Marine Yards Exmouth	Exmouth	Storage / Laydown and Staging Area Materials consolidation Marine equipment storage, staging & repairs

Forward Staging Areas

Staging areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Control Agency for shoreline response activities. Wildlife treatment facilities may also be set-up under the direction of DoT and DBCA to clean and rehabilitate oiled wildlife.

Transport

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

Mobile plant

Mobile plant and equipment for mechanical clean-up can be provided from suppliers in Exmouth, Carnarvon or Perth as required.

Decontamination

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

Ablutions

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

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

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

Security

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

Messing

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

Freight movement

The transportation of all equipment and service from all stockpiles and centres can be facilitated through Santos WA 's third party logistics providers.

Cleaning and repair

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

Suppliers

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

Accommodation

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

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

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

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

Providoring

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

The providoring requirements for transportable and remote messing would be provided directly through Sodexo and BRT respectively, including the transportation thereof.

PPE

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

In the event of a spill incident Santos WA would engage the services of a third party to provide and maintain inventory for the duration of oil spill operations.

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

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

Radio communications

For Exmouth region response operations Santos WA would request the use of Woodsides radio communication trailers based in Perth. These trailers are licenced for locations in Exmouth and along the Ningaloo coast and permit land, sea and air radio communications.

Santos WA could additionally utilise the services of a specialist communication provider to hire hand-held and vehicle mounted UHF radios to support response and clean-up personnel. Portable deployed repeater stations (battery or mains powered) can be positioned along the shoreline to provide a ‘voting’ system for transmitting and receiving during the clean-up operation. Communication equipment will be supplied through local, national, and international suppliers as the operational situation dictates.