Devil Creek Pipeline and Reindeer Well Head Platform Oil Pollution Emergency Plan

PROJECT / FACILITY	Devil Creek
REVIEW INTERVAL (MONTHS)	30 Months
SAFETY CRITICAL DOCUMENT	NO

Rev	Owner	Reviewer/s *Managerial/Technical/Site*	Approver
	Senior Spill Response Adviser	**Team Lead – Security & Emergency Response**	**Manager HSE**
8			

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Rev	Rev Date	Author / Editor	Amendment
8	03/04/20	Santos	Revised following NOPSEMA opportunity to modify and resubmit
7	17/12/19	Santos	Revised following NOPSEMA request for further written information
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AMOSC	●	
OSRL	●	
Intranet – Emergency Preparedness	●	

How to use this OPEP in the event of a spill

Sections 1 to 4 contain background information only:

+ Activity description and location,
+ OPEP requirements,
+ Spill Response Levels
+ Oil Spill Response Framework
  - Spill Response Levels
  - Jurisdiction Authorities and Control Agencies
  - Santos WA Incident Management Structure (Roles and responsibilities; Training and exercises)
  - Integration with other Organisations
+ Spill Modelling and Protection Priorities
+ Response Options

Sections 5 to 18 contain directions on how to respond to the spill

+ Initial actions
+ Notifications
+ IAP planning
+ Spill Response Plans:
+ Source Control Plan
+ Monitor and Evaluate Plan
+ Mechanical Dispersion Plan
+ Shoreline Protection and Deflection Plan
+ Shoreline Clean-up Plan
+ Onshore Response Plan
+ Oiled Wildlife Response Plan
+ Waste Management Plan
+ Scientific Monitoring Plan
+ Forward Operations Plan
+ Spill Response Termination

Sections 19 to 20 contains

+ OPEP Administration
+ References

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1 Overview

1.1 Description of Devil Creek Operations

This Oil Pollution Emergency Plan (OPEP) covers the continuous operational activities at the Reindeer Well Head Platform (WHP) and associated gas/condensate export pipeline, the Reindeer 16” pipeline. The Reindeer 16” pipeline runs from the WHP to the Devil Creek Gas Plant (DCGP) (**Figure 1-1**). The OPEP does not cover activities within the DCGP.

Gas and condensate is produced from the Reindeer gas field at the WHP, approximately 80 km northwest of the Port of Dampier, situated in 58 m water depth. The gas/condensate from production wells is transported ashore through the Reindeer 16” Pipeline and processed at the DCGP. The Reindeer pipeline crosses Commonwealth and State waters and continues onshore as buried pipeline from the horizontal directional drilling (HDD) entrance point just offshore from the shoreline until it reaches the DCGP. Dry sales gas produced at the DCGP is fed into the Dampier Bunbury Natural Gas Pipeline (DBNGP), for industrial customers via the Devil Creek Sales Export Pipeline.

Operations covered by the OPEP include, but are not limited to the following:

+ Production and transport of gas/condensate between the WHP and the DCGP
+ Inspections, surveys, maintenance and modifications of the WHP and Reindeer pipeline
+ Vessel, ROV, AUV, Diver, Sonar and pigging operations supporting the above
+ Transfer of personnel, equipment and chemicals to the WHP by vessel
+ Well interventions from the WHP or vessel (Mobile Offshore Drilling Unit (MODU) well interventions not included)

A detailed description of the operational activities associated with the Reindeer WHP and associated pipeline are provided in the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; EA-14-RI-10002.01) and Devil Creek Gas Supply and Sales Export Pipeline Operations Environment Plan (Devil Creek EP; EA-14-RI-10001.01). A schematic overview of the Reindeer WHP and Devil Creek offshore and on-shore gas supply pipeline is provided in **Figure 1-1**.

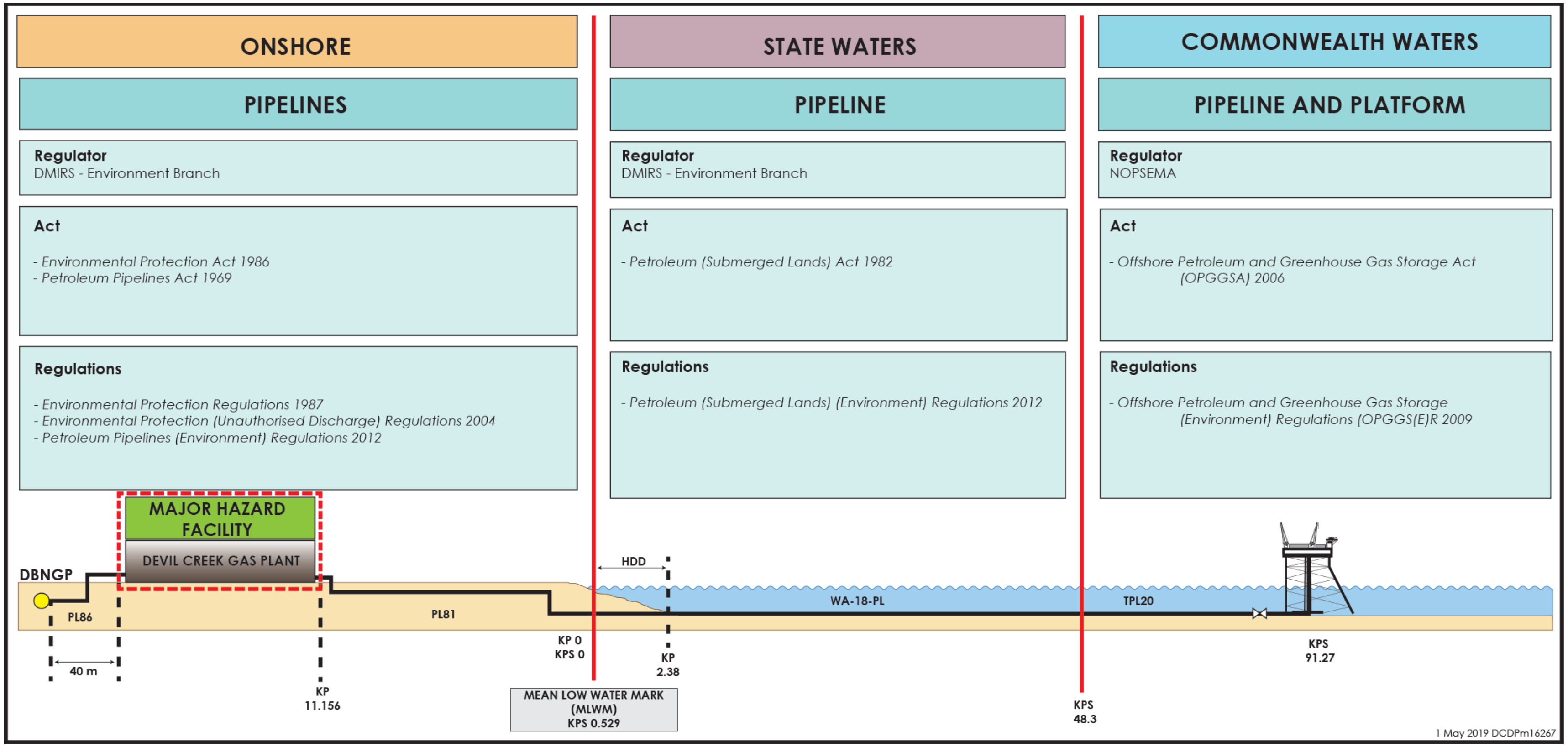

Figure 1-1 Schematic of the Reindeer WHP and Devil Creek Pipeline

1.2 Purpose and Scope of OPEP

The OPEP is an operational document and contains all information necessary for Santos WA to carry out a response to an emergency oil spill arising from the activity.

This document is the accompanying Oil Pollution Emergency Plan (OPEP) to the Devil Creek Gas Supply Pipeline and Sales Gas Pipeline Operations Environment Plan for Onshore & State Waters (EA-14-RI-1000.01) and the Reindeer Wellhead Platform & Offshore Gas Supply Pipeline Operations Environment Plan for Commonwealth Waters (EA-14-RI-10002). The EP is required by Regulation 14(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations) and the State Petroleum (Submerged Lands) (Environment) Regulations 2012 (P(SL)(E) Regulations) and the State Petroleum Pipeline (Environment) Regulations 2012 (PP(E) Regulations).

This OPEP 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: Maritime Environmental Emergencies.

1.3 High-Level Objectives of OPEP

The overall aim of this OPEP is to prevent 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 as low as reasonably practicable (ALARP).

The objectives of this OPEP are to:

+ Provide guidance to the IMT in relation to spill response implementation; and
+ To demonstrate the capability requirements for response activities.

2 Oil Spill Response Framework

2.1 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 Company Incident Command and Management Manual (QE-00-ZF-00025) and further detailed in **Table 2-1** below for hydrocarbon spills.

Table 2-1 Santos WA Oil Spill Response Levels

<table>
<tr><th colspan="2">Level 1</th></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td>Oil is contained within the incident site.
Spill occurs within immediate proximity to the site.
Discharge in excess of permitted oil in water (OIW) content (15 ppm).
Able to respond to the spill immediately.</td><td>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.</td></tr>
<tr><th colspan="2">Level 2</th></tr>
<tr><td colspan="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.</td></tr>
<tr><td>Danger of fire or explosion.
Possible continuous release.
Concentrated oil accumulating in close proximity to the site or vessel.
Potential to impact other installations.</td><td>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.</td></tr>
<tr><th colspan="2">Level 3</th></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td>Loss of well integrity.
Actual or potentially serious threat to life, property, industry.
Major spill beyond site vicinity.
Significant shoreline environmental impact.</td><td>Level-2 resources overwhelmed, requiring international assistance.
Level- 3 resources to be mobilised.
Significant impact on local communities.
International media attention.</td></tr>
</table>

2.2 Jurisdictional Authorities and Controlling Agencies

During a spill response there will be both a Jurisdictional Authority and a Controlling Agency assigned to the oil spill incident for all Spill Response Levels. The Jurisdictional Authority is the relevant Statutory Authority that has responsibilities for oil pollution in that jurisdiction. The Controlling Agency is the agency or company assigned by legislation, administrative arrangements or within the relevant contingency plan to control response activities to an oil pollution emergency. With respect to a hydrocarbon spill from Devil Creek operations and Reindeer Well Head Platform, the relevant Jurisdictional Authority and Controlling Agency varies dependent upon the location of the spill (Commonwealth or State waters or onshore), the nature of the incident (vessel based or Facility based) and the Spill Response Level (refer **Table 2-2**).

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Table 2-2 Jurisdictional Authorities and Controlling Agencies for Devil Creek Pipeline and Reindeer Well Head Platform oil spill response

Role	Spill Level	State Waters		Commonwealth Waters		On-Shore
		Facility[1]	Vessel[2]	Facility	Vessel[1]	
Controlling Agency	1	Petroleum Titleholder (Santos WA)	DoT	Petroleum Titleholder (Santos WA)	AMSA	Petroleum Titleholder (Santos WA)
	2/3	DoT	DoT	Petroleum Titleholder (Santos WA)	AMSA	DFES
Jurisdictional Authority	1/2/3	DoT	DoT	NOPSEMA	AMSA	DFES/DER

2.2.1 Petroleum Activity Spill in Commonwealth Waters

For an offshore petroleum activity oil spill incident 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 Controlling Agency in Commonwealth waters, in accordance with this OPEP.

Santos WA is responsible as Controlling Agency until such a time as the relevant Jurisdictional Agency (NOPSEMA) identifies the need to delegate control. In this situation, Controlling 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 Controlling Agency responsibilities.

2.2.2 Petroleum Activity Spill in State Waters

For WA State waters, the DoT Marine Safety General Manager is prescribed as the Hazard Management Agency (HMA) for marine oil pollution as per the WA Emergency Management Act 2005 and Emergency Management Regulations 2006. The DoT as the HMA has developed the State Hazard Plan: Maritime Environmental Emergencies (DoT, 2018) (replacing the WestPlan-MOP). These arrangements effectively nominate DoT as the equivalent Jurisdictional Authority for Petroleum Activity spills in State waters, whose responsibility is to ensure there is an adequate response to the State waters marine pollution.

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[1] (Petroleum activity) 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, 2017b) as a seismic vessel, supply or support vessel, or offtake tanker.

Under the WestPlan-MEE, the Controlling Agency for Level 1 Petroleum Activity spills in State waters is the Petroleum Titleholder (Santos WA) with the Controlling Agency for Level 2/3 spills nominated as DoT.

While Santos WA is not the Controlling Agency for Level 2/3 Petroleum Activity spills in State waters, Santos WA is required to have adequate plans and resources available to effectively respond to a worst-case spill originating in State waters under State Petroleum legislation administered by DMIRS:

+ Petroleum (Submerged Lands) Act 1982 and Petroleum (Submerged Lands) (Environment) Regulations 2012
+ Petroleum Pipelines Act 1969 and Petroleum Pipelines (Environment) Regulations 2012

The framework under which Santos WA will provide support to DoT for an oil response within State waters is detailed in **Section 2.4.3**.

2.2.3 Cross-jurisdiction Petroleum Activity Spills

For a Level 2/3 Petroleum Activity spill, there is the possibility of the spill crossing jurisdictions between Commonwealth and State waters with two Jurisdictional Authorities (i.e. NOPSEMA for Commonwealth waters and DoT for State waters). Similarly, 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).

The arrangements between DoT and Santos WA for coordinating a response across both Commonwealth and State waters are further detailed in **Section 2.4.3**.

2.2.4 Vessel Spills in Commonwealth Waters

For a vessel incident originating in Commonwealth Waters the Jurisdictional Authority and Controlling 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.

AMSA is the designated Combat Agency (Controlling Agency) for oil spills from vessels within the Commonwealth jurisdiction. Upon notification of an incident involving a ship, AMSA will assume control of the incident and respond 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-sourced incidents.

AMSA is to be notified immediately of all ship-sourced incidents through RCC Australia (refer to **Table 6-1**)

As with petroleum activity spills, Santos WA is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within Commonwealth waters under OPGGS Act 2006 and OPGGS (E) Regulations.

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

2.2.5 Vessel Spills in State Waters

For a vessel incident originating in State Waters the Jurisdictional Authority/ Hazard Management Agency is DoT as it is for petroleum activity spills. DoT is also the Controlling Agency for Level 2/3 vessel spills in State waters under WestPlan-MEE arrangements.

As with petroleum activity spills, Santos WA is required to have adequate preparedness arrangements for spills from vessels undertaking Petroleum Activities within State Petroleum legislation administered by DMIRS.

Santos WA will be responsible for coordinating a first-strike response to all vessel-based spill until DoT takes over the role as Controlling Agency, in the event of a Level 2/3 spill, at which time Santos WA would provide all necessary resources (including personnel and equipment) as a Supporting Agency.

2.2.6 Cross-jurisdictional Vessel Spills

For a large vessels 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). Controlling Agency responsibilities will determined by DoT and AMSA with Santos WA providing all necessary resources (including personnel and equipment) as a Supporting Agency.

2.2.7 On-shore Spills

In the event of a hydrocarbon spill along the onshore section of Santos WA's Devil Creek Pipeline, the Jurisdictional Authority and Hazard Management Agency (HMA) for incident response is the Department of Fire and Emergency Services (DFES). The DFES is the prescribed HMA for response under the Emergency Management Regulations 2006 for all emergencies in which there is 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".

The DFES will respond as Controlling Agency in accordance with the State Hazard Plan: Hazardous Materials Emergencies (HAZMAT), which includes emergencies at or involving on-shore pipelines licensed pursuant to the Petroleum Pipelines Act 1969 (Section 1.2.2 (c); FESA 2010).

Notwithstanding this, Santos WA is required to have adequate plans and resources available to effectively respond to a worst-case spill originating from its pipelines as per the Petroleum Pipelines Act 1969 and Petroleum Pipelines (Environment) Regulations 2012. Santos WA will provide first strike response until such time as DFES assumes control.

As stated in the Hazmat, on-site recovery and clean-up of hazardous materials is the responsibility of the owner and as such. Santos WA will ensure clean-up and remediation of any on-shore spill is completed to the satisfaction of the Department of Water and Environmental Regulation (DER) as the relevant Jurisdictional Authority for the clean-up of onshore oil spill pollution and management of contaminated sites.

2.3 Santos WA Incident Management Structure

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 Devil Creek/Reindeer incident includes:

+ Devil Creek Incident Response Team (IRT);
+ Incident Management Team (IMT) – Perth based to coordinate and execute responses to an oil spill incident;

+ Crisis Support Team (CST) and 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;
+ Other field-based command, response and monitoring teams.

The Santos WA incident response organisational structure is defined in the *Incident Command and Management Manual* (QE-00-ZF-00025), and in **Figure 2-1** for reference.

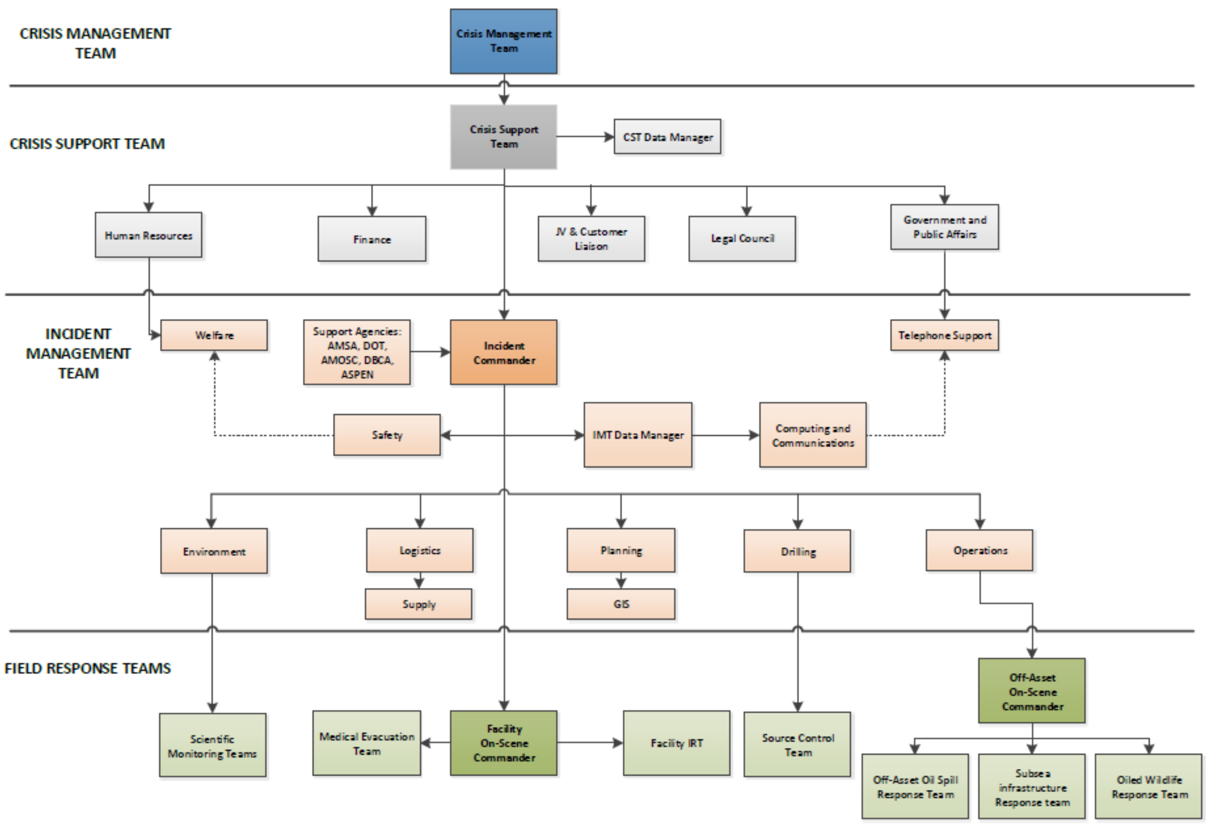

Figure 2-1 Santos WA Incident Response Organisational Structure

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 partnership with the DoT in providing spill response capability. Santos WA's expanded organisational structure for these situations is detailed in ***Section 2.4.3***

2.3.1 Roles and Responsibilities

The tables below provide an overview of the responsibilities of the Santos WA CST **(Table 2-3)**, IMT (**Table 2-4)**, and Field-based response team members in responding to an incident (**Table 2-5**), the Emergency & Oil Spill Coordinator in preparing for and responding to an incident, and the Chief Executive Officer in supporting an incident response.

Also provided are the roles and responsibilities of Santos WA personnel required to work within DoT's organisational structure (**Table 2-6**), where DoT has responsibilities for spill response as a Controlling Agency (**Table 2-7**), 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 2-3 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 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 2-4 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 + 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

Santos WA IMT Member	Main Responsibilities
	+ 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 + 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'.

Santos WA IMT Member	Main Responsibilities
	+ 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 2-5 Roles and Responsibilities in the Field-Based Response Team.

Field-Based Position	Main Responsibilities
Devil Creek On-Scene Commander	+ Commands the onsite response to Devil Creek 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
Devil Creek Incident Response Team (IRT)	+ Respond to incidents under the instruction of an Incident Response Team Leader in accordance with actions developed by the DC 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
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 2-6 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	+ Provide a direct liaison between the Santos WA CST and the MEECC + Facilitate effective communications between DoT's SMEEC and the Incident Controller and Santos WA' appointed CST Commander and Incident Controller + 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 Controller as required
Media Liaison Officer	+ Provide a direct liaison between the Santos WA Media team and DoT IMT Media team + Facilitate effective communications and coordination between the Santos WA 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 WAWA Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures

Table 2-7 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 and the State Maritime Environmental Emergency Coordination Centre (MEECC) + Facilitate effective communications and coordination between the Santos WA CST Commander and the State Maritime Environmental Emergency Coordinator (SMEEC) + Offer advice to SMEEC on matters pertaining to Santos WA crisis management policies and procedures
Deputy Incident Officer	+ 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
Intelligence Support Officer	+ As part of the 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 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)
Environmental Support Officer	+ As part of the Planning Team, assist the Environmental Officer in the performance of their duties in relation to the provision of environmental support into the planning process + Assist in the interpretation of the Santos 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
Public Information Support & Media Liaison Officer	+ As part of the Public Information Team, provide a direct liaison between the Santos WA Media team and DoT IMT Media team + Facilitate effective communications and coordination between Santos WA 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 WA 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 WA 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)
Facilities Support Officer	+ As part of the Logistics Team, assist the Logistics Officer Supply in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters + Facilitate the acquisition of appropriate services and supplies through Santos WA's existing private contract arrangements related to waste management

Santos WA roles embedded within the State MECC/ DoT IMT	Main Responsibilities
	+ 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 On Scene Commander (FOB)	+ 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 On Scene Commander and the DoT On Scene Commander + Offer advice to the DoT On Scene Commander on matters pertaining to Santos WA 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 WA safety policies and procedures

2.3.2 Incident Response Authority

During the course of incident, team members may be required to make technical and financial decisions that exceed those levels set for normal operations.

The Incident Commander has full technical authority to request all Santos WA and contracted resources deemed necessary to manage the incident, and to call in additional resources if required.

The Incident Commander is to request the CST Leader to obtain authority from the CMT for financial commitments to respond to the incident consistent with the level of authorisation required for normal operations.

2.3.3 Training and Exercises

2.3.3.1 CST/IMT 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 2-8**.

Table 2-8: 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

2.3.3.2 Oil Spill Responder Training

Santos has an internal capability of trained oil spill responders that can be deployed into the field in a spill response and has access to external trained spill responder resources (**Table 2-9**).

Table 2-9: Oil Spill Responder Training and 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
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

Responder	Role	Training	Available Number
Oiled Wildlife Response Roles (Level 2 to 4)	Refer **Section 14** and **Appendix K**.		
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, the following resources are available to Santos WA:

+ 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, 2014); and
+ WestPlan–MOP: State Response Team (SRT) and NW Regional Response Team (RRT) – Oil pollution response teams available to assist under the jurisdiction of the DoT. SRT and RRT members remain trained and accredited in line with WestPlan–MOP requirements.

In the event of a spill, the trained spill responders 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 for shoreline clean-up would be filled through Santos WA AMOSC Core Group Responders and industry Core Group Responders, which combined represent approximately 100 personnel.

2.3.4 Response Testing

Testing of onsite Devil Creek emergency arrangements, including major hydrocarbon spill incidents, are as per the requirements of the Devil Creek Incident Response Plan (DC-40-IF-00096) and are recorded in the Santos WA Learning Management System with actions tracked in the Santos WA Action Tracking System.

Regulatory and service provider notifications/ activations of the plan are tested by the Emergency and Oil Spill Coordinator 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 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 a large IMT/CST exercise twice per year using an emergency scenario at either one of Santos's main operating facilities on the North West Shelf or at a drilling activity. An oil spill incident scenario is used for the 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 are done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider is assessed.

Santos WA regularly provides IMT and responder personnel to participate in exercises and workshops as the opportunity arises, run by response agencies and related organisations including DoT, AMSA, CSIRO, AMOSC and OSRL.

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

2.3.5 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 5-year Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001) is reviewed and revised annually.

2.3.6 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 Devil Creek oil spill response are summarised in **Table 2-10**.

Table 2-10: Oil Spill Response Testing Arrangements

Exercise	Objective	Frequency	Recording and review
Communication Test	To test all communication and notification processes to service providers and	Required for every approved OPEP.	Any results of the test are recorded in a Test Report. Corrections are updated within the

Exercise	Objective	Frequency	Recording and review
	regulatory agencies defined within the OPEP.	When response arrangements have changed. At least annually.	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 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	As per Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001) Minimum of one oil spill activation exercise per year.	All exercises undertaken are recorded in Santos 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	As per Incident and Crisis Management Training and Exercise Plan (QE-92-HG-10001)	Test reports are recorded
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

Exercise	Objective	Frequency	Recording and review
			report made available to members.
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.

2.3.1 Incident Management Environmental Performance

Table 2-11 indicates the environmental performance outcomes, controls and performance standards for the Santos WA incident management framework.

Table 2-11 Environmental performance outcomes, controls and performance standards for incident management

Environmental Performance Outcome	Manage incident via a systematic planning process		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Incident Management	**Response Preparedness**		
	Competent and sufficient Incident Management Team (IMT) and oil spill responder personnel	Maintaining numbers of responder personnel trained as per Santos WA standards and procedures	Training and exercise records
	Incident management facilities	Maintain IMT/CST facilities as per Santos WA standards and procedures	Inspection reports
	Response Implementation		
	Net Environmental Benefit Analysis (NEBA)	NEBA undertaken to inform response strategy selection or rejection	Incident Log Incident Action Plan

		NEBA undertaken each operational period to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	Incident Log Incident Action Plan
	Incident Action Plan (IAP)	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

2.4 Integration with other Organisations

2.4.1 Australian Marine Oil Spill Centre (AMOSC)

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

Response equipment and personnel are allocated on a first-come-first-served basis, with the intent, under best efforts, to address any short-fall through AMOSC's affiliation with UK-based oil spill response company, Oil Spill Response Limited (OSRL), of which Santos WA is a direct subscriber. Further support can be gained through OSRL to the Global Response network (GRN).

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

2.4.2 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 vessel, AMSA or another nominated National Plan agency (under NatPlan arrangements) may assume control of the incident. Santos WA has arrangements in place to conduct the first strike response (e.g. aerial surveillance operations) until AMSA or a nominated National Plan agency assumes Incident Command (as the Control Agency). Santos WA will continue to implement response activities outlined in this OPEP and operational and scientific monitoring activities as deemed necessary by the Control Agency. NatPlan resources may be made available to Titleholders through request to AMSA.

2.4.3 WA Department of Transport (DoT)

In the event that a Level 2/3 spill that 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 Emergency Coordinator (SMEEC) and DoT will take on the role as a Controlling Agency.

Santos WA will notify the DoT Maritime Environmental Emergency Response (MEER) unit as soon as reasonably practicable (within 2 hours of spill occurring). 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 is required to work in coordination 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: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp). The coordinated response may occur within a single jurisdiction (spill within State waters) or cross-jurisdiction (spill crossing from Commonwealth to State waters).

2.4.3.1 Single Jurisdiction Arrangements

For Level 2/3 spills originating within State waters, DoT will assume control as the Controlling Agency with the exception of source control activities (for example well intervention and relief well drilling) which will remain under the control of Santos WA's IMT.

The initial first strike response will be undertaken by Santos WA; formal protocols for the transfer of Controlling Agency responsibility from Santos WA to DoT are outlined within Section 6.4.2 of DoT's MOP: Response and Consultation Arrangements.

At the request of the SMEEC, Santos WA will be required to provide all necessary resources, including personnel and equipment, to assist the DoT's IMT in performing duties as the Controlling Agency for State waters response. This includes providing an initial 9x personnel to work within the DoT IMT located at Marine House, Fremantle, no later than 8 am following the day of the request. It also includes providing 1x personnel to serve in DoT's Forward Operating Base no later than 24 hours following formal request by the SMEEC.

Two DoT personnel will be provided from DoT's command structure into Santos WA's CST/IMT as CST/Media Liaison Officers.

The roles and responsibilities of Santos WA personnel working within DoT's command structure and DoT personnel working within Santos WA's command structure are provided in **Section 2.2**.

In addition to these incident management roles, Santos WA, at the request of the SMEEC, will be required to provide an appropriate number of operational field personnel to assist with field response activities, such as shoreline protection and clean-up and oiled wildlife response, with the required number determined based on the nature and scale of the spill and response requirements. DoT may also stand-up field response capability through the State Response Team and request National Response Team support.

Any matters of contention between Santos WA and DoT, with respect to the partitioning of resources and responsibilities between IMTs will be referred to the SMEEC for resolution.

2.4.3.2 Cross Jurisdictional Arrangements

For Level 2/3 spills that crosses from Commonwealth waters to State waters, both DoT and Santos WA will be Controlling Agencies. 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.

DoT's MOP: 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 jurisdiction 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 WA and will ensure alignment of objectives and provide a mechanism for de-conflicting priorities and resourcing requests.

As with a single jurisdiction response Santos WA will be responsible for ensuring adequate resources are provided to DoT as Controlling Agency, including 10x personnel to fill roles in the DoT IMT or FOB (refer **Section 2.3.1**) and operational personnel to assist with those response strategies where DoT is the Lead IMT.

Figure 2-2 shows Santos WA's organisational structure for a Petroleum Activity spill within (single jurisdiction) or entering (cross-jurisdiction) State waters. In both instances, the Santos WA IMT and DoT IMT will provide a coordinated response. While Santos WA will stand up its IMT structure in both single and cross jurisdiction incidents, the scale of operations will likely be lesser for a single jurisdiction response (State waters only) where Santos WA will primarily be controlling Source Control activities.

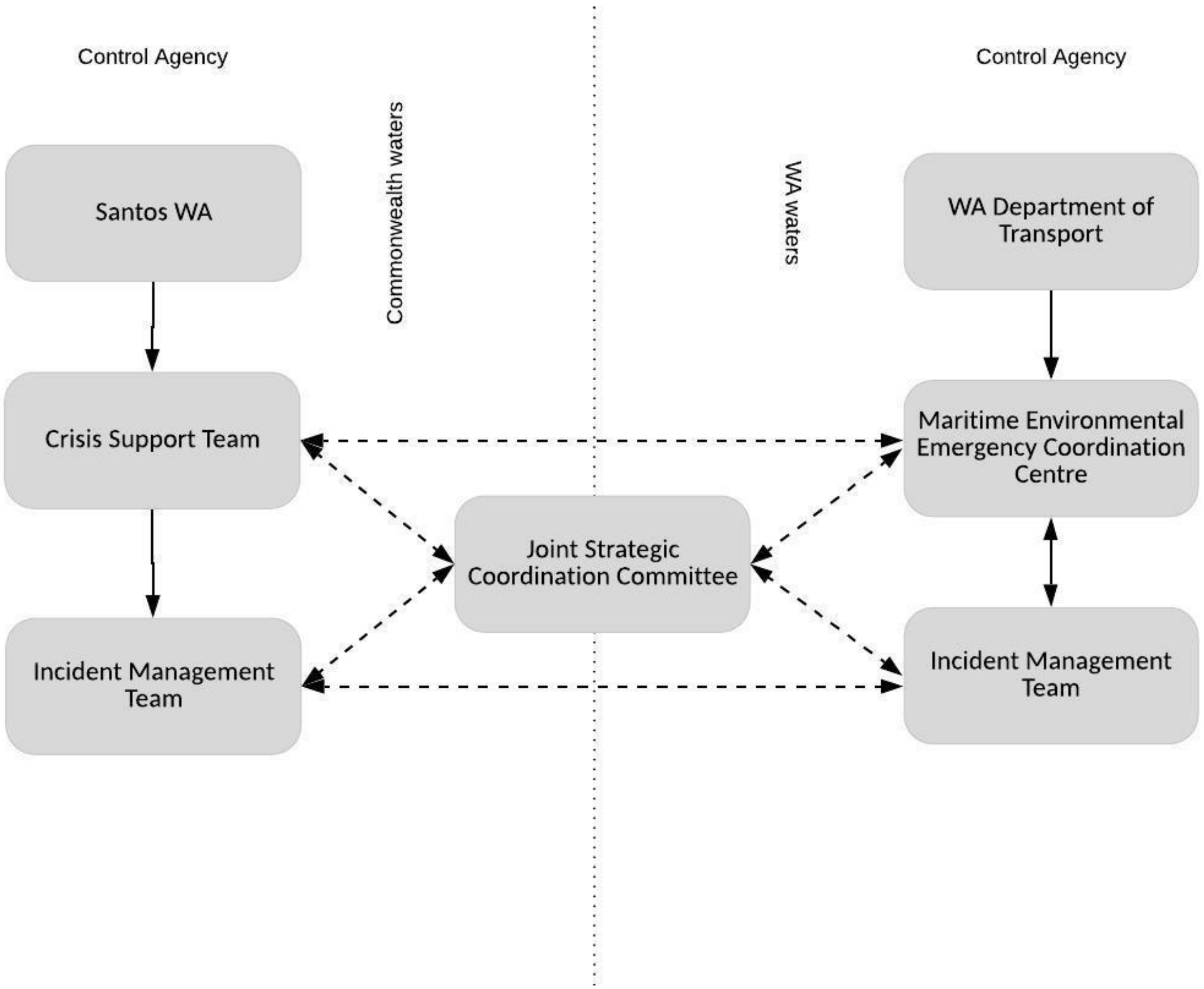

Figure 2-2 Santos WA incident management structure for Level 2/3 marine oil pollution incident within or entering State waters

2.4.4 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 Wildlife Conservation Act 1950 (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 Controlling 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 Controlling Agency responsible for overall control of an oiled wildlife response. Santos WA will provide appropriate resources (equipment and personnel) to DoT facilitated through an industry (AMOSC) Oiled Wildlife Advisor (OWA).

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.

2.4.5 WA Department of Fire and Emergency Services (DFES)

In the event of a release of hydrocarbon (gas/condensate) from the Devil Creek pipeline onshore section, DFES will be engaged as per the Devil Creek Incident Response Plan (DC-40-IF-00096) and may assume responsibilities, including the nomination of an Incident Controller, as a Controlling Agency (Combat Agency) under Emergency Management Regulations 2006 and as outlined within the HAZMAT. DFES will then notify or activate the State HAZMAT Emergency Advisory Team (HEAT) to provide advice to the Incident Controller on appropriate response strategies for the hazardous material.

DFES will advise once control of the emergency situation and hazardous material has been established and when the site is safe for recovery by non-emergency services. At this point in time Santos WA will take control of the site recovery under the supervision of DER.

2.4.6 Department of Water and Environmental Regulation (DWER)

For an onshore spill, the direct on-site recovery and clean-up of the hydrocarbon pollution is the responsibility of the owner of the hazardous material (Santos WA). DWER have responsibilities under the Environmental Protection Act 1986 to ensure that the pollution is cleaned up by the owner. DWER administers the Contaminated Sites Act 2003 and may declare and supervise the clean-up of, a Contaminated Site, as a result of oil pollution.

2.4.7 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).

2.5 Interface with 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.

+ NatPlan - National Plan for Maritime Environmental Emergencies & 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.

+ WA State Hazard Plan: Maritime Environmental Emergencies

Details the management arrangements for preparation and response to maritime environmental emergencies 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

+ 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 Devil Creek operations.

+ HAZMAT - Western Australia State Hazard Plan for Hazardous Materials Emergencies

Details the emergency management arrangements for hazardous materials emergencies throughout the State of Western Australia

+ 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.

2.6 Interface with Internal Documents

Emergency preparedness and response, including oil spill response, is a key element within Santos WA's Health, Safety and Environment Management System (HSEMS) (QE-91-IF-00001).

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

+ Incident Command & Management Manual (QE-00-ZF-00025);
+ Reindeer Well Head Platform Operations Environment Plan (EA-14-RI-10002.01);
+ Devil Creek Offshore Gas Supply Pipeline Operations Environment Plan (EA-14-RI-10001.01);
+ Devil Creek Incident Response Plan (DC-40-IF-00096);
+ Incident Response Telephone Directory (QE-00-ZF-00025.020);
+ Environment Incident Notification Guidelines and Matrices (QE-91-HF-10003);
+ Source Control Emergency Response Plan (DR-00-ZF-10001);

+ Santos Drilling & Completions Management Process;
+ Incident Reporting Guideline Environmental Approvals Supporting Information (QE-91-ZF-10003);
+ Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038);
+ 16” Reindeer Pipeline Operational Safety Case and Pipeline Management Plan (RE-14-RF-00036.02);
+ Reindeer Schlumberger Report 1-1BAORA3
+ Reindeer Source Control Plan Rev0 (28th Sept 2017)
+ NWA Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053);
+ Oil Spill Response Safety Management Manual (QE-91-RF-10016);
+ Oil Spill Scientific Monitoring Plan (EA-00-RI-10099);
+ Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162);
+ 5-year Incident and Crisis Management Exercise and Training Plan (QE-92-HG-10001);
+ Values and Sensitivities of the Marine and Coastal Environment (EA-00-RI-10062); and
+ Astron Standby Services Manual (EA-00-RI-10162).

2.7 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.

3 Spill Risk and Protection Priorities

3.1 Spill Scenarios

Environmental impacts and risk assessments for the operational activities of the Devil Creek pipelines (offshore and onshore) and the Reindeer WHP have been undertaken in the Devil Creek Gas Supply and Sales Export Pipeline Operations Environment Plan (Devil Creek EP; EA-14-RI-10001.01) and the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; EA-14-RI-10002.01), respectively.

The worst case credible scenarios for the activity are presented for commonwealth, state and state onshore releases (**Table 3-1**, **Table 3-2** and **Table 3-3)**, all other scenarios are of a lesser scale and extent. By demonstrating capability to manage the response to the worst-case scenarios, Santos WA assumes other scenarios that are smaller in nature and scale can also be managed by the same capability. Response performance measures have been defined based on a response to these worst-case scenarios.

These initial assessments and subsequent revisions has identified the following credible offshore (WHP, offshore gas supply pipeline) and onshore (onshore gas supply and sales gas pipeline[3]) spill scenarios (**Table 3-1**, **Table 3-2** and **Table 3-3** respectively). The scenarios have been segregated based on Commonwealth and State jurisdictions.

Table 3-1 Identified Devil Creek WHP and Pipelines hydrocarbon spill scenarios for Commonwealth Waters

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)
Surface – complete loss of well control (100% full bore flow rate release).	Reindeer condensate	14,935 m^3 over an 11-week period (77 days)

Table 3-2 Identified Devil Creek WHP and Pipelines hydrocarbon spill scenarios for State Waters

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m3)
Surface spill – Release from support/ supply vessel fuel tank (due to vessel collision or lifting operations)	Diesel (Group II)	329 m^3 over a 0-24 hours period

[3] Sales gas supply pipeline oil spill is not credible due to its dry gas content

Table 3-3 Identified Devil Creek WHP and Pipelines hydrocarbon spill scenarios for State (onshore pipeline)

Worst case credible spill scenario	Hydrocarbon type	Maximum credible volume released (m^3)
Land-based spill – release from supply gas onshore pipeline due to a major rupture [4]	Reindeer condensate	275 m^3 over a 14.6 hour period

3.2 Hydrocarbon Characteristics and Behaviour

During the Reindeer and Devil Creek operations activities, the following hydrocarbons may be unintentionally released to the marine environment: Reindeer condensate, hydraulic/ lube oils and marine diesel. **Table 3-4** provides a summary of these oil characteristics, while the following subsections provide additional details on the weathering behaviour

[4] A rupture of the onshore buried pipeline is of low credibility due to its buried position. A slow leak is a more likely release mechanism. A maximum credible slow leak volume was calculated as 205 m^3. Given this is on a similar scale to a rupture volume, the rupture volume has been used for conservatism and consistency with the offshore pipeline section.

Table 3-4 Characteristics of Hydrocarbons

Hydrocarbon	Hydrocarbon Classification (AMSA, 2015)	Initial density (kg/m^3)	Viscosity (cP)	Component	Volatiles	Semi-volatiles	Low volatility	Residual	Aromatics
				Boiling Point(oC)	<180 C4-C10	180–265 C11-C15	265–380 C16-C20	>380 >C20	Of whole oil <380
					Non-Persistent			Persistent	
Reindeer Condensate	Group I	792	0.803 @ 20°C	% of total	65.4	17.4	14.8	2.4	34.9
Diesel	Group II	836.8	766 @ 25°C		6	34.6	54.4	<5	3.0
Hydraulic Oil	Group II	871	46 @ 25°C		12	20.5	34	33.5	5.5
Lube Oil	Group II	875	157 @ 25°C		0	4.0	4.0	92.0	1.5

Source: APASA (2013, 2014, 2019)

3.2.1 Reindeer Condensate

Reindeer condensate assay results show the condensate to be highly volatile with low viscosity. The weathering curve for Reindeer condensate indicates that a large proportion of the condensate will evaporate rapidly. Evaporation rates will increase with temperature, but in general about 65.4% if the oil mass should evaporate within the first 12 hours (BP < 180 °C); a further 17.4% should evaporate within the first 24 hours (180 °C < BP < 265 °C); and a further 14.8% should evaporate over several days (265 °C < BP < 380 °C).

The whole condensate has a low asphaltene content (<0.5%), indicating a low tendency for the hydrocarbons to take up water to form water-in-oil emulsions over the weathering cycle.

However, because the oil would be injected into the water column under the spill scenarios, there will be variable periods of time required for the droplets to surface before atmospheric weathering can commence. This factor will extend the effective weathering time for the oil and will result in variable compartmentalisation of the oil between the water surface and the water column over time.

Laboratory assays of Reindeer condensate are undertaken regularly. And can be accessed at:

+ http://auperweb019.energylimited.com/drawings/default.asp?grp=Assays

Safety Data Sheet information for Reindeer Condensate is provided in Santos WA's online ChemAlert system.

For more details relating to the environmental impacts and risks from Reindeer condensate (including weathering information), see the Reindeer Operations EP (EA-14-RI-10002.01).

3.2.2 Marine Diesel

In the marine environment diesel will behave as follows:

+ Diesel will spread rapidly in the direction of the prevailing wind and waves;
+ 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;
+ The evaporation rate of diesel will increase in warmer air and sea temperatures; 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 (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 (Table 3-4).

For more details relating to the environmental impacts and risks from marine diesel, see the Reindeer Operations EP (EA-14-RI-10002.01).

3.3 Spill Trajectory Modelling (State and Commonwealth waters)

Spill trajectory modelling has been conducted to inform the impact assessment and spill response requirements for Devil Creek operations. The onshore pipeline spill scenario including information pertaining to the zone of potential impact are discussed separately in Section 3.4. Santos WA have undertaken spill trajectory modelling for the Level 2 and 3 maximum credible spill scenarios identified. The modelling discussed here only covers the offshore State and Commonwealth waters spill scenarios detailed in Reindeer WHP OSM Blowout Modelling, (Santos WA 2019). The location of the modelled scenarios for the credible worst-case release volumes are presented previously in Figure 3-1.

+ Surface release: A long-term (up to 77 day) uncontrolled surface blowout of 93,940 bbl (14,935 m^3) Reindeer Condensate from the Reindeer WHP (20° 01' 26.74" S, 116° 18' 35.02" E), representing a high pressure, rich gas scenario.

+ Release from support/ supply vessel fuel tank (due to vessel collision) of 329 m^3 onto the water surface at the horizontal directional drilling (HDD) break through location (shoreline crossing).

The location of shoreline receptors used to evaluate results are provided in **Figure 3-1**.

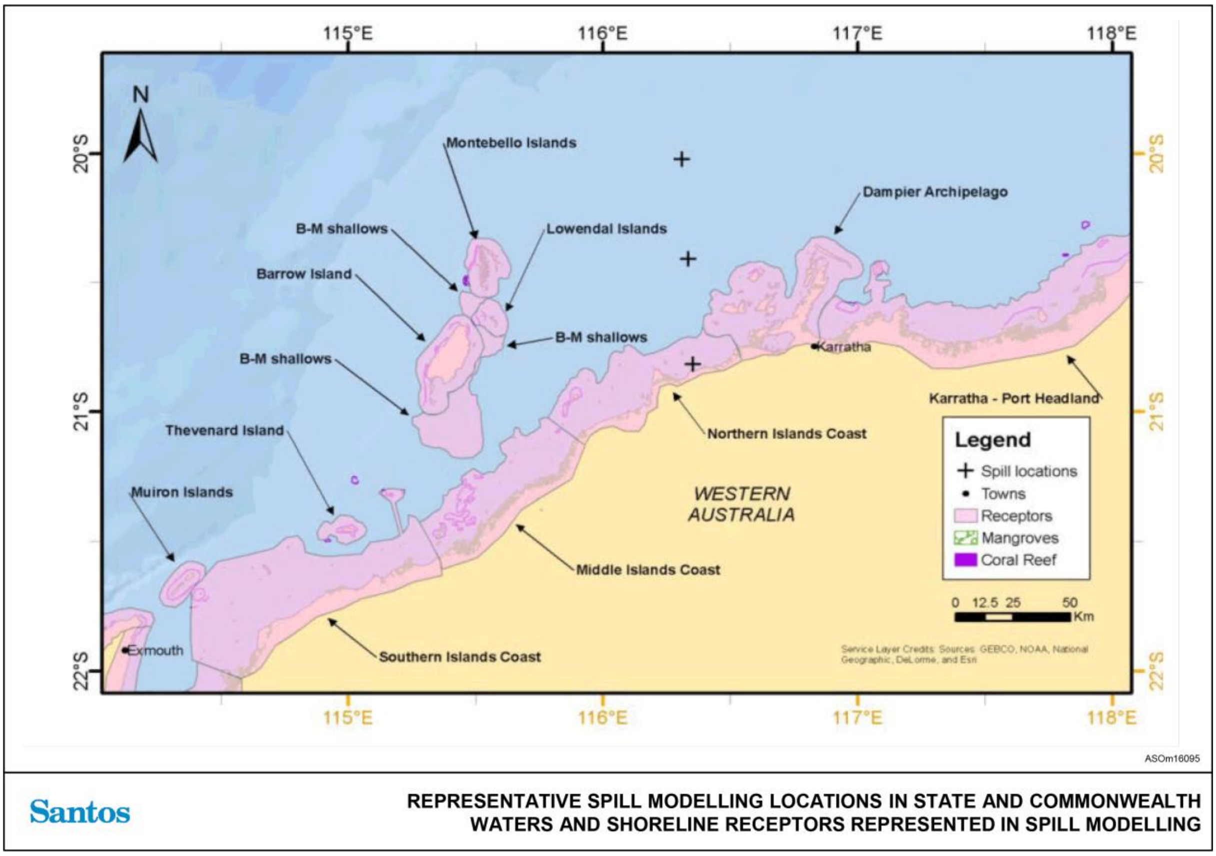

Figure 3-1 Representative spill modelling locations in State and Commonwealth waters and shoreline receptors represented in spill modelling

3.3.1 Stochastic Modelling

All scenarios were modelled using a stochastic approach running multiple simulations (50 simulations per season, 50 simulations for the year for each release scenario).

Environmental impact assessment thresholds are addressed in **Section 7.5.4** of the EPs. 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 3-5**.

Table 3-5: Surface Hydrocarbon Thresholds for Response Planning

Hydrocarbon (g/m^2)	Description
>1	+ Estimated minimum threshold for commencing some scientific monitoring components (refer to **Appendix L: Scientific Monitoring Plans)**
50	+ Estimated minimum floating hydrocarbon threshold for containment and recovery
100[1]	+ Estimated floating hydrocarbon threshold for effective containment and recovery + Estimated minimum shoreline accumulation threshold for effective 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 $50g/m^2$.

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, and therefore these are the results presented in this OPEP.

Results for the various scenarios have only been included if there was:

+ A greater than 5 % probability of 100 g/m^2 of hydrocarbons accumulated on the shoreline, as this is both the threshold for response and impact.[1]

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 the Accidental Release of Hydrocarbons in **Section 7.5** of the Commonwealth EP (EA-14-RI-10002.01) and Section 7.6 State EP (EA-14-RI-10001.01) for further description on selection of impact exposure values.

3.3.2 Deterministic modelling

Following the stochastic modelling, deterministic modelling was conducted to interrogate the stochastic modelling results determining the worst-case outcomes for the region and identifying the deterministic replicate simulations associated with such outcomes. The deterministic criteria are:

+ Replicate simulation with the maximum oil volume accumulation on shorelines
+ Replicate simulation with the maximum length of shoreline oiled,
+ Replicate simulation with the shortest time before floating oil at or above 10 g/m^2 contacted an onshore feature, and

[1] Santos uses a minimum threshold of $100g/m^2$ (which equates to an oil thickness of 0.1mm) to determine the lower limit for effective shoreline clean-up operations.

+ Replicate simulation with the shortest time before floating oil at or above 10 g/ m^2 contact an offshore feature.

3.3.3 Modelling results

Sections below present the spill modelling results of the worst-case scenarios only. The geographical extent or 'scale' of the area potentially affected by the spill scenarios is described using the maximum extent of the spill impact thresholds known as the Environment that May Be Affected (EMBA). Receptor locations used for assessment in the modelling and the EMBA are in provided in Sections 3.1 and 7.5 Reindeer EP (EA-14-RI-10002)/ 7.6 Devil Creek EP (EA-14-RI-10001.01).

The diesel spill modelling of a worst case 329 m^3 at the HDD entrance point has been used to inform spill response planning for shoreline impact (accumulation and time to contact), while the long-term (up to 77 day) uncontrolled surface blowout of 14, 935 m^3 is used for worst case for shoreline extent. Modelling of a 329 m^3 has been conducted in Commonwealth and State waters and the HDD entrance point, respectively, as well as at the boundary of Commonwealth and State waters. These are considered representative of a spill anywhere along the pipeline and also cover specific modelling requirements for Commonwealth and State Waters Environment Plans.

The modelling information required to inform a hydrocarbon spill response for the worst case credible scenarios is presented below, with further detail of modelling results found in **Table 3-6**.

These results focus on Protection Priority areas that have been identified as those areas having a high environmental value and greatest exposure to floating oil that could be responded to using spill response measures.

3.3.3.1 A long-term (up to 77 day) uncontrolled surface blowout of 93,940 bbl. (14,935 m3) Reindeer Condensate

+ No floating hydrocarbon contact to sensitive receptors >10 g/m^2 floating hydrocarbon concentration.

+ Shoreline accumulation > 100 g/m^2 at multiple locations. Montebello Islands with the largest accumulation of 8 m^3.

+ Surface hydrocarbons do not exceed 10 g/m^{2}anywhere in the modelled domain.

3.3.3.2 Release from support/ supply vessel fuel tank (due to vessel collision) of 329 m^3 onto the water surface at the horizontal directional drilling (HDD) break through location (shoreline crossing).

+ Due to the hypothetical spill site being located within the boundaries of the Northern Islands Coast receptor, a probability of 100% is forecasted for floating oil to occur in nearshore waters of this receptor at concentrations ≥ 10 g/m^2 within an hour.

+ Shoreline accumulation >100 g/m^2 at various locations. The worst-case estimates for the total volume of oil that could accumulate along a section of shoreline is forecasted for Northern Islands Coast and Dampier Archipelago. shoreline volumes up to ~173 m^3 are indicated for Northern Islands Coast and up to 73 m^3 are indicated for Dampier Archipelago.

+ Surface oil exceeding 10 g/m^2 was predicted to extend up to a maximum distance of ~18 km from the release location.

The spatial extent of floating diesel and condensate >10 g/ m^2 and the shoreline loading >100 g/m^2 are found in **Table 3-6.**

Table 3-6 Modelling results informing hydrocarbon response.

Release scenario/location	Maximum Credible Scenario Released	EMBA for floating hydrocarbons >10 g/m^2	Receptors contacted	Minimum time to shoreline contact at > 10 g/m^2	Probability (%) of shoreline accumulation at concentrations > 100 g/m^2	Time to Accumulation concentration > 100g /m^2 (hours)	Maximum accumulated volume along shoreline for modelled spill across all seasons, above 100 g/m^2(m3)
Uncontrolled surface blowout of Reindeer Condensate	14,935 m^3 over 77 days	Surface hydrocarbons do not exceed 10g/m^2 concentration.	Montebello Islands	NC	10%	1, 237 hours	8 m^3(T)
			Lowendal Islands	NC	8%	411 hours	5 m^3 (S)
Vessel collision, tank rupture release diesel (at HDD shoreline crossing, State waters)	329 m^3 over 24 hours	Surface oil exceeding 10 g/m2 was predicted to extend up to a maximum distance of ~18 km from the release location.	Dampier Archipelago	16 hour (S)	25%	23 hours	73 m^3 (T)
			Northern Islands Coast	1 hour (all)	62%	4 hours	173 m^3 (S)

*** S – summer; W – winter; T – transition.**

3.4 Onshore Spill Zone of Potential Impact

As described in **Table 3-3** (c) the onshore spill scenario's maximum credible spill relates to the release of 275 m^3 of condensate due to a rupture of the export pipeline (16 " Reindeer Pipeline) (11.1km, from Gnoorea Point to gas plant boundary). The pipeline is buried 1.2m below surface along 40 Mile Beach Road reserve adjacent to Mardie and Karratha Stations pastoral leases.

Santos WA will activate emergency shutdown (ESD) as first strike response to 'control' the spill. Maximum spill volume of 275 m^3 is the maximum volume remaining in the entire pipeline between isolation points (from WHP to the gas plant). It is unlikely for an onshore rupture to release the entire pipeline volume due to its length and gradient (sloping downward towards the sea from the plant). This volume is therefore considered very conservative for planning purposes.

3.4.1 Predicted Spill Fate and Transport

The onshore section of the Devil Creek Supply Pipeline is below ground; therefore it is unlikely that there will be any surface expression of condensate given the relatively low rate of condensate flowing the bottom section of the gas supply pipeline and the porosity of the sediments. However the exception to this could be if the spill occurs at the saline flat section (**Figure 3-2**). This section has a shallow water table and is subject to inundation after a rainfall/storm event (not tidal influence). Due to the condition, this section of the onshore pipeline section has concrete coating to control the buoyancy forces acting on the pipeline to ensure its integrity at all times. The pipeline section cutting across the saline flats which may flood during rainfall may also be the point where oil can pool if the rupture occurs up gradient of this point i.e. from south east towards North West direction of the pipeline route.

Depending on where the rupture occurs, the rate the oil percolates down through the subsurface layers before reaching the groundwater table may vary significantly due to the varying water tables and soil profiles. The groundwater table in the vicinity of the pipeline section closer to the gas plant location will likely to be contacted much later due to the deep water table levels (10.9m -15.1 m AHD) in the area (**Figure 3-2**). This will contrast significantly when compared to the sections of the pipeline towards the shoreline, particularly at the saline flats area, where the depths are shallower therefore resulting a faster contact time.

Notwithstanding surface expression of the spill at a specific location described above, sub-surface risk to soil and the groundwater system is the most likely exposure pathway. The exposure pathways based on a site conceptual model are described in detail in **Section 3.5**.

The inferred groundwater flows indicate a likely hydraulic gradient flowing from south-east to north-west (i.e. towards the ocean), due to the elevated topography inland and the general flow of surface run-off to the west (**Figure 3-2**).

3.4.2 Predicted effect to the groundwater system

Based on extensively studied spill sites like the pipeline crude oil spill near Bemidji in the US, fundamental knowledge derived pertaining to the fate and transport of hydrocarbon in the subsurface has been applied to the understanding of the soil and groundwater contamination risk of the Devil Creek onshore pipeline spill scenario. In the case of the Bemidji spill even after 16 years, the leading edge of the plume[5] of ground water containing BTEX had moved only about 200 m down hydraulic gradient, whereas advective flow of ground water since the spill has been about 500 m. The primary reason is that hydrocarbons get biodegraded under natural attenuation process and evidence suggest that the spill reaches equilibrium and stabilises. This condition is likely to be analogous to the Devil Creek

[5] Note that this different to the leading edge of the oil floating (free phase oil or LNAPL) on the water table which had moved 40 m down the hydraulic gradient since the spill. The former refers to the contamination plume that contains concentrations of dissolved constituents such as BTEX. Although the plume migration characteristics are influenced by the actual ground-water flow velocities and sorption constants for these compounds, the behaviour of the plume are expected to be similar.

onshore pipeline spill scenario thus affecting limited areas of the aquifer around the spill site as shown in **Figure 3-2**. The groundwater dissolved contaminant plume extent is estimated to have a potential to move 200 m from leak/rupture point to either side of the pipeline within a year and this is under conservative conditions. This Zone of Potential Impact was derived based on the modelled estimates provided in a detailed general pipeline spill assessment[6]. The basis for estimating the 200 m extent was based on the assumption that the soil type is representative of the loamy to sandy soil profiles used in the US study. Soil profiles within the onshore pipeline sections vary considerably as described in **Section 3.5.**

[6] Pipeline Spill Model Report prepared for Summit County to define appropriate setback distances for varying land conditions and spill scenarios. Full reference included in the References Section 20.

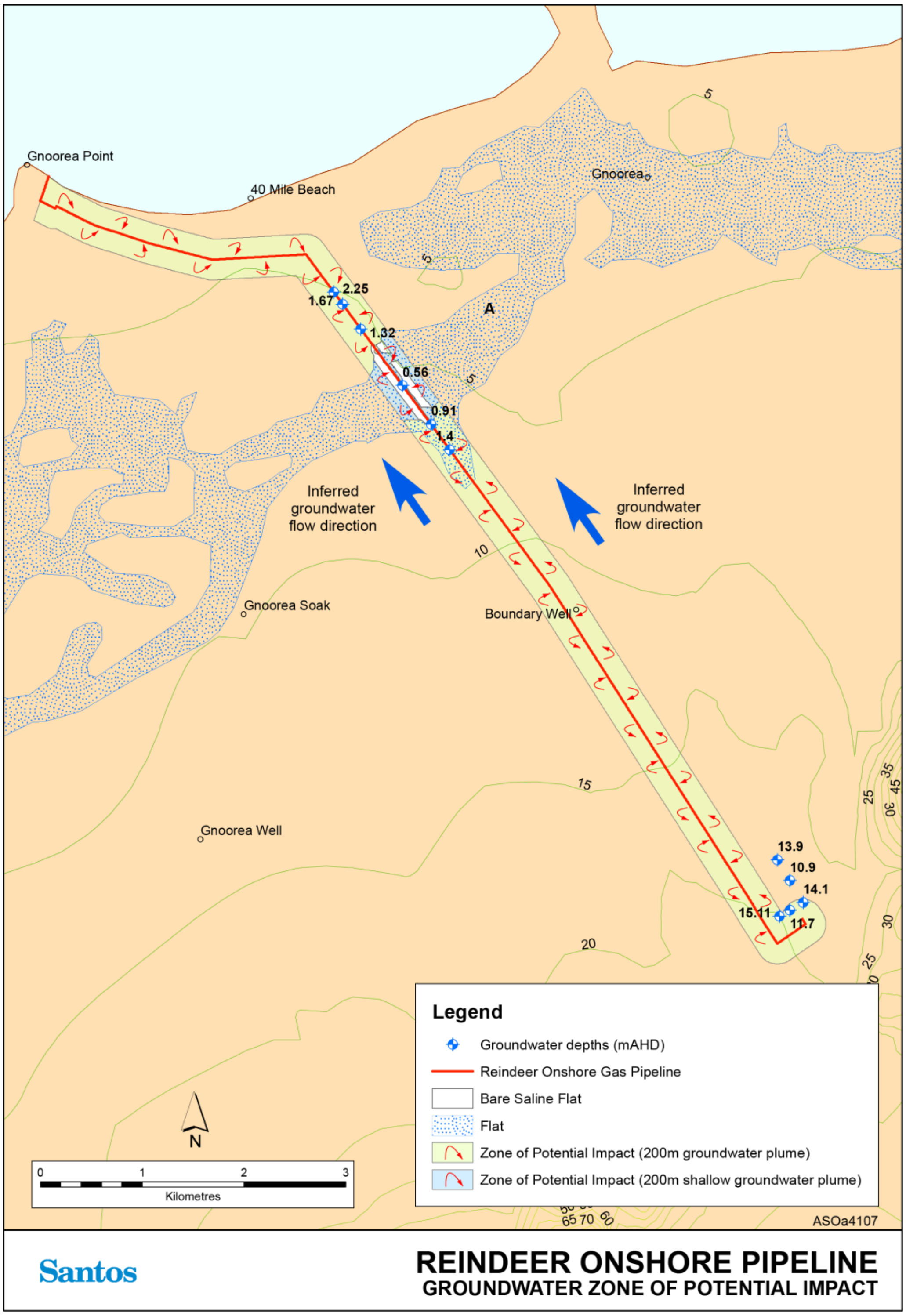

Figure 3-2 Reindeer Onshore Pipeline Groundwater zone of potential impact

3.5 Identify Priority Protection Areas

3.5.1 Offshore Spill

Spill modelling undertaken indicates that the following shoreline where shoreline accumulations from a worst replicate spill exceeded the threshold of 100 g/m^2 (**EA-14-RI-10002.01)**

Table 3-7). These are considered Protection Priority Areas for spill response:

+ Montebello Islands
+ Northern Island Coast
+ Lowendal Islands
+ Dampier Archipelago

Potential shoreline contact includes coastlines that contain sensitive receptors as detailed in **EA-14-RI-10002.01)**

Table 3-7, in addition the windows for sensitivity and relevant key periods are found in Section 3.2 of the EPs (Devil Creek EP EA-14-RI-10001.01 and Reindeer EP EA-14-RI-10002.01)

Table 3-7 Priorities for Protection during a Level 2/3 Spill Response

Protection Priority Area	Key sensitivities
Montebello Islands	Turtle nesting – loggerhead green (significant rookery); also hawksbill and flatback turtles Mangroves – particularly Stephenson Channel Coral and other subsea benthic primary producers Seabird nesting Migratory and threatened seabirds and shorebirds Humpback/ Pygmy blue whale migration Fishing/ charter boat tourism
Northern Island Coast	Coral and other subsea benthic primary producers Grey Nurse Shark nursery area Onslow Prawn Managed Fishery Beech-de-mer fishery Tourism beaches (Dolphin Island Beach) Minor indigenous heritage sites. Recreational fishing/ charter boat tourism
Lowendal Islands	Turtle nesting – Beacon, Parakeelya, Kaia and Pipeline), Loggerhead and green turtle nesting (minor) Varanus pipeline, Harriet and Andersons) Seagrass beds (around the islands) Coral and other subsea benthic primary producers Mangroves Migratory shorebird Recreational fishing/ charter boat tourism
Dampier Archipelago	Turtle nesting – Hawksbill - NW of Rosemary Island and Delambre; Flatbacks - Legendre, Huay, Delambre) Mangroves – West Intercourse & Enderby Coral and other subsea benthic primary producers Seabird nesting* -breeding on Goodwyn, Keast Islands, Nelson Rocks Migratory shorebirds Humpback whale migration Recreational fishing/ charter boats, tourism related to water based activities and nature

	National Heritage, Aboriginal sites, camping beaches Shipping fairway

3.5.2 Onshore Spill

The existing sensitivities surrounding the onshore pipeline section is shown in Figure 3-3. The coverage of the area shown in the map is broad and not limited only to the area most probably affected if an onshore pipeline spill occurs. The relevant environmental settings, values and sensitivities potentially exposed to an onshore pipeline spill are detailed in the **Table 3-8.**

Table 3-8 Onshore environmental features and sensitivities

Feature/Element	Description of the feature/element
Site Features	
Landforms/Topography	The topography of the areas generally shows a gradual fall in elevation from the 20 m AHD elevation from the gas plant location (south east) towards the Indian Ocean (about 11 km to northwest of the plant).
Surface water	The nearest surface water is Devil Creek an ephemeral creek located about 200 m to the east of the pipeline alignment. This creek drains to the north and topography of the pipeline section close to the gas plant site does not appear to allow natural drainage of surface water to the creek as majority of the site slopes towards the north.
Soil Profile	The typical subsurface profile in the area closer to the gas plant is mainly made up of clayey silt to sandy clayey silt on the top layer and (0 m-1.8 m). Layers beneath are made up of conglomerates (1.8 m to 4.1m and calcarenite limestone (1.8m to >8m). The profile varies for sections along the pipeline route along 40 Mile Beach Road. Based on geotechnical data two distinct conditions were reported. For the sections closer towards the shoreline, the subsurface profile comprised silty sand overlying calcarenite rock containing some calcrete layers. The remaining section of the route towards the plant site comprise of varying profile generally including silty sand, clayey sand clayey silt, silty clay gravelly clay and many other composition combinations. In several locations the test pit met refusal on rock above the target depth. Perched groundwater tables on silty and clayey soils may occurs following periods of rainfall. The above profiles were based on the pre –construction surveys. It should be noted for the installation to layer above the top of the pipe have been replaced with compacted sand fill material with most of the excavated spoil has been re-used as backfill. Pipe laying involved removing topsoil and replacing with gravel
Groundwater hydraulic gradient and quality	Groundwater quality is expected to be mostly freshwater/brackish making potential beneficial use limited to mainly irrigation, industrial processes but drinking water will require desalination. Sub-surface groundwater flows are considered to most likely have a hydraulic gradient flowing from east to west (i.e. towards

	the ocean), due to the elevated topography inland and the general flow of surface run-off to the west
Sensitivities/Value Potentially Affected	
Flora	The vegetation in the area has been disturbed by activities which occurred prior to the pipeline operations. Weed proliferation (particularly Buffalo grass) is common and no species of ecological significance is present in the area. The condition of the vegetation is influenced by the seasons and although controlled weed proliferation is still occurs reducing native species cover and diversity. This is also attributed to the external factors such as public vehicle, road maintenance livestock activities causing continuous disturbance. Most significant sensitivity include a single species (Avicennia marina) sparse mangrove stand on the west side of Gnoorea Pt, adjacent to the pipeline shore crossing.
Fauna	Fauna of ecological significance in the area are mainly associated within the shoreline location were the mangroves occur (most abundant on the western face of Gnoorea Point) or sandy beach areas adjacent to the pipeline. These include the 54 vertebrate fauna specific of conservation significance expected to be found in the area. Majority are birds likely to be found in the intertidal zone or mangroves areas. However protected fauna including mammals (including the Northern Quoll; Greater Bilby) and reptiles (including turtles). Stygofauna which belong to the freshwater aquatic ‘subterraneous’ ecosystem (not high conservation significance in the context of its occurrence in the area) have been found in the groundwater system.
Socio-Economic Receptors	The area along the beach adjacent to the pipeline close to the shoreline at Gnoorea point is a camping site with a boat ramp. The 40 mile beach road adjacent and parallel to the on shore pipeline route is the main access to the 40 mile beach. 40 Mile Beach Road pipeline reserve is adjacent to Mardie and Karratha Stations pastoral leases. Livestock may be exposed in the event of a spill. A significant sensitivity include a groundwater bore/well (Boundary Well) located less than 200m from the pipeline. Based on the data search available from the Department of Water’s Groundwater Bore Database (WIN), it is possible that the bore water can be used for livestock purpose, however, unable to verify if the data is current. In addition to Santos WA operated wells there are few other wells (outside Santos WA facility) in the surrounding area, however, not expected to be within the potential zone of impact.

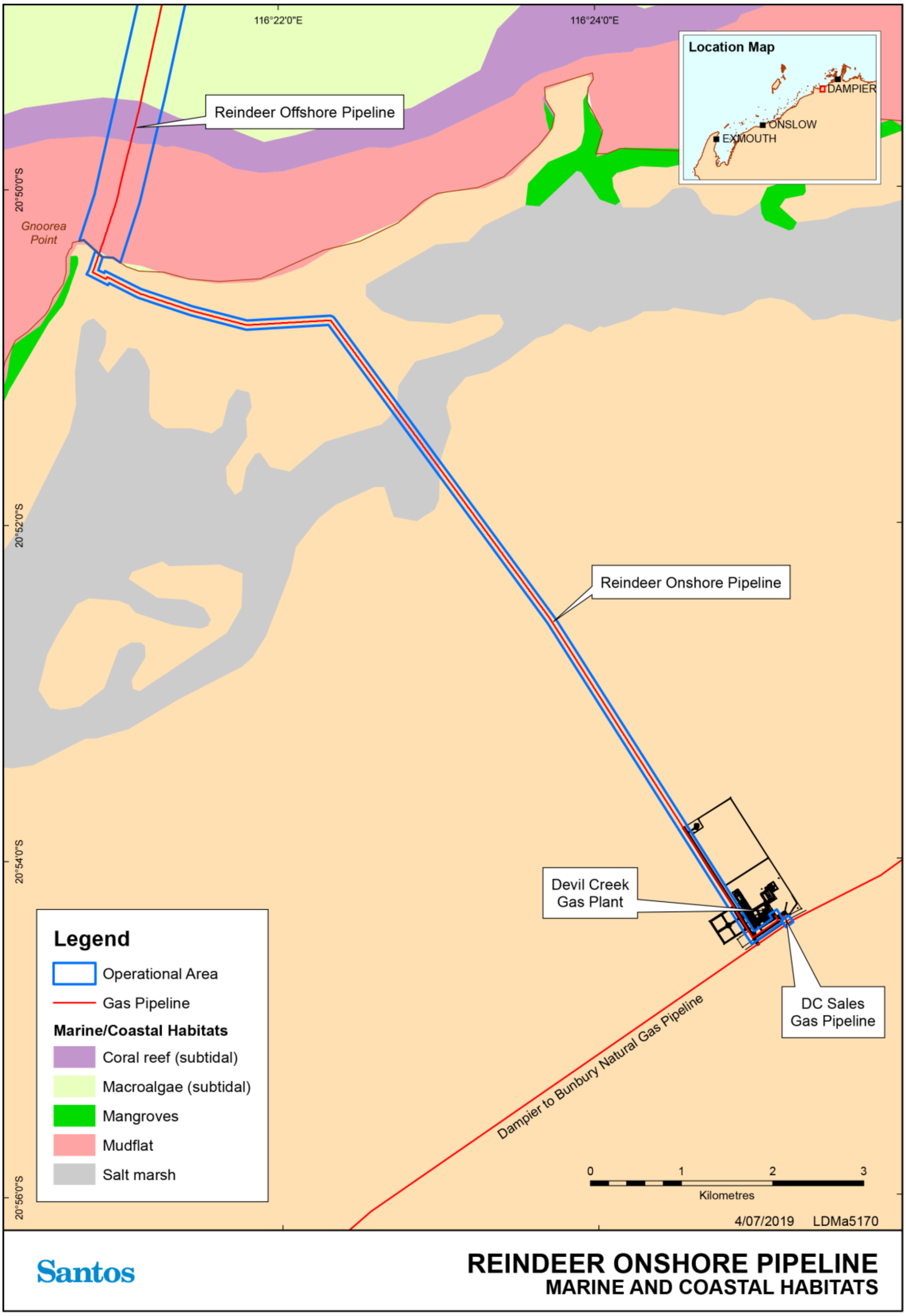

Figure 3-3 Onshore Pipeline Environmental Habitat

3.5.2.1 Conceptual model

A preliminary understanding of the exposure risk due to the pipeline spill is described here based on the conceptual site model (**Figure 3-4)** developed by Coffey Environments (2009) for a potential spill nearby the gas plant. This model supported a preliminary site investigation conducted during pre-construction phase of the Devil Creek Gas Plant facility. The key sensitivities represented being exposed to contamination risk is likely to be the same identified for the pipeline.

In reference to a potential exposure pathway to surface water systems, in accordance to the preliminary site investigation, the migration of groundwater off-site to impact on a freshwater aquatic ecosystem exposure scenario was not considered to be complete given Devil Creek is an ephemeral feature and not considered to be hydraulically connected to the groundwater flow system.

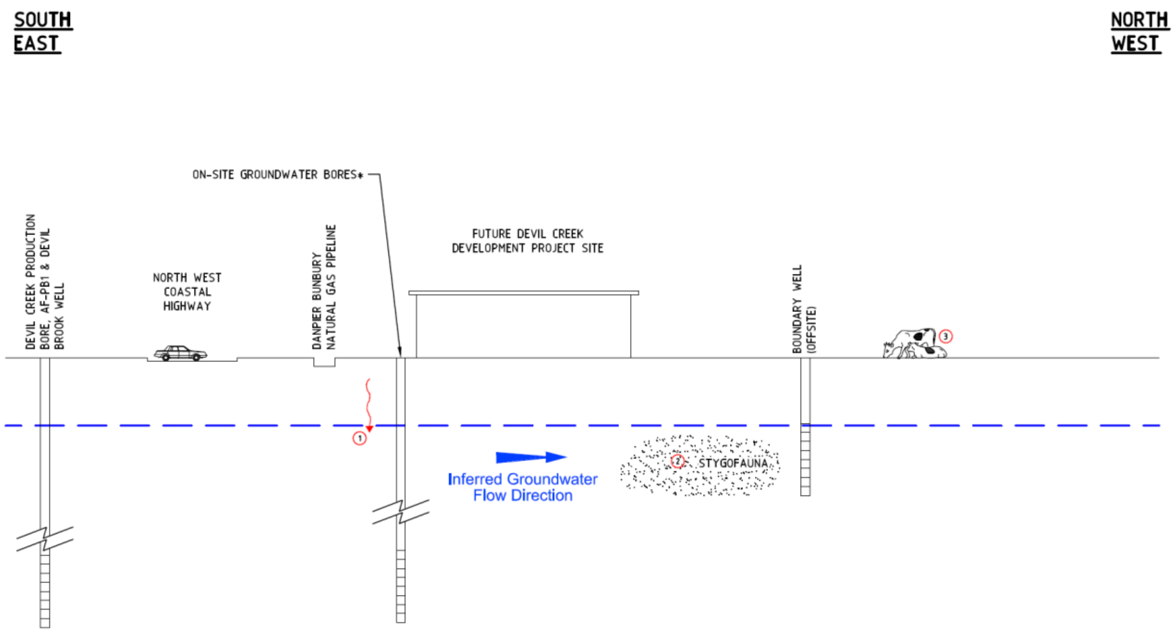

Figure 3-4 Conceptual site model for pipeline spill near the gas plant

4 Response Option Selection

The response strategies outlined in this OPEP have been developed by Santos WA utilising risk assessments to identify credible worst-case 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 spill dispersion extent that is used to identify potential sensitive receptors and response strategies required to reduce the consequences of a spill to ALARP.

The process implemented throughout the response to assess the appropriate response strategies and implement these in a controlled manner to ensure the health and safety of operational personnel and effectiveness in response is the Incident Action Planning (IAP) process.

Incident action planning is the responsibility of the spill Control Agency. It is the responsibility of the Control Agency IMT to evaluate the response strategies provided in this OPEP based on actual and real circumstances. Where Santos WA is not the Control Agency, Santos WA will provide support to the incident action process adopted by the Control Agency through provision of situational awareness information and available resources. Where there is more than one Control Agency (i.e. a cross-jurisdictional response in coordination with DoT), Santos WA will undertake the IAP process as Lead IMT for those spill response activities it is responsible for and provide information and personnel to support DoT's planning function for those activities which DoT assumes control as Lead IMT.

4.1 Evaluation of Applicable Response Strategies

Based on the nature and scale of the credible spill scenarios outlined in **Section 3.1** , the following spill response strategies have been assessed as potentially applicable for combatting a spill (**Table 4-1**).

Note: The information contained in **Table 4-1** has been developed by Santos WA for preparedness purposes. Santos WA may not be the Controlling 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.

Table 4-1 Evaluation of Applicable Response Strategies

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
Source Control	Spill kits	✔ 1	✔ 1	Relevant for containing spills that may arise on board a vessel or WHP.
	Secondary containment	✔ 1	✔ 1	Relevant for spills that may arise due to stored hydrocarbons, and from spills arising from machinery and equipment on board a vessel or WHP. 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 d
	Shipboard Oil Pollution Emergency Plan (SOPEP)	✔ 1	X	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.
	Pipeline isolation (Emergency Shutdown (ESD))	X	✔ 1	Triggered automatically or manually as per Devil Creek Incident Response Plan
	Well Emergency Shutdown (ESD)	X	✔ 1	
	Surface well kill	X	✔ 1	Considered during relief well planning but may not be possible depending upon technical and safety constraints. Surface well kill is only considered when the estimated leak rate is small enough not to generate an explosive gas cloud and access to the platform is still preserved. This methodology would not be

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
				considered should safe access to the platform or ability to operate a vessel alongside the platform not be achievable.
	Capping Stack	X	X	Not applicable for production platform wells (not compatible with Capping Stack).
	Relief well drilling	X	✔ 1	Relevant to for loss of well control. 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	Not applicable to gas wells due to safety hazards. The condensate is predicted to be very volatile with naturally high rates of volatilisation and evaporation. 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	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	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
				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 Requires processing May return false-positives

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
	Operational Water Quality Monitoring			Fluorometry surveys are used to determine the location and distribution of the entrained oil and dissolved aromatic hydrocarbon components of the 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	X	X	Marine spills of a size where chemical dispersion could potentially be applied are a vessel diesel tank rupture and a loss of well control at Reindeer platform. *Marine Diesel* 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 increased impacts. *Condensate* Reindeer condensate is not considered a persistent hydrocarbon, and has a very high natural evaporation and dispersion rates in the marine environment reducing the volume of hydrocarbon remaining at the sea surface. Spill
	Aerial Application	X	X	
	Subsea Application	X	X	

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
				modelling indicates that these natural weathering processes will prevent floating condensate from impacting shorelines at all but extremely low volumes. Given the gas release and relative shallow depth of the Reindeer platform, applying subsea dispersant through an SFRT is not considered feasible due to access and safety constraints. On the basis of the above, chemical dispersant application is not recommended as an applicable strategy the credible spill scenarios covered under this OPEP.
Offshore Containment and Recovery	Use of offshore booms/ skimmers or other collection techniques deployed from vessel/s to contain and collect oil.	X	X	Given the fast spreading nature of diesel and Reindeer condensate causing the slick to break up and disperse, this response is not considered to be effective in reducing the impacts of a diesel spill. The ability to contain and recover spreading diesel and Reindeer condensate on the ocean water surface is extremely limited due the very low viscosity of the fuels.
Mechanical Dispersion	Vessel prop-washing	✔ 2	✔ 2	Marine diesel and Reindeer condensate are very light oils that can be easily dispersed in the water column by running vessels through the plume and using the turbulence developed by the propellers to break up the slick. Once dispersed in the water column the smaller droplet sizes enhance the biodegradation process. Given the condensate is predicted to have a high rate of natural volatility and a spill would originate in offshore waters, dispersing fresh condensate underwater would not be recommended. Dispersing weathered condensate away from the spill site (that has lost lighter products) may be beneficial if there was a potential for this hydrocarbon to impact on receptors at the sea surface or along shorelines. Mechanical dispersion will be considered for non-ship sourced spills at the discretion of the On-Scene Commander/IMT or by the relevant Controlling Agency.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
Protection and Deflection	Booming in nearshore waters and at shorelines	✔ 2	✔ 2	Considered if operational monitoring shows or predicts contact sensitive shorelines. Diesel: Contact from floating hydrocarbon above 10 g/m^2 (Dampier Archipelago and Northern Island Coast). Shoreline hydrocarbons >100 g/m^2 concentration was predicted to contact the Northern Island Coast (173 m^3), and Dampier Archipelago (73 m^3). Reindeer condensate: Stochastic modelling showed no contact from floating hydrocarbon >10 g/m^2. Contact at multiple locations >1 g/m^2. Shoreline hydrocarbons >100 g/m^2 concentration include Montebello Islands (8 m^3), Lowendal islands (5 m^3).
Shoreline clean-up	Activities include physical removal, surf washing, flushing, bioremediation, natural dispersion	✔ 2	✔ 2	Intrusive activities such as physical removal of waste using manual labour or mechanical aids requires careful site-specific planning to reduce secondary impacts of habitat disturbance, erosion and spreading oil beyond shorelines. 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 will biodegrade. This response has potential to cause more harm than benefit 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.
Onshore response	Protection, onshore clean up and monitoring	✔ 1	✔ 1	The onshore pipeline is buried to 1.2 m and containment by soil will slow initial spread of hydrocarbon. Contamination of groundwater is the main issue but in areas of the pipeline corridor with a shallow groundwater table, and which are subject to inundation after rainfall, contamination of surface waters may occur in which case the use of sorbent boom may be applicable.

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
				Site remediation of soil and groundwater will be under direction of DWER and will be detailed in a remediation action plan under Contaminated Site legislation.
Oiled wildlife Response	Activities include hazing, pre-emptive capture, oiled wildlife capture, cleaning and rehabilitation.	✔ 2	✔ 2	Can be used to deter and protect wildlife from contact with oil. Mainly applicable for marine and coastal fauna (e.g. birds) where oil is present at the sea surface or accumulated at coastlines. Potential for onshore releases to impact nesting areas. Surveillance can be carried out as a part of the fauna specific operational monitoring Wildlife may become desensitised to hazing method. Hazing may impact upon animals (e.g. stress, disturb important behaviours such as nesting or foraging) Permitting requirements for hazing and pre-emptive capture.
Scientific Monitoring	The monitoring of environmental receptors to determine the level of impact and recovery form the oil spill and associated response activities.	✔ 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 filter feeders) + Seabirds and shorebirds + Marine megafauna (incl. whale sharks and mammals) + Marine reptiles (incl. turtles)

OSR Strategy	Activities	Applicability and Designated Primary (1) or Secondary (2) Response Strategy		Considerations
		Diesel	Condensate	
				+ Seafood quality + Fish, fisheries and aquaculture The type and extent of scientific monitoring will depend upon the nature and scale of oil contact to sensitive receptor locations as determined through operational monitoring. Pre-defined initiation criteria exist for scientific monitoring plans associated with marine and coastal sensitivities.

4.2 Demonstration of ALARP

A detailed ALARP assessment on the adequacy of resourcing available to support spill response strategies and control measures is presented in **Table 4-2**.

Table 4-2: ALARP Assessment of the Resourcing for Spill Response Strategies

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Source Control-Relief Well Drilling	Contract/MoUs for source control personnel Santos WA Drilling and Completions Source Control Team APPEA MoU for mutual assistance for relief well drilling MODU Capability Register	Santos WA's Drilling and Completions Source Control Team will work in collaboration with external Source Control specialists whom will be mobilised within 3 days of the LOWC. The monthly monitoring of the availability of MODUs, and the APPEA MoU for mutual assistance for relief well drilling, enable access to suitable MODUs and associated personnel. It could take up to 34 days to have a MODU onsite. This is due to the time required for the MODU to suspend current operations, prepare, and move to the relief well location. A Safety Case Revision for the relief well MODU will be submitted within 14 days of the LOWC. The critical path time allowed for the actual writing of the document is 3 days. The remaining estimated time	Santos WA base case timeframe for the drilling of a relief well is 77 days. Access to source control specialists is not considered limiting nor a factor in the base case timeframe. A MODU on standby close to the well location for the duration of any drilling operations reduces the timeframe to mobilise a MODU to site which potentially reduces the overall timeframe to limit the hydrocarbon released.	The total cost of having a MODU on standby is about $600,000 per day. If adopted this cost is paid regardless if there is a loss of containment event or not.	The likelihood of a LOWC is considered rare and the cost and the additional safety and environmental risks of having another MODU and support equipment/personnel on standby is considered grossly disproportionate to the environmental benefit gained. The current source control arrangements are considered adequate to provide the required function.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		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.			
Direct surface intervention	Local personnel supplemented by additional personnel, as required, through arrangements with Wild Well Control, as outlined within the Source Control Emergency Response Plan (SCERP) (DR-00-ZF-10001 Pumping equipment (e.g. cement units/ triplex pumps, high pressure treating iron pipe-work and flexible high pressure hoses) are readily available within the region.	Direct surface intervention (i.e. deployment onto the jack-up rig) using specialised well control personnel is a strategy that could be adopted however limited to very specific incidents where the technical and safety factors are not a constraint. Santos has successfully planned and executed well-kill/ bull-heading/ flushing operations during routine non-leak well suspension activities in numerous platforms using this type of equipment and local personnel.	Additional resources are not considered required or limiting. The limiting factor is the meeting of technical and safety aspects of the LOWC event which could only be assessed at the time of a spill event.	Not considered required.	Given the uncertainty for the response strategy feasibility, in combination with the potential safety hazards surrounding the well, the current preparedness measures for well intervention is considered ALARP

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Monitor and Evaluate- Aerial Surveillance	Helicopter services available through Santos WA's primary contracted supplier based out of Karratha. Activation of aerial surveillance using helicopter pilots will occur within 3 hours of notification of the spill. Trained Aerial Observers (7) will be available from Day 2 of the incident, following activation (based in Perth and Santos WA facilities).	Given location of spill sites, mobilisation of helicopters from Karratha (via VI if required) is considered adequate for surveillance. Endurance is not considered a limiting factor at these locations. Mobilisation and refuelling from Exmouth is possible depending on trajectory of spill. Current arrangements can provide for 2 passes (am and pm) of the spill area per day. This has been exercised as part of major spill exercises. Trained Aerial Observers can mobilise to Karratha or Exmouth for Day 2 operations. Day 1 surveillance and recording using helicopter pilots considered adequate for initial situational awareness.	Resource not considered limiting. Primary supplier on contract with additional providers available to provide desired overpass frequency. Santos WA trained observers can be provided on rotation from Day 2.	No additional costs as helicopters are currently contracted for day-to-day operations to and from Santos WA facilities. In the event that additional passes are required due to data gaps, the cost of the additional flights will be added to the cost of the response.	There is no value in increasing dedicated overpasses; therefore, the arrangements are considered ALARP. However, opportunistic aerial surveillance can be provided through the shared use of aircraft deployed for other purposes.
Monitor and Evaluate-Vessel Surveillance	On-hire vessels supporting Santos WA's VI and Ningaloo Vision facilities. Vessel of opportunity from other operators.	On-contract vessels performing duties at VI and Ningaloo Vision will be available, as well as vessels of opportunity from other petroleum operators. The activity area is central on the North West Shelf and	Based on the close proximity of the activity to VI and the central location of the activity relative to the main marine base of Dampier, dedicated additional vessels for	The current vessel arrangements are considered to provide the required function. Dedicated vessels on standby for vessel surveillance would cost	There is no benefit in having additional dedicated surveillance vessels, given surveillance can be performed from any vessel; and these duties will be shared

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Additional vessels contracted through Santos WA vessel providers out of Dampier. Santos WA has access to automatic identification system live-vessel tracking portal to establish vessel availability. Vessel surveillance will be activated within 90 minutes for available on-site (at VI) vessels.	offshore from the major marine base of Dampier. Additional available vessels out of Dampier can be put on hire through Santos WA's contracted vessel providers; mobilisation times to site can provide additional contracted vessels relatively quickly. Additional mobilisation from Exmouth can be made through Santos WA's contracted vessel providers. This strategy is not designed to perform 'whole of spill' coverage, which is provided by aerial surveillance (i.e., it is a secondary strategy).	the purpose of oil spill surveillance is not considered to be required, given the need is met through vessel sharing. Surveillance will also be conducted through a number of complementary strategies (aerial surveillance, oil spill trajectory modelling, tracker buoys).	tens of thousands of dollars per day and are not considered required.	amongst spill response vessels.
Monitor and Evaluate- Oil Spill fate Modelling	24/7 standby Oil Spill Trajectory Modelling (OSTM) service provider . OSTM provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill (as per Section 2.1 of the VI HUB OPEP). Spill modelling to be	OSTM provider 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. Operational surveillance data (aerial, vessel, tracker buoys) will be provided to OSTM provider to verify and adjust fate	Predictive oil spill modelling will be used to forecast (using real-time data) the trajectory and fate of the spill. Resource is not considered limiting with no environmental benefit from dedicating additional modelling capability.	Santos WA pays for the provision of the service by OSTM provider. This is considered to provide the required function.	There is no benefit in having additional modelling capability given that OSTM provider have staff based across Australia and can provide 24/7 coverage.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	initiated within 24 hours. Upon activation, OSTM provider will provide trajectory models within: 2 hours for OILMAP model for offshore and open ocean; and 4 hours for OILMAP operation for near-shore.	predictions of the spill and improve predictive accuracy.			
Monitor and Evaluate- Tracker Buoys	Up to 12 Santos WA tracker buoys (at different Santos WA facilities); 4 are immediately available on VI, and deployment can be at a staggered rate determined by the need to track oil heading towards sensitive receptors. Subscription to tracker buoy tracking website. Santos WA on-hire vessels and vessels of	In addition to aerial surveillance, tracker buoys are an additional strategy to provide real-time verification data (particularly beneficial at night and in conditions limiting aerial surveillance). 12 buoys are sufficient to enable timely retrieval and redeployment. Four are available on VI. Vessels for buoy deployment will be Santos WA on-hire vessels and other operators of vessels of opportunity. Vessels can be shared across this and	Additional buoys are available through secondary suppliers (e.g., AMOSC, OSRL and AMSA – more than 20 buoys available) if required. These can be registered on the Santos WA/Joubeh satellite tracking system within hours. Dedicated vessels are not required given that the need is met through vessel sharing.	Santos WA has 12 buoys linked to a satellite-tracking website designed for first strike deployment across its operational facilities. No additional buoys need to be purchased by Santos WA given secondary availability through AMSA, AMOSC, OSRL within days. There is no additional upfront cost for accessing these secondary buoys.	The number of buoys immediately available and the availability of secondary buoys within days is sufficient to cover tracking of oil fronts, especially given the spread of oil will be limited within the initial days of the spill. Therefore, no additional requirements and the response is considered ALARP.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	opportunity for buoy deployment. Subject to weather and vessel availability, the tracker buoys can be mobilised within 2 hours upon request from the IMT or on-scene commander.	other tasks (e.g., surveillance and tracker buoy deployment).			
Monitor and Evaluate-Satellite Imagery	Contract in place with third party provider to enable access and analysis of satellite imagery	Suitable imagery can be accessed through existing contracts with AMOSC and OSRL. The most appropriate images for purchase will depend on the extent and location of the spill. Frequency of reporting is subject to satellite overflight schedule.	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. Given the adequate provision of satellite imagery and analysis through a third-party provider there is no requirement for additional resources.	Not considered required.	The current satellite imagery arrangements are considered adequate to provide the required function.
Monitor and Evaluate-Water	Fluorometers (for hydrocarbon	Santos WA has field tested deployment of subsea gliders	There are locally available subsea	Santos WA can access subsea gliders with	The existing arrangements are

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
Quality Monitoring (operational and scientific)	detection) within subsea gliders or towed fluorometers. CTD (conductivity, temperature, and depth) meters, including fluorometry and dissolved oxygen sensors. Water sampling equipment (e.g., Niskin bottles, jars). Water quality monitoring personnel. Glider Field Engineer for deployment and recovery. Dedicated vessels for towed fluorometers, CTD meter deployment, water sampling. Vessels of opportunity (vessel sharing) for subsea glider deployment.	and data transfer using local provider (Blue Ocean Monitoring) with access to gliders within Australia and the USA. Gliders and Towed fluorometers are available through contract with OSRL – located in Singapore. CTD meters with fluorometers and water sampling equipment available locally and to be arranged through Santos WA's contracted scientific monitoring provider. Contractual standby arrangements are in place for rapid activation, planning and deployment of operational water quality monitoring personnel. Subsea gliders and towed fluorometers can cover approximately 1 km/hr. One glider could cover 24 km/day. CTD meters provide discrete 'single point' readings over a	gliders and access to towed fluorometers. Water sampling equipment and CTD meters are also available locally. Water sampling equipment is not considered a bottleneck to deployment. Given multiple access avenues to equipment, dedicated equipment (i.e., purchased or standby on-hire equipment) is not considered required. Deployment personnel will initially be provided through Santos WA's contracted monitoring provider and subsea glider deployment personnel.	fluorometers and towed fluorometers through OSRL. Santos WA's contracted scientific monitoring provider is on an existing standby footing in Perth with mobilisation time of personnel to site within 72 hours following approved monitoring action plan based on incident specifics. An enhanced standby with vessels, equipment and personnel all prepositioned for immediate deployment would cost in the order of tens of thousands of dollars per day. Similarly, subsea gliders set-up and prepositioned on standby for immediate deployment would cost in in the order of tens of thousands of dollars.	considered sufficient to provide targeted 'first strike' operational water quality monitoring to priority sites as identified through oil spill modelling and surveillance.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Oil sample collected using a vessel of opportunity and analysed on VI or in Perth.	depth profile. Water quality sampling at discrete locations. For subsea gliders and towed fluorometers, the deployment philosophy is not to 'blindly' patrol the entire spill area. Deployments will be targeted to ground truth spill modelling predictions. That is, the predicted front or fronts of entrained oil will be traversed by gliders to verify entrained oil presence. This will be prioritised where fronts are predicted to reach sensitive receptor areas. Similarly, discrete water sampling will target sites positioned to validate modelling predictions.			
Monitor and Evaluate – Shoreline and Coastal Habitat Assessment	Spill response teams (Santos WA and AMOSC core group, State Response Team) Santos WA GIS resources Santos WA contracted vessels and vehicles	Shoreline Assessment strategies will be implemented under the direction of DoT as the HMA. AMOSC contract to facilitate mutual aid arrangements for access to Oil Spill Responders. Santos WA will make available AMOSC Core Group	Personnel and equipment for shoreline and coastal habitat assessment is not considered limiting. However, the time for deployment may exceed predicted times to minimum shoreline contact, particularly at	Not considered required.	The existing arrangements are considered sufficient to provide a first strike shoreline and coastal habitat assessment in addition to supporting DoT.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	available as required for shoreline access	Responders for shoreline and coastal habitat assessment positions. Existing information on shoreline character can be obtained from Santos WA's GIS, including habitat/fauna distribution layers and aerial imagery. The diesel spill (State waters) from a vessel collision/tank rupture at HDD shoreline crossing could result in the quickest shoreline contact (above 100 g/m^2) at the Northern Island Coast (4 hrs) and Dampier Archipelago (23 hrs). For these scenarios first strike deployment arrangements would come from Dampier or VI. A surface blowout of Reindeer condensate could result in shoreline contact (above 100 g/m^2) at the Lowendal Islands (411 hrs) and Montebello Islands (1237 hrs).	the Northern Island Coast. The pre-positioning of personnel and/or pre-assessment of shorelines prior to a spill is considered of limited benefit since: • Shoreline and Coastal Habitat Assessments do not need to occur prior to oiling since they are designed to record information about level of oiling and applicable response techniques. • Shoreline characteristics change over time and thus pre-assessments may not be accurate or relevant at the time of a spill.		

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		First-strike deployment arrangements would come from personnel and equipment based at VI. This includes Santos WA AMOSC Core Group personnel, and IRT members. Santos WA maintain the capability to implement a first strike shoreline and coastal habitat assessment within the first 24-48 hours of a spill notification.			
Monitor and Evaluate – Wildlife Reconnaissance (aerial/ vessel surveillance. Shoreline and coastal habitat assessment)	Spill response teams (Santos WA and AMOSC core group, State Response Team) Santos WA and AMOSC Core Group Aerial Observers. Santos WA contracted helicopters, vessels and vehicles available as required. Third party Scientific Monitoring Wildlife aerial observers	First strike wildlife reconnaissance will rely on personnel conducting monitor and evaluate activities (aerial and vessel surveillance) with all wildlife sightings reported (including wildlife contacted with hydrocarbons or at risk of contact) in or near the spill trajectory and during shoreline and coastal habitat assessments. Access to experienced fauna aerial observers and targeted fauna surveys will occur through activation of the third-party scientific monitoring provider as per scientific	Having experienced fauna observers and dedicated helicopters and vessels on standby for targeted fauna surveys from the very start of the spill could result in improving the quality of data initially received.	The cost of personnel, helicopters and vessels on standby for this purpose would cost in the order of tens of thousands of dollars per day.	The current arrangements, in terms of using monitor and evaluate surveillance to provide the initial wildlife reconnaissance, followed by targeted fauna surveys with experienced fauna observers as part of the scientific monitoring program, are considered adequate. The cost of having dedicated personnel and

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		monitoring arrangements. This may occur within 72 hours following an approved monitoring action plan			helicopter(s)/vessels on standby is considered grossly disproportionate to the environmental benefit gained.
Mechanical dispersion	On-hire vessels supporting Santos WA's VI and Ningaloo Vision facilities. Vessel of opportunity from other operators.	Mechanical dispersion may be beneficial depending upon the state of the hydrocarbon, weather conditions and proximity of oil to sensitive receptors. It is a strategy that therefore depends on situational awareness gathered at the time of the incident. This strategy targets discrete patches of oil in an opportunistic manner and can be undertaken by vessels performing other duties. Dedicated vessels are therefore not considered to be required.	Given there will be on-hire vessels supporting the activities and the central location of activity relative to the main marine base of Dampier, dedicated additional vessels specifically for the purpose of mechanical dispersion are not considered to be required, particularly given this strategy can be tasked through vessel sharing.	The current vessel arrangements are considered to provide the required function given this strategy is applied opportunistically. Vessels and crew on standby would cost tens of thousands of dollars per day and is not considered required based on the limited value they would provide.	The strategy depends on conditions at time of the spill and can be delivered by vessels co-tasked with other activities. Therefore, the ongoing vessel access arrangements and vessels contracted are considered adequate.
Protection and deflection	Shoreline and nearshore booms plus ancillary equipment (Santos WA – VI; AMOSC – Broome, Exmouth, Fremantle and Geelong; AMSA –	Shoreline and nearshore booms provided by Santos WA or through AMOSC or AMSA are available from Exmouth, VI and Dampier within close proximity to shorelines potentially contacted as	Boom equipment is not considered limiting. However, the time for deployment may exceed predicted times to shoreline contact, particularly at the	Having either pre-positioned boom and response personnel or boom/ personnel on standby vessels would involve costs in the	The cost of having dedicated personnel and equipment prepositioned or on standby vessels is considered grossly disproportionate to the

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Fremantle and Dampier). Boom tow-vessels. Spill response teams (Santos WA and AMOSC core group, State Response Team). Tactical response plans in place for the deployment of booms at offshore island locations (e.g., Montebello Islands).	predicted by modelling. Combined, multiple kilometres of boom are available from these locations. Mutual aid arrangements through AMOSC also provide access to additional booms from other operators (e.g., Chevron equipment based at Barrow Island). For the scenarios with predicted short-time frames to shoreline contact (diesel spill at the HDD shoreline crossing (State waters) and the surface blowout of Reindeer condensate), first-strike deployment arrangements would come from personnel and equipment based at VI. This includes Santos WA AMOSC Core Group personnel, IRT members and shoreline/nearshore booming equipment held at VI. Regular deployment exercises conducted by VI AMOSC Core Group and IRT personnel of spill response equipment have demonstrated the ability of loading of VI field support	Northern Islands coast (contact within 4 hrs). In addition, boom deployment locations cannot be confirmed until oil spill fate modelling and/or aerial/vessel surveillance data has been assessed. Prepositioning equipment closer to or at sensitive receptor locations or having personnel and equipment on standby vessels would potentially reduce deployment time. However, pre-deploying boom at sensitive locations creates potential for impacts which weighed against the uncertainty of an oil spill reaching the location are deemed to be unacceptable.	order of thousands of dollars per day.	environmental benefit gained. Pre-positioning boom would also create potential environmental impacts which would likely outweigh any potential benefits in the event of a spill. Given personnel and equipment for deployment of boom are already available on VI and within close proximity to shorelines with the greatest potential, and quickest timeframes, for impact, the existing arrangements are considered to reduce risk to ALARP.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		vessels within relatively short timeframes (<4 hours). Santos WA maintain the capability to implement first strike protection and deflection strategies within the first 24-48 hours of a spill notification, taking into consideration the need for oil spill modelling, surveillance and an operation NEBA to guide such a response. For some scenarios, given the proximity of the spill to the shoreline or due to weather conditions, it will not be possible to implement strategies prior to the minimum modelled contact times. For such instances, protection and deflection could still have environmental benefit once implemented.			
Shoreline Clean-up	Manual clean-up and flushing equipment (Santos WA, AMOSC, AMSA, hardware supplies) Staging infrastructure	Shoreline clean up strategies will be implemented under the direction of DoT as the HMA. Given the light and volatile nature of the condensate and diesel and the relatively low concentration or volumes predicted to arrive at shorelines	Given the light nature of the condensate and diesel and the high proportion of volatile components, intrusive clean-up and removal of oiled debris may not be required.	During a spill event, the cost of additional resources is not considered the limiting factor; the limiting factor is considered to be access and support services for plant and	The current level of resources available are considered to be appropriate. There is a limit to the number of personnel and equipment that can be mobilised to

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Clean-up team leaders (Santos WA, AMOSC core group, AMSA) Clean-up labour personnel (labour hire as required) Vessels for transport (Santos WA contracted vessel providers). Equipment is prepositioned on Varanus Island so readily available.	under worst-case conditions, intrusive and labour-intensive methods are unlikely to be favoured or required. The greatest predicted shoreline loading is from the diesel spill at the HDD shoreline crossing (State waters) with 173 m^3 (>100 g/m^2) accumulating along the Northern Islands coast. The greatest predicted shoreline loading of condensate from a surface blowout is 8 m3 (>100 g/m^2) at the Montebello Islands. Existing Santos WA equipment and that available through AMOSC and AMSA arrangements are considered to be sufficient given stockpile locations at Dampier, Exmouth and Varanus Island. Further equipment can be provide through additional Australian stockpile locations.	The main limitation of undertaking a shoreline clean-up response is based around access for plant and personnel to remote locations. VI can accommodate a maximum of 160 personnel outside of cyclone season. Barrow Island also has resident personnel associated with Chevron's operations. Provision of additional clean-up resources such as spill kits, sorbents, brooms, shovels, buckets etc are not considered to provide an environmental benefit unless additional personnel can be mobilised.	personnel to remote offshore island locations.	offshore islands – both in terms of transportation, access and support arrangements and in terms of safety of responders and environmental impact.
Waste management	Assorted waste receptacles and trucks.	Santos WA's waste service provider is contracted to provide first-strike and ongoing waste storage, transport and	Waste contractor has access to sufficient resources for the worst-case waste	Contracted resources are considered greater than required to	Resources are considered to be adequate based on

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Waste personnel – project manager, local responsible personnel and operations personnel. Vessels for waste transport from offshore islands. Dedicated spill equipment container available on VI with equipment to establish waste storage areas during shoreline clean-up (e.g., collapsible bunds, absorbent rolls, drain covers, temporary fencing).	disposal requirements commensurate with a worst-case spill across Santos WA's operations. These resources are over and above those required for the worst case scenarios described in this OPEP.	requirements associated with the activity; there is no benefit to acquiring additional resources specifically for the activity. Additional equipment to manage shoreline clean-up waste on offshore islands can be accessed and replenished from the mainland during an ongoing response.	respond to a worst-case scenario.	worst-case modelled waste requirements.
Oiled wildlife response	Oiled wildlife response kits and containers available from AMOSC, AMSA, DBCA or DoT in Darwin, Broome, Exmouth, Karratha, Fremantle, or Kensington. Oiled Wildlife Response personnel	In Commonwealth waters, Santos WA is the control agency for an OWR in consultation with DBCA. If a spill occurs in or crosses into State waters an OWR will be implemented under the direction of DoT as the HMA and Santos WA will assist the response.	Prehire and/or prepositioning of staging areas and responders may enhance response times and hence the overall success of an OWR. As Santos WA has access to OWR kits through 3rd party	The cost of personnel (Level 1 responders) on standby is $1,500 per person per day as per existing arrangements through recruiting agencies. This is a guaranteed cost regardless of whether a spill occurs or not. Given that personnel on this level	The cost of setting up staging areas and having responders on standby is considered grossly disproportionate to the environmental benefit gained. The overall OWR capability Santos WA can access through

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
	Level 2 to 4 as per the WA Oiled Wildlife Response Plan (AMOSC, AMOSC-activated Oiled Wildlife Response contractors, Industry Mutual Aid, DBCA, OSRL-activated Oiled Wildlife Response contractors, "Sea Alarm"). VI HSE Advisors with fauna handling training Untrained resources (level 1) through personnel-hire arrangements Level of escalation of the oiled wildlife response is under authority of the DoT incident controller with technical input from the DBCA – Oiled Wildlife Advisor.	An operational NEBA would direct efforts for maximum effectiveness and ensure the response effort itself does not cause more harm. Given the nature of the hydrocarbon released (condensate or diesel) and the limited spatial extent of floating oil above an impact threshold of 10 g/m^2 widespread physical oiling of wildlife is not expected. Santos WA will provide all necessary resources to assist DoT, mainly, and initially, through its access to AMOSC oiled wildlife resources. In the event of a large-scale OWR, further specialised OWR equipment and personnel will be accessed through AMOSC and OSRL. Equipment and personnel required for the development and operation of staging areas/ treatment facilities can be provided locally. The Pilbara Region OWR Plan provide detail of local organisations and suppliers for personnel and equipment. Labour hire	agreements that can be mobilised in a timely manner, it is not considered to be necessary to increase equipment. The available OWR kits are strategically positioned within WA enabling flexibility on locations for staging areas to be established. The first strike capability of Santos WA, prior to the arrival of OWR/wildlife specialists, would be enhanced through the development of a VI Oiled Wildlife First Strike Plan, which would include training requirements.	can be arranged within relatively short timeframes there is not considered sufficient environmental value in having dedicated OWR responders on standby. This is further supported by OWR being undertaken in consultation with relevant agencies (e.g. DoT, DBCA and DoEE) which is expected to be more of a limiting factor with regards to time than mobilising additional resources.	AMOSC, OSRL/Sea Alarm and through Santos WA Workforce hire are considered adequate. Santos WA is committed to improving their first strike OWR capability through the development of a Varanus Island Oiled Wildlife First Strike Plan prior to the end of 2020.

Strategy	Resourcing	Justification	Environmental Benefit of Additional Resources	Cost of Additional Resources	ALARP Assessment
		agencies would be used to provide large numbers of level 1 responders that would undergo an induction and basic training. Mobilisation of OWR personnel and equipment to site will start to occur in 24-48 hours following notification of actual or imminent impact to wildlife. This will occur through access to AMOSC oiled wildlife resources. Preceding this, at Varanus Island a first strike response may be undertaken by the VI HSE Advisors whom have undertaken fauna handling training and are listed on the DBCA licences (Regulation 25 and 28) which allow them to handle, and if necessary euthanise wildlife. Prior to any first strike actions, approval and instruction would be sort from DBCA.			

4.3 Net Environmental Benefit Analysis (NEBA)

The Control Agency IMT use the NEBA process to inform the development and refinement of incident response strategies and tactics, so the most effective response strategies with the least detrimental environmental impacts can be identified, documented and executed.

The Environmental Team Lead is responsible for identifying and prioritising environmental receptors at risk of impact and applying NEBA to identify which response options 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 Controlling 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 prioritise 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 (both condensate and Diesel), with the benefit or potential impact to each sensitivity identified (refer **Table 4-3** for Condensate and

Table 4-4 for Marine Diesel). 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 in 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 9**) 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 seasonal);
+ Assist in prioritising and allocating resources to sensitivities with a higher ranking; 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/SIMA is applied to the current situation, or operationalised. To complete the NEBA/SIMA:

+ All ecological and socioeconomic sensitivities identified within the spill trajectory area are inserted; and
+ Potential effects of response strategies on each sensitivity are assessed and assigned a positive, negative or no change rating.

The Operational NEBA/SIMA 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/SIMA provides guidance to the IAPs and is revisited each Operational Period.

Table 4-3 Strategic NEBA Matrix Table for Condensate

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Note: These strategies are implemented with consideration to the control measures in Section 4								
Montebello Islands								
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					N/A	N/A		
Fishing/charter boat tourism								
Lowendal Islands								
Turtle nesting – particularly flatback and green turtles								
Mangroves and mudflats (shorebird foraging)							N/A	
Coral and other subsea benthic primary producers					N/A	N/A	N/A	
Seabird nesting								
Migratory shorebirds								

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Aboriginal listed sites incl. pearling camps							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.							

Table 4-4 Strategic NEBA Matrix Table for Marine Diesel

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Note: These strategies are implemented with consideration to the control measures in Section 4								
Dampier Archipelago								
Turtle nesting –particularly flatback and green turtles								
Mangroves and mudflats (shorebird foraging)							N/A	
Coral and other subsea benthic primary producers							N/A	
Seabird nesting								
Migratory shorebirds								

Priority for Protection Area	No Controls	Source Control	Monitor and Evaluate	Mechanical Dispersion	Shoreline Protection & Deflection	Shoreline Clean-Up	Oiled Wildlife Response	Scientific Monitoring
Aboriginal listed sites incl. pearling camps								
Northern Island Coast								
Coral and other subsea benthic primary producers							N/A	
Grey Nurse Shark Nursery Area								
Commercial Fisheries								
Aboriginal listed sites								
Tourism Beaches (inc. Dolphin Beach)								

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.

5 Initial Response (First Strike Activations)

The initial response actions to major incidents at Devil Creek facilities are outlined within the Devil Creek Incident Response Plan (DC-40-IF-00096). This includes site- and role-specific information relevant to the initial stages of an incident response including notifying the Central Control Room (CCR), raising the alarm, mustering of personnel and ESD of facility infrastructure. The Devil Creek Incident Response Plan (DC-40-IF-00096) should be consulted as an overall guide to incident response at Devil Creek Facilities, which includes all major incidents additional to oil spills.

For hydrocarbon spills to the environment, the Devil Creek On-scene Commander (Devil Creek PIC) is to contact the Incident Commander (Incident Commander) in Perth via the on-call Duty Manager (**Table 5-1)**.

Table 5-1 First Strike Activations

Position	Type of communication	Timeframe	To Whom
On-Scene Commander	Verbal	Within 30 minutes of incident having been identified or as soon as additional resources are required	Incident Commander via Duty Manager

First strike activations required for the credible oil spill incidents identified in this plan are outlined in **Sections 5.1** to **5.4** below.

5.1 Level 1 Offshore Spills

Level 1 activations are based on spills which will not have an adverse effect on the public or the environment and can be controlled by the use of resources available onsite, without the need to mobilise additional resources for combatting the spill. First strike actions for level 1 offshore are detailed below (**Table 5-2**).

Low flow well leak incidents identified from subsea inspection activities are included in **Table 5-2**, given worst case credible releases are relatively low in volume and not considered not to require a typical Level 2/3 spill response. Nevertheless, these releases would need operational monitoring to assess the potential environmental consequence (refer **Section 9.8**) and following evaluation of operational monitoring information may be reassessed as a Level 2 spill requiring scientific monitoring to be initiated.

Table 5-2 First Strike Activations for Level 1 Offshore Spills

When	Activation	Who
Immediate	Manage the safety of personnel on platform or vessel.	Offshore On-Scene Commander (Offshore Platform Designated Person / Vessel Master)
Immediate	Control the source using available onsite resources where applicable. Refer to the Source Control Plan (refer **Section 8**)	Offshore On-Scene Commander

When	Activation	Who
Immediate	Report incident to Devil Creek On-scene Commander via Devil Creek Gas Plant Central Control Room (CCR)	Offshore On-Scene Commander
30 minutes	Report incidents where spill has reached marine environment to on-call Incident Commander	Devil Creek On-Scene Commander (Devil Creek PIC)
60 minutes	If spill has reached surface waters marine waters gain further situational awareness by undertaking surveillance of the spill from vessel or platform (refer **Section 8.1**)	Offshore On-Scene Commander Devil Creek On-Scene Commander (Devil Creek PIC)
60 minutes	Initiate regulatory notifications as per Notifications Plan (refer **Section 6**)	Offshore On-Scene Commander Devil Creek On-Scene Commander IMT Safety Team Leader IMT Environment Team Leader
Ongoing	Consider undertaking mechanical dispersion using available vessels (refer **Section 10**). Continue to monitor spill behaviour.	Offshore On-Scene Commander Devil Creek On-Scene Commander
Ongoing	In the instance of a low flow subsea well leak identified from subsea inspection activities refer to **Section 9.8** for operational monitoring requirements.	Santos Offshore Operations (Gas Assets)

5.2 Level 2/3 Offshore Petroleum Activity Spills (Reindeer Platform or Devil Creek Pipeline)

For Level 2/3 spills from offshore petroleum facilities (petroleum activity spills) the Controlling Agency is Santos WA (Commonwealth waters), DoT (State waters) or both Santos WA and DoT (spill crossing between Commonwealth and State waters). Santos WA will provide first strike response and then work in coordination with DoT if DoT is required to assume Controlling Agency responsibilities. First strike activations for a level 2/3 offshore non-vessel spill are found below (**Table 5-3**).

Table 5-3 First Strike Activations for Level 2/3 Offshore Petroleum Activity Spills

When	Activation	Who
Site Actions		
Immediate	Manage the safety of personnel on platform or vessel.	Offshore On-Scene Commander (Offshore Platform Designated Person / Vessel Master)
Immediate	Report incident to Devil Creek On-scene Commander via Devil Creek Gas Plant Central Control Room (CCR)	Offshore On-Scene Commander
Immediate	Control the source using available onsite (platform and remote) resources. Refer to the Source Control Plan (Section 8)	Offshore On-Scene Commander
30 minutes	Assess the situation and undertake response as per Devil Creek Incident Response Plan	On-Scene Commander (Field Superintendent)
30 minutes	Notify IMT	On-Scene Commander (Field Superintendent)
IMT Actions (0-48 hours) – reactive phase		
Within 90 minutes of notification	Gain situational awareness by initiating Operational Monitoring. Refer to the Monitor and Evaluate Plan (Section 9).	IMT Operations Team Leader IMT Logistics Team Leader IMT Environment Team Leader
Refer timeframes (Section 6)	Initiate notifications to relevant Controlling Agency (DoT if spill within or entering State waters), other regulatory agencies and oil spill service providers as per Notifications Plan (Section 6)	IMT Incident Commander (or delegate) IMT Safety Team Leader IMT Environment Team Leader
Day 1	Prepare for use of offsite source control resources as applicable. Refer to the Source Control Plan (Section 8)	IMT Drilling Team Leader
If/when initiated	Use mechanical dispersion (vessel) as applicable. Refer to Mechanical Dispersion Plan (Section 10)	IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for use of Shoreline Protection and Deflection (Section 11)	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader IMT Supply Team Leader
If/when initiated	Prepare for Oiled Wildlife Response (Section 14)	IMT Environment Team Leader IMT Logistics Team Leader IMT Supply Team Leader

When	Activation	Who
If/when initiated	Prepare for scientific monitoring as per Scientific Monitoring Plans where applicable (Section 16)	IMT Environment Team Leader IMT Logistics Team Leader IMT Supply Team Leader
If/when initiated	Prepare for initiation of Shoreline Clean-up Plan (Section 12)	IMT Operations Team Leader IMT Logistics Team Leader IMT Supply Team Leader
If/when initiated	Prepare for initiation of Waste Management Plan (Section 15)	IMT Logistics Team Leader
Day 1-2	Prepare for proactive phase by: + Developing common operating picture from operational monitoring + Beginning incident action planning (including Operational NEBA) for subsequent operational periods. + Development of Safety plans Refer Oil Spill Recovery Safety Management Plan (QE-91-RF-10016) + Arrange personnel roster to extend the IMT coverage Begin set-up and mobilisation of personnel to forward operations base (FOB) as required Undertake arrangements for supplying IMT personnel to DoT as applicable	IMT
IMT Actions (48+ hours) – proactive phase		
Ongoing	Santos WA to continue formal IAP process (Section 7) for spill response activities where Santos WA is Controlling Agency or Lead IMT. + Santos WA to support (response equipment and personnel / operational and IMT support) spill response activities where it is not Control Agency or Lead IMT.	IMT

5.3 Level 2 Offshore Vessel-based Spills

Level 2 activations are based on spills that cannot be controlled by the use of facility (or on-scene vessel) resources alone or spills that may be able to be controlled using on-site resources, but which will have an adverse effect on the public or the environment.

For Level 2 spills from vessels, AMSA is the Controlling Agency for Commonwealth water spills and DoT the Controlling Agency for State waters spills. Santos WA will provide first strike response and then support DoT or AMSA in their role as Controlling Agencies through provision of resources. First strike activations for a level 2 vessel spills are found below (**Table 5-4**).

Table 5-4 First Strike Activations for Level 2 Vessel Spills

When	Activation	Who
Site Actions		
Immediate	Manage the safety of personnel on the vessel.	Vessel Master
Immediate	Report incident to the Devil Creek On-scene Commander via Devil Creek Gas Plant Central Control Room (CCR)	Vessel Master/Company site rep
Immediate	Control the source using available vessel resources. Refer to the Source Control Plan (**Section 8**)	Vessel Master
30 minutes	Report incident to the Perth based Incident Commander (Incident Commander)	Devil Creek On-scene Commander
IMT Actions (0-48 hours)		
Within 90 minutes of notification	Gain situational awareness by initiating Operational Monitoring. Refer to the Monitor and Evaluate Plan **(Section 9**).	IMT Operations Team Leader IMT Logistics Team Leader Incident Commander
Refer timeframes (**Section 8**)	Initiate notifications to relevant Controlling Agency (DoT or AMSA), other regulatory agencies and oil spill service providers as per Notifications Plan (Section 6)	IMT Incident Commander IMT Safety Team Leader IMT Environment Team Leader
Day 1	Prepare for use of offsite source control resources as applicable. Refer to the Source Control Plan (**Section 8**)	IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Use mechanical dispersion (vessel) as applicable. Refer to Mechanical Dispersion Plan (**Section 10**)	IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation of Shoreline Protection and Deflection (Section 11)	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation Oiled Wildlife Response as applicable (**Section 14**)	IMT Environment Team Leader IMT Logistics Team Leader IMT Supply Team Leader
If/when initiated	Prepare for initiation of scientific monitoring as per Scientific Monitoring Plans where applicable (Section 16)	IMT Environment Team Leader
If/when initiated	Prepare for initiation Shoreline Clean-up Plan (Section 12)	IMT Operations Team Leader IMT Logistics Team Leader IMT Supply Team Leader

5.4 On-Shore Pipeline Spills

For response to a gas/condensate leak from the onshore section of Devil Creek pipeline (Reindeer 16” pipeline), DFES is the Controlling Agency with Santos WA providing first strike response (source control) and support to DFES. Santos WA is responsible for the monitoring and remediation of the spill site.

Santos WA will provide support to DFES during their response until such time as the site is handed over to Santos WA. DWER are responsible for ensuring the site is cleaned up and remediated following cessation of a response by DFES. First strike activations are outlined in **Table 5-5**.

Table 5-5 First Strike Activations for Onshore Pipeline Spill

When	Activation	Who
Site Actions		
Immediate	Manage the safety of personnel on the vessel Implement first-strike source control where possible (**Section 8**)	Vessel Master
Immediate	Report incident to the Devil Creek On-scene Commander via Devil Creek Gas Plant Central Control Room (CCR)	Vessel Master/ Company Site Rep
30 minutes	Assess the situation and undertake response as per Devil Creek Incident Response Plan	On-Scene Commander (Field Superintendent)
30 minutes	Report incident to the Perth based Incident Commander (Incident Commander)	Devil Creek On-scene Commander
IMT Actions (0-48 hours) – reactive phase		
Within 90 minutes of notification	Gain situational awareness by initiating Operational Monitoring. Refer to the Monitor and Evaluate Plan (**Section 9)**.	IMT Operations Team Leader IMT Logistics Team Leader IMT Environment Team Leader
Refer timeframes (Section 6)	Initiate notifications to relevant Controlling Agency (DoT or AMSA), other regulatory agencies and oil spill service providers as per Notifications Plan (Section 6)	IMT Incident Commander IMT Safety Team Leader IMT Environment Team Leader
Day 1	Prepare for use of offsite source control resources as applicable. Refer to the Source Control Plan (**Section 8**)	IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Use mechanical dispersion (vessel) as applicable. Refer to Mechanical Dispersion Plan (**Section 10**)	IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation of Shoreline Protection and Deflection (Section 11)	IMT Environment Team Leader IMT Operations Team Leader IMT Logistics Team Leader
If/when initiated	Prepare for initiation Oiled Wildlife Response as applicable (**Section14**)	IMT Environment Team Leader IMT Logistics Team Leader IMT Supply Team Leader
If/when initiated	Prepare for initiation of scientific monitoring as per Scientific Monitoring Plans where applicable (Section 16)	IMT Environment Team Leader
If/when initiated	Prepare for initiation Shoreline Clean-up Plan (Section 12)	IMT Operations Team Leader IMT Logistics Team Leader IMT Supply Team Leader

When	Activation	Who
If/when initiated	Prepare for initiation of Waste Management Plan (**Section 15**)	IMT Logistics Team Leader
Day 1-2	Prepare for proactive phase by: + Developing common operating picture from operational monitoring + Beginning incident action planning (including Operational NEBA) for subsequent operational periods. + Development of Safety plans Refer Oil Spill Recovery Safety Management Plan (QE-91-RF-10016) + Arrange personnel roster to extend the IMT coverage + Begin set-up and mobilisation of personnel to forward operations base (FOB) as required + Undertake arrangements for supplying IMT personnel to DoT as applicable	IMT
IMT Actions (48+ hours) – proactive phase		
Ongoing	+ Santos WA to continue formal IAP process (Section 7) until Control Agency for vessel based spills assumes control + Santos WA to support (response equipment and personnel / operational and IMT support) spill response activities of vessel based spill Control Agency.	IMT

6 Notification and Reporting Plan

The Devil Creek Incident Response Plan (DC-40-IF-00096) identifies the initial incident notifications and actions to be conducted by onsite personnel, including notifying the incident to the On-scene Commander and Devil Creek Central Control Room (CCR) and initial notification of emergency services where applicable.

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

6.1 Regulatory Notification and Reporting

Environment incident notification and reporting requirements for Devil Creek facilities are contained within the Environment Incident Notification Guideline and Matrices (QE-91-HF-10003) and should be consulted as the primary source of Regulatory reporting requirements for all environmental incidents at Devil Creek facilities.

Table 6-1 outlines 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 will apply for spills originating in Commonwealth waters if the spill moves from Commonwealth to State waters. **Table 6-2** outlines the Regulatory Notification and reporting for Onshore Pipeline Spills. Contact details for the Regulatory agencies outlined in **Table 6-1** are provided within the Incident Response Telephone Directory (QE-00-ZF-00025.020).

Table 6-1 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 REPORTABLE INCIDENTS					
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 the Varanus Island Hub Operations that has the potential to cause moderate to significant environmental damage	Notification by IMT Environmental Team Leader (or delegate)	Incident reporting requirements: https://www.nopsema.gov.au/environmental-management/notification-and-reporting/
NOPTA (Titles Administrator)	Written report to NOPTA 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
TIER 1-3 SPILLS					
AMSA (AMSA Response Centre (ARC))	Immediate verbal notification (The message must begin with the code word “POLREP”,	National Plan for Maritime Environmental Emergencies	All slicks trailing from a vessel All spills to the marine environment All spills where National Plan	Vessel Master	Incident reporting requirements: https://www.amsa.gov.au/marine-environment/marine-pollution/mandatory-marpol-pollution-reporting Online POLREP - https://amsa-forms.nogginoca.com/public/

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
	then the name, the IMO number and the call sign of the ship). Written POLREP form, timing not specified		equipment is used in a response		
Commonwealth Department of the Environment and Energy (DoEE) (Director of monitoring and audit section)	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
WA Department of Transport (WA DoT) (WA Maritime Environmental Emergency Response (MEER) unit)	Verbal notification within 2 hours Follow up with POLREP as soon as practicable after verbal notification If requested, submit	State Hazard Plan: Maritime Environmental Emergencies As per State legislation (i.e. *Pollution of Waters by Oil and Noxious Substances 1987*)	All actual or impending spills in WA waters, regardless of source or quantity Notify if spill has the potential to impact wildlife in State waters (to activate the Oiled	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

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
	SITREP within 24 hours of request		Wildlife Coordinator)		
WA Department of Mines, Industry Regulation and Safety	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	All actual spills regardless of the source or quantity in State Waters	Notification by IMT Environmental Team Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx
Department of Biodiversity Conservation and Attractions (Pilbara Regional Office)	Immediate Verbal notification	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	Immediate Verbal notification	Western Australian Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters	Notification by IMT Environmental	Not applicable

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
(State Duty Officer and Pilbara Regional Office)			(to activate the Oiled Wildlife Advisor)	Team Leader (or delegate)	
Parks Australia (Director of National Parks)	Verbal notification as soon as practicable	*Environment Protection and Biodiversity Conservation Act 1999*	All actual or impending spills which occur within a marine park or are likely to impact on an Australian marine park	Notification by IMT Environmental Team Leader (or delegate)	Not applicable, but the following information should be provided: Titleholder's details Time and location of the incident (including name of marine park likely to be affected) Proposed response arrangements as per the OPEP Details of the relevant contact person in the IMT
Australian Fisheries Management Authority	Verbal phone call notification within 8 hours		Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by IMT Environmental Team Leader (or delegate)	Not applicable
Department of Primary Industry and Regional Development - Fisheries	Verbal phone call notification within 24 hours of spill reaching State waters		Fisheries within the EMBA Consider a courtesy call if not in exposure zone	Notification by IMT Environmental Team Leader (or delegate)	Not applicable

Table 6-2 Regulatory Notification and reporting for Onshore Pipeline Spills

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
WA Department of Mines, Industry Regulation and Safety	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	All actual spills regardless of the source or quantity	Notification by IMT Environmental Team Leader (or delegate)	Environmental and Reportable Incident/ Non-compliance Reporting Form http://www.dmp.wa.gov.au/Environment/Environment-reports-and-6133.aspx
WA Department of Water and Environmental Regulation	Verbal or electronic notification as soon as practicable Follow up written notification as soon as reasonably practicable	Section 72 of the *Environmental Protection Act 1986*	All actual spills likely to cause pollution or environmental harm	Notification by IMT Environmental Team Leader (or delegate)	S 72(1) Waste Discharge Notification Form https://www.der.wa.gov.au/images/documents/your-environment/pollution/Notification_of_waste_discharges.pdf

6.2 Level 2/3 Spill Response Support Notifications

Table 6-3 outlines notifications that should be made to supporting agencies to assist with spill response activities outlined within this plan. This list contains key response providers 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 Company Incident Response Telephone Directory (QE-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 Company Incident Control room and online (intranet procedures and emergency response pages).

Table 6-3 List of notifications to escalate from Level 1 to Level 2/3 spill response

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

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
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	When equipment from movements are required in Exmouth and Dampier	Verbal	Assistance with mobilising equipment and loading vessels	**Phone call**	IMT Logistics Team Leader (or delegate)
North West Alliance – Waste	When Shoreline Clean-up is activated (Section 12)	Verbal	Santos has contract arrangements in place with North West Alliance to take overall responsibility to transport and dispose of waste material generated through clean up activities.	Phone call to the Primary Contact Person. In the event the Primary Contact Person is not available, the Secondary Contact Person will be contacted.	IMT Logistics Team Leader (or delegate)
Astron	Scientific Monitoring Plan initiation criteria are met (Section 16)	Verbal and written	Astron has been contracted by Santos to provide Standby Services for Scientific Monitoring Plans (SMPs) 1-11. This includes provision of personnel and equipment. Aston annually reviews the	**Step 1.** Obtain approval from Incident Commander to activate Astron for Scientific Monitoring **Step 2.** Verbally notify Astron followed by the submission of an Activation Form (Environment Team Leader Folder) via email	IMT Environment Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
			SMPs for continual improvement.	**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	
Intertek Geotech (WA) Environmental Services and Ecotoxicology	When characterisation of oil is activated (**Section 9.6**)	Verbal	Oil analysis including GC/MS fingerprinting Ecotoxicology	**Phone call**	IMT Environment Team Leader (or delegate)
Oil Spill Response Limited (OSRL), OSRL Duty Manager	If spill requires additional resources or technical expertise	Verbal OSRL Mobilisation Authorisation Form	Santos has a Service Level Agreement with OSRL, which includes the provision of support functions, equipment and personnel to meet a wide range of scenarios.	**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)
RPS Group	Within 2 hours	Verbal and written	Santos has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for	Contact RPS Group Duty Officer	IMT Environment Team Leader (or delegate)

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
			any spill greater than Level 1. AMOSC can also run modelling on behalf of Santos, if required, as part of contracting arrangements with RPS Group		
Wild Well Control (WWC)	Within four hours of a loss of well control incident having been identified	Loss of well control only Verbal	Well intervention services. Under contract.	Step 1. Following Santos management confirmation of a 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 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	Drilling Team Leader

Organisation	Indicative Timeframe	Type of Communication	Resources Available	Activation instructions	Santos person responsible for activating
				provided by the emergency hotline attendant.	

7 Incident Action Planning

Santos WA incident response personnel use the incident action planning process 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;
1. Establish incident objectives;
2. Develop the plan;
3. Prepare and disseminate the plan; and
4. Execute, evaluate and revise the plan.

The Santos WA IMT will use the IAP process to determine and document the appropriate strategies as more information becomes available during an incident response. The IAP is to be used by the IMT for each operational period following the initial first-strike assessments, notifications, and activations defined in IR Plans, OSCPs or OPEPs.

Incident action planning is the responsibility of the spill Controlling Agency. Where Santos WA is not the Controlling Agency, Santos WA will provide support to the incident action process adopted by the Controlling Agency through provision of situational awareness information and available resources. Where there is more than one Controlling Agency (i.e. a cross jurisdictional response in coordination with DoT) Santos WA will undertake the IAP process as Lead IMT for those spill response activities it is responsible for and provide information and personnel to support DoT's planning function for those activities which DoT assumes control as Lead IMT.

The Santos WA IAP process is built on the phases described in **Figure 7-1**.

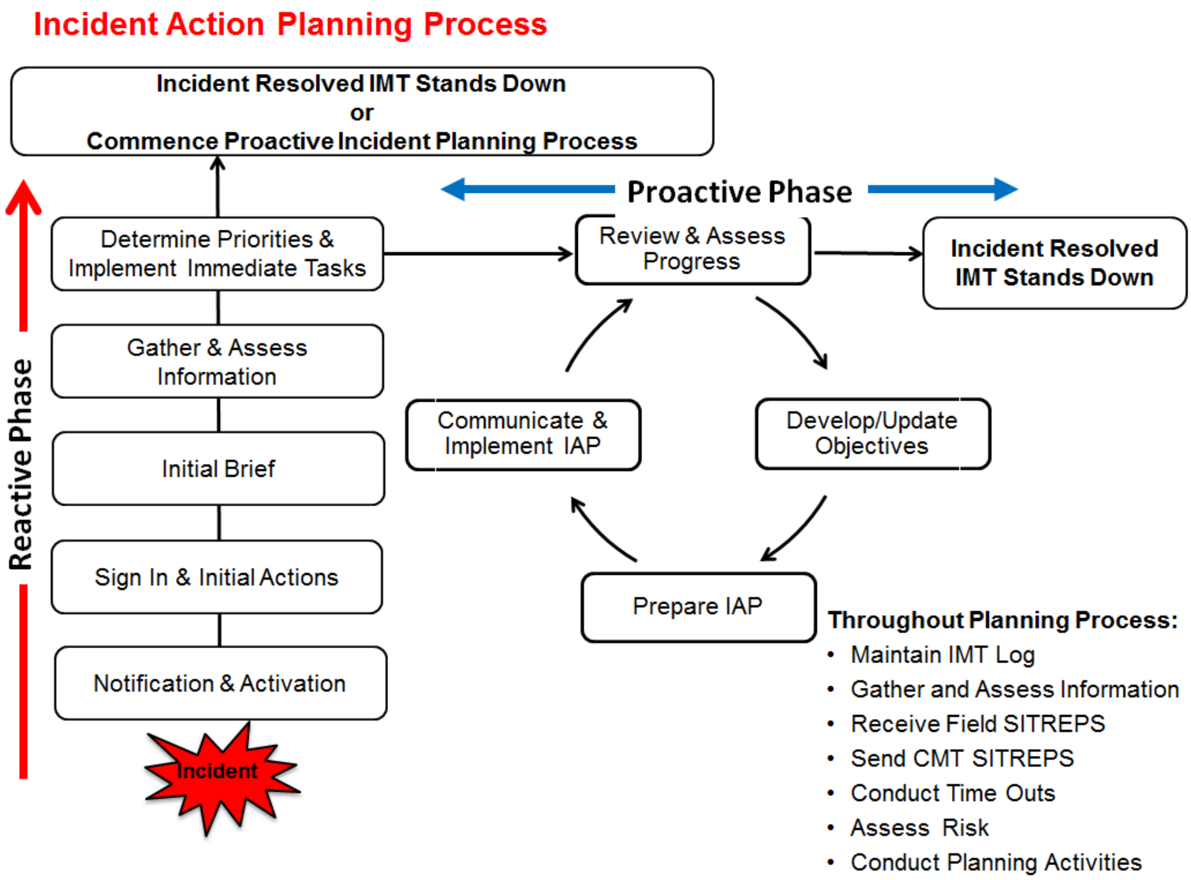

Figure 7-1 IAP process

The IAP process facilitates the determination of appropriate strategies as more information becomes available during a spill event. The IAP is used for each operational period following the initial incident response actions. An operational period is defined as the period scheduled for execution of actions specified in the IAP. The IAP is refreshed when conditions change. There can be multiple objectives and action plans occurring simultaneously within an IAP.

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, beach masters, 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 (QE-00-ZF-00025) and available from the Santos WA Emergency Response website.

Begin the response by copy 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 CST has subfolders carrying forms and processes unique to the functional position.

8 Source Control

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

For major hydrocarbon release incidents at Devil Creek facilities, the Devil Creek Incident Response Plan (DC-40-IF-00096) 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 any relevant initial actions to control the source of the spill.

For the ongoing response to a loss of well control incident at Reindeer Platform, the Source Control Emergency Response Plan (SCERP) (DR-00-ZF-10001) is to be consulted as the primary source of information. This plan includes:

+ Assessment of suitable surface locations
+ Relief well trajectory and casing design
+ Dynamic kill simulation results
+ Rig requirements and availability
+ Equipment availability (casing and wellhead)

No obstacles to achieving the stated relief well timeline have been identified.

The sections below provide an outline of source control activities noting that the Devil Creek Incident Response Plan (DC-40-IF-00096), Vessel SOPEP and SCERP (DR-00-ZF-10001), where applicable, will provide a higher level of detail for specific incidents.

8.1 Level 1 Vessel and Platform Releases

Level 1 activations are based on spills which will not have an adverse effect on the public or the environment and can be controlled by the use of resources available onsite, without the need to mobilise additional resources for combatting the spill. Level 1 spills associated with this activity are considered credible from leaks and spills associated with hydrocarbon storage and handling on Reindeer platform and supply vessels. This scenario does not include loss or well control or export riser/pipeline releases covered in Sections 8.3 and 8.4, respectively, or vessel fuel tank rupture, covered in **Section 8.2**.

Table 8-1 provides the objective, initiation criteria and termination criteria for 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. The implementation guide for vessel and platform releases is found in **Table 8-2**.

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 8-1 Vessel Platform Release – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Vessel and Platform Releases				
Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.			
Initiation Criteria	Level-1 incident (to be determined by On-Scene Commander)			
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**	**Hydraulic Oil**	**Lube Oil**
	✓	✓	✓	✓
Termination criterion	Release of oil to the marine environment has ceased and the workplace environment is deemed environmentally safe and free of hydrocarbon.			
Refer to Section 8.6 for relevant Performance Objectives, Standards and Measurement Criteria.				

Table 8-2: Vessel and Platform Releases Implementation Guide

Vessel and Platform Releases (hydrocarbon storage, handling and transfer)				
Activation time		Immediately upon notification of a vessel or platform release.		
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	In the event of a loss of production hydrocarbons from platform topside production equipment, consult the Devil Creek Incident Response Plan (DC-40-IF-00096)		Offshore Platform Designated Person/ 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	Offshore Platform Designated Person/ Vessel Master/ Facility On Scene Commander	❑

Vessel and Platform Releases (hydrocarbon storage, handling and transfer)			
Activation time	Immediately upon notification of a vessel or platform release.		
Action	Consideration	Responsibility	Complete
	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.		
Resources		Location	
Equipment	Refer to vessel, platform and activity specific procedures for details of equipment available.	Refer to vessel, platform and activity specific procedures for details of equipment locations.	
Personnel	Refer to vessel, platform and activity specific procedures for details of personnel.	Refer to vessel, platform and activity specific procedures for details of personnel.	
Maintenance of response	Spills of this nature are expected to be handled by the resources available at the spill location due to the relatively small credible release volumes and hydrocarbon types. The resources on hand are expected to be sufficient to maintain the response until the termination criteria are reached. If required, Santos has access to additional resources internally and through service providers to maintain this response.		

8.2 Vessel Fuel Tank Rupture

A diesel spill of up to a maximum of 329 m^3 is assessed as credible from the rupture of a vessel diesel fuel tank due to collision or grounding during Devil Creek operational activities.

Table 8-3 provides the objective, initiation criteria and termination criteria for 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. The vessel tank rupture implementation guide is presented in **Table 8-4.**

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 8-3 Hydrocarbon fuel tank rupture – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Hydrocarbon fuel tank rupture		
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	**Reindeer Condensate**	**Diesel**
	x	✓
Termination criterion	The cargo in the ruptured fuel or storage tank is secured and release to the marine environment stopped	
Refer to **Section 8.6** for relevant Performance Objectives, Standards and Measurement Criteria.		

Table 8-4: Vessel Tank Rupture Implementation Guide

Vessel Tank Rupture				
Activation time		Immediately upon notification of a vessel 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	❑
Resources			Location	
Equipment		Refer to vessel specific procedures for details of equipment available.	Refer to vessel specific procedures for details of equipment locations.	
Personnel		Refer to vessel specific procedures for details of personnel.	Refer to vessel specific procedures for details of personnel.	
Maintenance of response		Source control measures on vessels are typically contained in the vessel-specific SOPEP and / or Emergency Response Plan (ERP). The need for additional resources to support vessels undertaking source control measures will be specific for each spill. Santos has a range of potential resources (e.g. support vessels with capacity to store liquids) available through its VI Hub operations.		

Through the implementation of these controls, the amount of hydrocarbons released to the marine environment may be reduced. However, there are several influencing factors that would result in delay or failure to implement controls, potentially resulting in a full discharge of a fuel tank compartment; such as a high sea state, a significantly large rupture, or injuries to personnel.

8.3 Loss of Well Control

A Reindeer condensate spill of up to a maximum of 14,935 m^3 is assessed as credible from a loss of well control at the Reindeer platform. Only the surface release is credible, refer to the EP for further justification.

The Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038) identifies direct intervention, top-kill and relief well drilling as contingency strategies to respond to a loss of well control at Reindeer Platform wells.

The primary means of controlling a well that cannot be brought under control using onsite resources is the drilling of a relief well to intercept the well bore and kill the flow of hydrocarbons.

Table 8-5 provides the objective, initiation criteria and termination criteria for this tactic. **Table 8-6** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 8-5 Loss of well control – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Loss of Well Control		
Environmental Performance outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine environment.	
Initiation criteria	Loss of well control	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	x
Termination criterion	The primary well is contained and killed to prevent any further release of hydrocarbon to the environment.	
Refer to **Section 8.6** for relevant Performance Objectives, Standards and Measurement Criteria.		

8.3.1 Emergency Shutdown (ESD)

The Devil Creek Incident Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate Reindeer platform ESD systems, where they are not already triggered automatically.

8.3.2 Relief Well Drilling and Well Kill

The risk of a loss of well control event is introduced during well intervention activities due to the requirement to breach and enter the pressure envelope of the well.

As per the Reindeer Well Operations Management Plan (WOMP) (DR-91-ZG-10038) controlling a loss of well control through the drilling of a relief well by a MODU, or through top-kill from the platform or vessel, are strategies that will be pursued if the well cannot be contained through ESD or direct intervention.

Santos

Relief well pre-planning is required for Reindeer production wells prior to any wireline well intervention work. Relief well planning is conducted as per Santos Drilling & Completions Management Process. Findings from the planning will determine pumping/well-kill requirements for top-kill (if possible) and the technical design and MODU requirements for drilling a relief well.

Surface/Top Well Kill:

Prior to the 2017 Reindeer RST logging campaign which involved well activities entering the pressure envelope of the well, and as such introduced the risk of a loss of well control, a top kill study was conducted to demonstrate the feasibility of this option. The top-kill study was conducted by third party subject matter expert Schlumberger.

For clarity, the top-kill scenario is modelled on a small uncontrolled leak to atmosphere at the production tree that cannot be isolated upstream that may still allow safe access to the platform and tie-in to the leaking well via existing infrastructure (i.e. connecting to the production tree via the kill wing outlet) and safe operation of a vessel located alongside the platform. It is estimated that this leak rate would be in the range of 400cc/min, small enough not to generate an explosive gas cloud and access to the platform is still preserved. This methodology would not be considered should safe access to the platform or ability to operate a vessel alongside the platform not be achievable.

A high-pressure pumping package would be deployed on a vessel, the vessel is moored alongside the platform, and a flexible high pressure kill line is deployed from the vessel to the platform. The simulation assessed the ability to bullhead the well dead from a shut-in gas to surface scenario, whilst out-running the surface leak and not exceeding the safe working pressure of the surface equipment.

The top-kill model utilised a leak rate of up to 10,000cc/min (which is the lowest leak surface leak rate the modelling software allows) and demonstrated that utilising a minimum kill rate of 350gpm (~10bpm) the gas could be effectively bull-headed without excessive well bore pressures. A large range of reservoir injectivity values were assessed for both sea-water and kill-weight mud with a maximum pump pressure of less than 3,000 psi. This is well within the capability of high pressure pumping equipment (e.g. cement units/triplex pumps, high-pressure treating iron pipe-work and flexible high pressure hoses) readily available within the region. The simulation is further documented in Reindeer Schlumberger Report 1-1BAORA3.

Santos WA has successfully planned and executed well kill/bull-heading/flushing operations during routing non-leaking well suspension activities on numerous platforms using this technique with local personnel and equipment.

Relief Well Drilling:

The Santos WA Source Control Emergency Response Plan (SCERP) (DR-00-ZF-10001) outlines the process for planning and mobilising personnel and equipment into the field for the purpose of drilling a relief well. Campaign specific Source Control plans are developed prior to any well intervention activities as per WOMP requirements and a register of these plans is saved in the Santos WA document control system ECM.

Key high-level actions and resources used by Santos WA's IMT are outlined below.

Table 8-6 Loss of well control – Implementation Guide

Loss of Well Control				
Activation time		Loss of well control.		
Action		Consideration	Responsibility	Complete
Initial Actions	Notify Santos WA Drilling and Completions Team to assemble a Source Control Team and immediately begin preparations		IMT Drilling Team Leader	❑

Loss of Well Control			
Activation time	Loss of well control.		
Action	**Consideration**	**Responsibility**	**Complete**
Notify Wild Well Control 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	❑
Monitor progress of relief well drilling and communicate to IMT		IMT Drilling Team Leader	❑
Supporting Documentation			
Document Title	**Reference**	**Note**	
Source Control Emergency Response Plan (SCERP)	DR-00-ZF-1001		
Reindeer Well Operations Management Plan (WOMP)	DR-91-ZG-10038		
Santos Drilling & Completions Management Process			
Source Control Plan – as required			
Memorandum of Understanding: Mutual Assistance (To facilitate the transfer of Drilling Units and Well-Site Services between operators in Australian and Timor Leste administered waters to overcome emergency conditions)	N/A	Maintained on Santos WA Emergency Response Website	
Maintenance of response	Santos WA has the resources available from existing operations on the NWS to maintain and operate a MODU for as		

Loss of Well Control			
Activation time	Loss of well control.		
Action	Consideration	Responsibility	Complete
	long as the response is required. Santos WA D&C personnel and well control specialists will be rotated and the MODU will be maintained with support vessels through existing contracts with vessel suppliers.		

Relief well planning is embedded into the Santos Drilling & Completions Management Process as an integral part of Source Control considerations.

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 in Phase 2 (Evaluate) to generate a credible rate for oil spill modelling, as well as providing an input for the dynamic kill modelling, part of the Well Specific Source Control Plan (WDW Act 3.5); 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 (WDW Activity 3.5) to the appropriate level of detail.

The worst case credible loss of well control volume 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 and drill, an indicative schedule is provided in **Table 8-7**.

Table 8-7: Schedule for MODU arriving onsite

Loss of well control		
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	

These controls are assessed prior to any Reindeer well intervention activities as a part of the campaign specific source control plan. Currently this time-line has been assessed as ALARP (**Table 4-2**) 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.

Suitable rigs are identified at the time of writing the well intervention activity specific Source Control Plan.

During operations which require access to relief well drilling MODU, Santos WA tracks the MODU activity within the region and updates the tracker 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)
+ NOPSEMA safety case (yes/no)

The well intervention activity specific source control plan (including relief well study) for the Reindeer well intervention activity will verify the rig well kill capability and access to the relief well drilling location for the rig types operating within the region that Santos would expect to have access to.

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.

It is expected that 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 loss of well control, 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.

A relief well study was conducted for Reindeer-2, 3 and 4 for activities in 2017 (1-1BAORA3). Blowout modelling was performed for Reindeer-2 (RE02) using a surface atmospheric blowout (through completion tubing) worst case discharge scenario. RE02 was used as it has the greatest flowing potential producing from the Legendre Sandstone reservoir out of all three Reindeer platform wells.

For the purposes of the relief well modelling a nominal relief well location offset of 500 m from the Reindeer platform was selected (Latitude: 20°01'38.4746"S and Longitude: 116°18'24.7097"E). The location was selected given;

- The location allows a single relief well plan that can intersect any of the three existing Reindeer production wells.
- The location is a ‘safe’ distance from the existing platform.
- The location is typically upwind relative to the platform.

Constraints upon this potential location of a relief well were assessed, specifically:

- Existing infrastructure in proximity of the well location. The Reindeer WHP has two pipelines running directly south from the platform to shore which is connected to the Devil Creek Gas Processing Plant. The proposed location of the relief well is approximately 100m directly west of the pipelines.
- Water depth is 61.3m relative to Australian Height Datum (AHD). Although this water depth is sufficient for a semisubmersible MODU, the primary plan would be to drill the relief well using a jack-up. Apart from the pipelines mentioned above, no additional seabed hazards are present which would restrict MODU mooring operations;
- No shallow gas hazard identified however faults should be expected to be encountered above the target (-2095 m True Vertical Depth Sub Sea (TVDSS)). A possible shallow fault has also been previously identified at -380 m TVDSS.
- No shipping lane exclusion zones

Available bathymetry data shows the seabed to be relatively flat within the area of the planned relief well location.

A nominal well trajectory has been developed for the relief well. The planned intercept point for the relief well is as close as practical to the top-most perforation for each of the Reindeer wells (**Figure 8-1**).

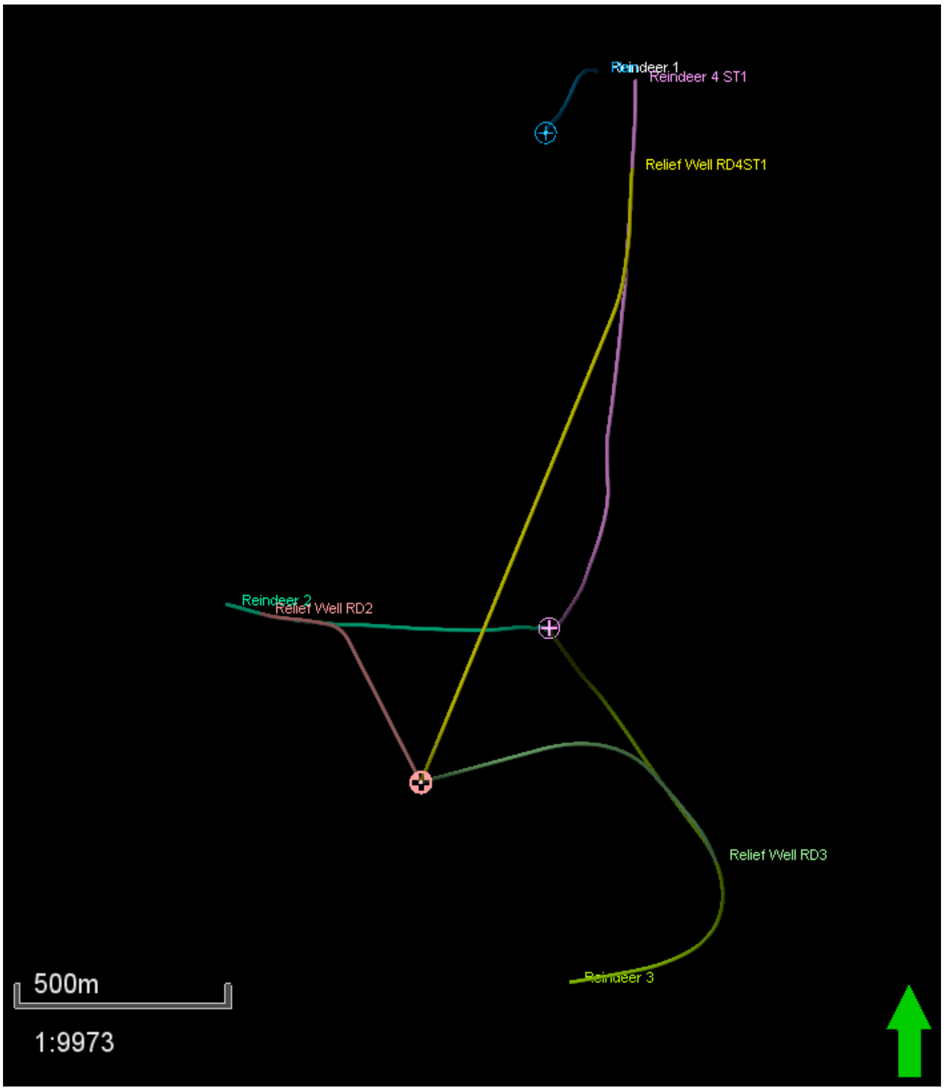

Figure 8-1: Reindeer Relief Wells Trajectory Top View

A dynamic kill simulation was modelled on the Reindeer 3 well due to its longest exposed reservoir section and the shallower intersection point with the following results:

- Kill mud weight is ranged between 1.2 and 1.5 SG.
- No fracture or burst limits being exceeded.
- Relief well intercepts with 8.5” bit drilled from 9-5/8” casing.

Well kill summary includes:

- Well kill commences with seawater at 1900 gpm to monitor for pressure losses whilst preparing the kill mud.
- A kill mud of 1.2 SG is pumped at the kill rate of 1900 gpm; which theoretically will kill the well within 10 mins.
- The well is lubricated for 30 mins at 1900 gpm then for 120 mins at 900 gpm to prevent under-balancing the well and having a further blowout scenario.
- Once the pumps are stopped, it is expected that the well will be 660 psi overbalanced.
- The maximum pump pressure at the kill line is 2740 psi, requiring 3020 HP of hydraulic power for the well kill.

+ A total of 680 bbls of seawater and 4380 bbls of 1.2 SG kill mud is required.

The relief well design was proposed to be similar to the original Reindeer wells but with a simplified casing design. At the time of the well services activities in 2017, provision for the availability of relief well casing was checked and verified against the Company's Oil Country Tubular Goods (OCTG) inventory which included the required 30" conductor, 13-3/8" 68 ppf L80, and 9-5/8" L80 casing strings. Access to wellhead systems for both jack-up MODUs and semi-submersible MODUs was also confirmed during the 2017 well services activities. The 2017 Reindeer relief well plan is further documented in the Schlumberger Report 1-1BAORA3 and the 2017 Reindeer Source Control Plan Rev0 (28th Sept 2017).

The relief well study originally planned for Reindeer-1 in 2017 was deferred due to no planned well activities involving Reindeer-1 and it being not materially different to the Reindeer platform wells. A relief well plan (and corresponding source control plan) will be developed for Reindeer-1 prior to any well activity (plug and abandonment) which involves entering the pressure envelope of the well.

8.4 Subsea Infrastructure Failure

Subsea infrastructure failure here includes the export riser and subsea pipeline to the shoreline. The worst case credible spill is a release of 275 m^3 of Reindeer condensate from the subsea pipeline between the platform (Subsea isolation valve) and the shoreline. This includes pipeline within Commonwealth and State waters.

Table 8-8 provides the objective, initiation criteria and termination criteria for 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. Refer to **Table 8-6** for the implementation guide for subsea infrastructure failure.

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 8-8 Subsea Infrastructure Failure – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Subsea infrastructure failure		
Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Activation criteria	Level-2/3 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	x
Termination criterion	The oil cargo in the ruptured subsea export pipeline is secured and release to the marine environment stopped.	
Refer to **Section 8.6** for relevant Performance Objectives, Standards and Measurement Criteria.		

Table 8-9 Subsea Infrastructure Failure– Implementation Guide

<table>
<tr><th colspan="5">Pipeline Release</th></tr>
<tr><td colspan="2">Activation time</td><td colspan="3">Immediately upon receiving notification of incident/ spill.</td></tr>
<tr><td colspan="2">Action</td><td>Consideration</td><td>Responsibility</td><td>Complete</td></tr>
<tr><td rowspan="2">Initial Actions</td><td>Consult The Devil Creek Incident Response Plan (DC-40-IF-00096 to activate riser / pipeline emergency shut down (ESD)).</td><td>These following Major Incidents outlined within the DC IRP (DC-40-IF-00096) are applicable:
+ DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)
+ RE- MAE #3 (Hydrocarbon Release from Riser and Pipeline close to Platform)</td><td>On-Scene Commander</td><td>❑</td></tr>
<tr><td>Where and when safe to do so, an inspection class ROV and support vessel, will be mobilised to visually identify any subsea incident location.</td><td></td><td>Incident Commander/ Operations Team Leader</td><td>❑</td></tr>
<tr><td colspan="3">Resources</td><td colspan="2">Location</td></tr>
<tr><td colspan="2" rowspan="2">Equipment</td><td>Inspection class ROV.</td><td colspan="2">On vessels of opportunity Contracted at the time of incident.</td></tr>
<tr><td>Vessels</td><td colspan="2">Santos WA operational sites
Vessels of opportunity</td></tr>
<tr><td colspan="2">Personnel</td><td>Santos WA Facility Incident Response Team members</td><td colspan="2">Santos WA Operational sites</td></tr>
<tr><td colspan="2">Maintenance of response</td><td colspan="3">The resources to activate the pipeline ESDs are always present within the Reindeer and DC control room. Additional response tactics that may be implemented following a pipeline release (e.g. containment and recovery) are discussed separately.</td></tr>
</table>

8.4.1 Initial Response

The Devil Creek Incident Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate riser/ pipeline ESD systems, where they are not already triggered automatically. These following Major Incidents outlined within the DC IRP (DC-40-IF-00096) are applicable:

+ DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)
+ RE- MAE #3 (Hydrocarbon Release from Riser and Pipeline close to Platform)

Pipeline inventory will be minimised where possible through DCGP operations, to reduce the potential volume released to the marine environment.

8.4.2 Identification and Repair

Where and when safe to do so, an inspection class ROV and support vessel, will be mobilised to visually identify any subsea incident location, in addition to vessel and aerial surveillance conducted as per the Monitor and Evaluate Plan (**Section 9**).

Pipeline repair will involve the mobilisation a repair team taking into consideration requirements as specified under the 16" Reindeer Pipeline Operational Safety Case and Pipeline Management Plan (RE-14-RF-00036.02).

8.5 On-Shore Pipeline Release

Onshore pipeline failure includes the buried export pipeline (Reindeer 16" pipeline) between the shoreline and the boundary of the Devil Creek Gas Plant (DCGP). A conservative worst case credible spill is a release of 275 m^3 of Reindeer condensate. Gas will also be released leading to the potential for ignition and fire. This section covers the initial response to control the source of Reindeer condensate from an onshore pipeline release.

Table 8-10 provides the Environmental Performance Outcome, initiation criteria and termination criteria for 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. Refer to **Table 8-11** for the implementation guide for an onshore pipeline release.

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 8-10 Onshore pipeline release - Objectives, Initiation Criteria and Termination Criteria

On-Shore infrastructure failure		
Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.	
Activation criteria	Level-2/3 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	**x**
Termination criterion	The cargo in the leaking or ruptured pipeline is secured and release to the on-shore (terrestrial) environment is stopped.	
Refer to Section 8.6 for relevant Performance Objectives, Standards and Measurement Criteria.		

Table 8-11 Onshore Pipeline Release– Implementation Guide

Onshore Hydrocarbon Spill					
Activation time		Immediately upon receiving notification of incident/ spill.			
Action		Consideration		Responsibility	Complete
Initial Actions	The Devil Creek Incident Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate pipeline ESD systems	The following Major Incidents outlined within the DC IRP (DC-40-IF-00096) are applicable: + DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)		On-scene Commander	❑
Resources				Location	
Personnel		Incident Response Team		Devil Creek	

8.5.1 Initial Response

The Devil Creek Incident Response Plan (DC-40-IF-00096) details the initial actions to be taken by offshore and onshore personnel to activate pipeline ESD systems, where they are not already triggered automatically. The following Major Incidents outlined within the DC IRP (DC-40-IF-00096) are applicable:

- DC- Major Incident #8 (Hydrocarbon Release from the Import Pipeline)

8.5.2 Identification

For the buried onshore pipeline, a small leak from loss of integrity (corrosion) is more likely than a rupture from external impact. Where a small leak is below the limit of detection of automated ESD, identification of the leak may not occur until it is manually identified during routine pipeline ROW/easement surveillance.

The requirements and frequency of pipeline ROW/easement and surveillance for the buried onshore section of the Reindeer 16” pipeline is outlined within the Onshore Pipeline Inspection Procedure (OP-14-IG-00001). The surveillance is currently conducted every 6 months.

8.6 Source Control Environmental Performance

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

Table 8-12 Environmental performance outcomes, controls and performance standards for the operational monitoring response strategy

Environmental Performance Outcome	Implementation of source control methods to stop the release of hydrocarbons into the marine/onshore environment.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Source control – loss of well control	**Response Preparedness**		
	Source Control Emergency Response Plan	A Source Control Emergency Response Plan is in place during activity	Source Control Emergency Response Plan
	(Well specific) Source Control Plan	A (well specific) Source Control Plan is in place prior to a well intervention taking place	(Well specific) Source Control Plan
	MODU Capability Register	Monthly monitoring of the availability of MODUs to meet specifications for source control	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
	Industry Mutual Aid to facilitate and expedite the mobilisation of a relief well	APPEA MoU for mutual assistance for relief well drilling	Signatory of APPEA MoU
	Response Implementation		
	Drilling and Completions Source Control Team	Drilling and Completions Source Control Team mobilised within 24 hours of loss of well control	Incident Log
	Equipment/Services for Relief Well drilling	Equipment/Services for Relief Well drilling sourced within 5 days of loss of well control	Incident Log
	Well Control Specialists	Well control specialists mobilised within 72 hours of loss of well control	Incident Log
	Relief Well MODU	A Safety Case Revision for the relief well rig to be submitted within 14 days from the loss of well control	Incident Log Submission of Safety Case Revision

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 loss of well control.	Incident Log
	Relief Well Drilling	First well kill attempt within 77 days of loss of well control	Incident Log
	Source Control Emergency Response Plan (DR-00-ZF-10001)	Relief well drilling implemented in accordance to the Source Control Emergency Response Plan (DR-00-ZF-10001) during a loss of well control	Incident Log
Source control vessel collision	**Response Preparedness**		
	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
	Response Implementation		
	As per the vessel SOPEP	Actions to control vessel tank rupture followed in accordance with SOPEP.	Vessel logs
		SOPEP source control measures will be undertaken to contain and clean up oil spills on vessels.	Incident log Vessel logs
		Clean-up waste will be stored in bunded or sealed area for onshore disposal.	Incident log Vessel logs
		In the event of a hydrocarbon release from a fuel tank rupture, vessel master is to follow procedures outlined with the vessel’s SOPEP.	Incident log Vessel logs
		Response terminated when end-point criteria is met.	Incident log

9 Monitor and Evaluate Plan (Operational Monitoring)

Operational monitoring is key to gaining situational awareness of an oil spill and in helping to identify, assess and adapt spill response strategies such that environmental impacts are reduced to ALARP. Operational monitoring provides information that can be used to answer the following questions:

+ How much hydrocarbon has been spilt?
+ Is the source under control?
+ Where is the hydrocarbon going?
+ What are the chemical and physical properties of the hydrocarbon?
+ What is the observed and expected behaviour of the hydrocarbon that has been spilt?
+ Is there anything in the path of the predicted hydrocarbon travel zones?
+ Can the hydrocarbon be approached or are there safety concerns?
+ Will shoreline contact occur and protection/clean-up be required?
+ Will wildlife be affected and require response?

The sections below outline the operational monitoring strategies considered applicable to worst case spill events identified for Devil Creek operational activities.

9.1 Vessel Surveillance

Direct observations from the platform or vessels can be used to assess the location and visible extent of an oil spill, aid with the verification of spill trajectory modelling and inform the application and effectiveness of response strategies. 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 (e.g. gas/condensate).

Table 9-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 9-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 8.6 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-1 Vessel Surveillance – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Vessel Surveillance		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	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 no net environmental benefit being achieved. Vessel surveillance will terminate if there are unacceptable safety risks associated with gas and VOCs at the sea surface.	
Refer to **Section 9.11** for relevant Performance Objectives, Standards and Measurement Criteria.		

First-strike actions to be initiated by Santos WA are as detailed below.

Table 9-2 Vessel Surveillance – Implementation guide

Vessel Surveillance				
Activation time		Within 90 minutes for available onsite vessels		
Action		Consideration	Responsibility	Complete
Initial Actions	Request Vessel Master of nearest available Support Vessel to commence surveillance- direct to spill location	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 TL	❑
	Source additional contracted vessels of possible need for assistance.		Logistics Team Leader	❑
	Record surface slick location and extent, weather conditions, and marine fauna. Vessel surveillance forms are located in **Appendix C: Vessel Surveillance Observer Log**.	Trained observers will not be available immediately – photos and locations will provide initial information that can be interpreted by IMT.	Vessel Observers	❑

Vessel Surveillance				
Activation time		Within 90 minutes for available onsite vessels		
Action		Consideration	Responsibility	Complete
	Relay surveillance information (spill location, weather conditions, marine fauna sightings and visual appearance of the slick to the IMT (Operations and Planning TL)	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	❑
Resources			Location	
Equipment		Santos WA Contracted Support Vessel Vessels of Opportunity	Santos WA Operational Areas Dampier port	
Personnel		Support Vessel Crew	With vessel	
Systems		AIS vessel tracking software	Santos WA ER intranet	
Documentation		Bonn Code of Oil Appearance	Santos WA Procedures Index	
Maintenance of response		This response will be maintained through Santos WA's existing contractual arrangements with vessel suppliers, which will ensure that sufficient surveillance can be maintained. Regular rotations of vessel crews and refuelling runs will be timed with other surveillance vessels to maintain the response. Daily observations and reporting to IMT to be maintained. Observations may be undertaken by vessels undertaking other duties.		

9.2 Aerial Surveillance

Aerial surveillance is used to record the presence and characteristics of oil at surface and 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

Table 9-3 provides the objective, initiation criteria and termination criteria for this tactic. **Table 9-4** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-3 Aerial Surveillance - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Aerial Surveillance		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	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 no net environmental benefit being achieved.	
Refer to **Section 9.11** for relevant Performance Environmental Performance Outcome, Standards and Measurement Criteria.		

First-strike actions to be initiated by Santos WA are as detailed below.

Table 9-4 Aerial Surveillance – Implementation guide

Aerial Surveillance				
Activation time		Within 3 hours from notification		
Action		**Consideration**	**Responsibility**	
Initial Actions	Contact contracted helicopter provider – provide details of incident location and request aerial surveillance	Untrained oil observers (e.g. pilots) can perform initial surveillance of the spill to gain situational awareness. - recording extent and appearance of oil (including using photos where possible)	Operations TL Logistics TL	❑
	Identify available Santos WA Aerial Observers and deploy them to flight departure location	Santos WA maintains a record of current trained Aerial Observers comprising both field staff and office staff. Aerial Observers based in Perth can be mobilised to the airbase the day following activation. Field based observers may be available same day as notification.	Santos WA Emergency & Oil Spill Coordinator Logistics TL	❑

Aerial Surveillance				
Activation time		Within 3 hours from notification		
Action		Consideration	Responsibility	
	Develop flight plan (frequency and flight path) to meet IMT expectations. Expected that 2 overpasses per day of the spill area completed.	Flight plan to confirm with On-Scene Commander that aircraft are permitted in the vicinity of the spill. Flights are only to occur during daylight and in weather conditions that do not pose significant safety risks.	Operations Team Leader / Aviation Superintendent	❑
	Determine the spill extent by completing Aerial Surveillance Log (**Appendix D: Aerial Surveillance Observer Log**) and Aerial Surveillance Surface Slick Monitoring Template. Calculate volume of oil (**Appendix E: Aerial Surveillance Surface Slick Monitoring Template**). Take still and/or video images of the slick. Thickness estimates are to be based on the Bonn Agreement Code (Santos WA Procedure Index)		Aerial Observer	❑
	Record presence and type of fauna by completing the Aerial Surveillance Marine Fauna Sighting Record Sheet (**Appendix F: Aerial Surveillance Marine Fauna Sighting Record**)		Aerial Observer	❑
	Record shoreline habitat type and degree of oiling by completing the Shoreline Aerial Reconnaissance Log (**Appendix G: Aerial Surveillance Shoreline Observation Log**)	Thickness estimates are to be based on the Bonn Agreement Code (Santos WA Procedure Index)	Aerial Observer	❑

Aerial Surveillance				
Activation time		Within 3 hours from notification		
Action		Consideration	Responsibility	
	Relay all surveillance records: logs, forms, photographic images, video footage to the IMT (Operations/Planning TLs) following completion of survey (nominally 2 reports per day)	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	❑
Resources			Location	
Equipment		Helicopters through Santos WA contracted aircraft suppliers.	Karratha	
		Aerial Observer Kits (GPS, camera, forms)	Perth, Varanus Island	
Personnel		Santos WA Trained Aerial Observers, Industry Aerial Observers through AMOSPlan Mutual Aid	Perth, NWS various	
Document		Bonn Agreement Code	Santos WA Procedure Index	
Maintenance of response		Aerial surveillance will be maintained through continual procurement of additional aircraft as required from Perth, the Pilbara regions and interstate. Trained Aerial Observers will be rotated on a roster throughout the response.		

Santos WA maintains a trained pool of Aerial Observers comprising both field staff and office staff, with field staff located for quick deployment.

Initial aerial surveillance support can be provided from Karratha utilising on-contract helicopters to Santos WA. Flying time to location from Karratha is 15 to 25 minutes with up to 120 minutes loiter time onsite.

9.3 Tracking Buoys

Table 9-5 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 9-6** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-5 Tracking Buoys - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Tracking Buoys		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	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 Combat Agency or NEBA is no longer being achieved.	
Refer to Section 9.11 for relevant Performance Objectives, Standards and Measurement Criteria.		

Santos WA maintains a minimum of 12 spill tracking buoys across their North West Shelf operations available for deployment in the event of a spill. These are located on Santos WA facilities, contracted drilling rigs and support vessels. Each buoy acquires GPS data at 20 second intervals and transmits once every 30 minutes.

First-strike actions to be initiated by Santos WA as detailed below.

Table 9-6 Tracking Buoys – Implementation guide

Tracking Buoys				
Activation time		Mobilisation within 2 hours upon request from IMT or On-Scene Commander (deployment time subject to vessel locations and weather conditions)		
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Organise vessel to mobilise tracking buoys from Varanus Island or Santos WA Dampier logistics yard to the spill site.	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 Supervisor/ Operations Team Leader	❑
	Deploy tracking buoy at leading edge of plume:	Note deployment details and weather conditions in incident log	Vessel Master	❑
	Monitor movement of tracking buoys	Refer login details of tracking buoy monitoring website on Santos WA ER intranet site	On-Scene Commander and/or IMT Planning Team Leader/GIS	❑

<table>
<tr><th colspan="5">Tracking Buoys</th></tr>
<tr><td colspan="2">Activation time</td><td colspan="3">Mobilisation within 2 hours upon request from IMT or On-Scene Commander (deployment time subject to vessel locations and weather conditions)</td></tr>
<tr><td colspan="2">Action</td><td>Consideration</td><td>Responsibility</td><td>Complete</td></tr>
<tr><td rowspan="2"></td><td>Use tracking buoy data to integrate into Common Operating Picture</td><td></td><td>IMT Planning Team Leader/GIS</td><td>❑</td></tr>
<tr><td>Relay information to spill fate modelling supplier for calibration of trajectory modelling</td><td></td><td>Environmental Team Leader</td><td>❑</td></tr>
<tr><td>Escalation and Ongoing Response Actions</td><td>Mobilise additional tracking buoys if required from other Santos WA operations (Santos WA presently has 12 Tracker Buoys located on the NWS). Develop plan for rolling recovery and deployment of buoys if there is a continuous release.</td><td></td><td>Logistics Team Leader
Operations Team Leader</td><td>❑</td></tr>
<tr><td colspan="3">Resources</td><td colspan="2">Location</td></tr>
<tr><td colspan="2" rowspan="3">Equipment</td><td>Santos WA Contracted Support Vessel
Vessels of Opportunity</td><td colspan="2">Santos WA Operational Areas
Dampier port</td></tr>
<tr><td>Tracking buoys (12 in total)</td><td colspan="2">Various</td></tr>
<tr><td>Additional tracking buoys</td><td colspan="2">AMOSC/ AMSA/ OSRL</td></tr>
<tr><td colspan="2">Personnel</td><td>Vessel crew</td><td colspan="2">With vessel</td></tr>
<tr><td colspan="2" rowspan="2">Systems</td><td>AIS vessel tracking software</td><td colspan="2">Santos WA ER intranet</td></tr>
<tr><td>Tracking buoy tracking software</td><td colspan="2">Santos WA ER intranet</td></tr>
<tr><td colspan="2">Maintenance of response</td><td colspan="3">Additional tracking buoys will be procured as required during the response through existing contracts with service providers. The need for additional monitoring buoys will be determined by the Santos WA Emergency & Oil Spill Coordinator based on available information.</td></tr>
</table>

9.4 Spill Fate Modelling

Table 9-7 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 9-8** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-7 Spill Fate Modelling - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Spill Fate Modeling		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	Spill fate modelling will continue for 24 hours after the source is under control and surface sheens or in-situ hydrocarbons are no longer detectable, or until no longer beneficial to predict spill trajectory and concentrations.	
Refer to **Section 9.11** for relevant Performance Objectives, Standards and Measurement Criteria.		

A spill modelling service provider will be used to provide forecast spill fate modelling to assess the direction, speed, and potential impacts of the spill. At the time of OPEP preparation, Santos WA has engaged RPS APASA to provide forecast spill fate modelling. RPS APASA use SIMAP and OILMAP modelling systems that comply with Australian Standards (ASTM Standard F2067 "Standard Practice for Development and Use of Oil Spill Models"). APASA 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.

The spill fate modelling service is to be initiated by the submission of the RPS APASA trajectory modelling request form by the IMT (Santos WA Procedure Index). RPS APASA 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. Operational surveillance data (aerial, vessel, tracker buoys) is to be provided to RPS APASA to verify and adjust fate predictions of the spill and improve predictive accuracy.

First-strike actions to be initiated by Santos WA as detailed below.

Table 9-8 Oil Spill Fate Modelling– Implementation guide

Spill Fate Modelling				
Activation time		Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill. Spill modelling to be initiated within 24 hours. As per contractual agreements with the modelling service provider RPS APASA, upon activation and when requested by Santos WA, will provide trajectory models with the following minimum delay (or otherwise agreed with Santos WA on a case-by-case basis); Within 2 hours for OILMAP model for offshore and open ocean Within 4 hours for OILMAP operation for near-shore		
Action		Consideration	Responsibility	Complete
Initial Actions	Initiate spill modelling by submission of a trajectory modelling request form (Santos WA Procedure Index) to RPS APASA. Request for 3 day forecast trajectory modelling	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	Environmental Team Leader	❑
	Determine requirement for gas/VOC modelling and request initiation from RPS APASA	Gas/condensate 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	❑
	Any operational surveillance data (aerial, vessel, tracker buoys) to be provided to RPS APASA to verify and adjust fate predictions of the spill and improve predictive accuracy		Environment Team Leader Planning Team Leader	❑
	Login to the RPS APASA data sharing website and maintain connection. Download modelling results and report to GIS Support (refer Santos WA Procedure Index)		Planning Team Leader GIS Support	❑

<table>
<tr><th colspan="5">Spill Fate Modelling</th></tr>
<tr><td colspan="2">Activation time</td><td colspan="3">Oil Spill Modelling provider will be contacted immediately (within 2 hours) upon notification of a Level 2 or 3 spill. Spill modelling to be initiated within 24 hours.
As per contractual agreements with the modelling service provider RPS APASA, upon activation and when requested by Santos WA, will provide trajectory models with the following minimum delay (or otherwise agreed with Santos WA on a case-by-case basis);
Within 2 hours for OILMAP model for offshore and open ocean
Within 4 hours for OILMAP operation for near-shore</td></tr>
<tr><th colspan="2">Action</th><th>Consideration</th><th>Responsibility</th><th>Complete</th></tr>
<tr><td></td><td>Place RPS APASA modelling data onto the Santos WA Mapping System (Common Operating Procedure)</td><td></td><td>GIS Support</td><td>❑</td></tr>
<tr><td></td><td>Update IMT on spill trajectory.</td><td>Spill trajectory modelling is key data that will identify environmental sensitivities at risk, guide response strategies and objectives and help determine relevant jurisdictional spill response arrangements.</td><td>Planning TL</td><td>❑</td></tr>
<tr><th colspan="3">Resources</th><th colspan="2">Location</th></tr>
<tr><td colspan="2">Equipment</td><td>Modelling provided by service provider (e.g. RPS APASA).</td><td colspan="2">Perth</td></tr>
<tr><td colspan="2">Personnel</td><td>Modellers</td><td colspan="2">RPS APASA</td></tr>
<tr><td colspan="2">Documentation</td><td>Trajectory Modelling Request Form and Login Instructions</td><td colspan="2">Santos WA Procedures Index</td></tr>
<tr><td colspan="2">Maintenance of response</td><td colspan="3">This response will be maintained through contracts with suppliers to maintain spill trajectory modelling services to Santos WA. Modelling service providers have a 24 hr, 7-day capability.</td></tr>
</table>

9.5 Satellite Imagery

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.

Table 9-9 provides the Environmental Performance Outcome, initiation criteria and termination criteria for 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.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-9 Satellite Imagery - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Satellite Imagery		
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	Reindeer Condensate	Diesel
	✔	✔
Termination criterion	Satellite monitoring will continue until no further benefit is achieved from continuing; or as advised by relevant Control Agency.	
Refer to **Section 9.11** for relevant Performance Objectives, Standards and Measurement Criteria.		

Suitable imagery may be available satellite imagery suppliers. This can be done through existing contract with AMOSC and OSRL. 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.

Table 9-10: Satellite Imagery Implementation Guide

Satellite Imagery				
Activation time		*3-4 hours*		
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		Incident Commander 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	❑
Resources			**Location**	
Equipment		Satellite access provided by service providers (AMOSC and OSRL)	Provided by AMOSC and OSRL	

Personnel	Provided by service providers (AMOSC and OSRL)	Provided by AMOSC and OSRL
Maintenance of response	This response will be maintained through contracts with suppliers to maintain satellite imagery services to Santos WA.	

9.6 Initial Oil Characterisation

Table 9-11 provides the Environmental Performance Outcome, initiation criteria and termination criteria for 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. Refer to **Table 9-12** for the implementation guide for initial oil characterisation.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-11 Initial Oil Characterisation - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Initial Oil Characterisation		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	Oil sample and analysis to occur to terminate once enough data has been collected to profile the oil behaviour throughout weathering and to provide oil for toxicity testing.	
Refer to **Section 9.11** for relevant Performance Objectives, Standards and Measurement Criteria.		

Table 9-12: Initial Oil Characterisation Implementation Guide

Initial Oil Characterisation				
Activation time		Source and spilled oil samples collected with 24 hrs of activation of initial oil characterisation response tactic		
	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	❑
	Confirm suitable equipment onboard for sampling. Confirm sampling methodology Confirm laboratory for sample analysis Develop H&S requirements/ controls	Oil sampling kits incl sample bottles for laboratory analyses are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier. Appendix A and D of CSIRO oil spill monitoring handbook provide suitable procedure PPE and gas/VOC monitoring to be considered in context of release scenario (gas/condensate has highest rick)	Environment TL Safety TL	❑
	Vessel directed to sampling location	Sampling of oil at thickest part of slick – typically leading edge	Operations Team Leader Environment TL	❑
	Vessel crew to undertake sampling and delivery of samples to VI or Dampier for dispatch to laboratory. Environmental TL to confirm analysis of oil with lab	Varanus Island Hub and/or Dampier Supply Base personnel to assist with logistics of sending oil samples to laboratory for analysis.	Operations Team Leader Environmental TL Logistics TL	❑
	Continue sample collection for 14 day 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	Operations Team Leader Environment Team Leader Logistics Team Leader	❑

Initial Oil Characterisation				
Activation time	Source and spilled oil samples collected with 24 hrs of activation of initial oil characterisation response tactic			
Action	Consideration	Responsibility	Complete	
	monitoring once mobilised to site.			
Resources		Location		
Equipment	Hydrocarbon sampling equipment	Oil sampling kits incl sample bottles for laboratory analyses are currently being procured with the intent to store at Varanus Island and logistics yards at Exmouth and Dampier. Also provided through Monitoring Service Provider (once activated)		
	Nominated laboratories (Intertek Geotech / ESA or suitable alternatives).	Australia		
	Vessels of opportunity and contracted vessels	Within area of operations		
Personnel	Vessel crew Monitoring Service Provider	With vessel Perth, WA		
Documentation	Appendix A and D of CSIRO oil spill monitoring handbook	Santos WA Procedure Index		
Maintenance of response	Given the frequency and nature of hydrocarbon fingerprinting analysis, any of the analytical laboratories in area capable of sustaining hydrocarbon fingerprinting throughout a response.			

Given diesel is a common fuel type with known properties and Reindeer condensate 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 **Section 3.2**. Nevertheless, sampling and analysis of the released hydrocarbon will provide the most accurate information on the hydrocarbon properties at the time of release, as well as providing information on the effect of natural weathering at sea on these properties over time.

Using onsite vessels of opportunity, oil samples (minimum 2L) 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. Forensic fingerprinting of the released hydrocarbon, potentially allows contamination to be traced back to the source where this is otherwise unclear on in dispute.

Sampling of the released hydrocarbon is also to undertaken to provide samples for use in ecotoxicology analysis allowing the toxicity of different concentrations of the hydrocarbon to marine organisms to be assessed experimentally.

Ecotoxicology assessment of the oil will also be conducted at an ecotoxicology laboratory following the Australian and New Zealand Water and Sediment Quality Guidelines (ANZECC/ARMCANZ 2000 Guidelines). A minimum of 5 species across 4 taxonomic groups are to be used as the basis of toxicity tests. 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 ANZECC/ARMCANZ 2000 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). These species protection trigger levels will be used to aid interpretation of spill trajectory modelling outputs and inform the NEBA process.

9.7 Operational Water Quality Monitoring

9.7.1 Operational Water Sampling and Analysis

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.

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 16).

Table 9-13 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for 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. Refer to **Table 9-14** for the Operational Water Quality Sampling and analysis implementation guide. **Table 9-15** presents the water quality sampling and analysis plan considerations.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-13 Operational Water Sampling and Analysis - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Operational Water Sampling and Analysis		
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	**Reindeer Condensate**	**Diesel**
	▪ ✔	▪ ✔

Operational Water Sampling and Analysis	
Termination criterion	Operational water sampling and analysis will continue for 24 hours following control of the source provided oil is no longer detectable. Vessel surveillance will terminate if there are unacceptable safety risks associated with volatile hydrocarbons at the sea surface.

Table 9-14: Operational Water Quality Sampling and Analysis Implementation Guide

Operational Water Quality Sampling and Analysis				
Activation time		Activation is to follow that for mobilising water quality sampling personnel and equipment for the Water Quality Scientific Monitoring Plan (SMP1).		
	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 9.7) – Monitoring s 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** 9-15 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 when sampling condensate/diesel spills	Refer Oil Spill Response Safety Management Manual (QE-91-RF-10016)	Monitoring Service Provider Safety Team Leader	❑
	Source vessels for monitoring meeting Monitoring Service provider requirements	Monitoring Service provider to outline requirements in resource request form	Logistics Team Leader	❑
	Monitoring Service Provider to assemble team/s and water quality monitoring equipment			❑
	Organise Vessels, accommodation and transport requirements to mobilise monitoring team/s to site		Logistics Team Leader	❑
	Sampling and analysis undertaken. Daily communication and		Monitoring Service Provider	❑

Operational Water Quality Sampling and Analysis				
Activation time		Activation is to follow that for mobilising water quality sampling personnel and equipment for the Water Quality Scientific Monitoring Plan (SMP1).		
Action		Consideration	Responsibility	Complete
	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.		On-scene Commander Operations Team Leader Environment Team Leader Logistics Team Leader	
	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	❑
Resources			Location	
Equipment		Water sampling equipment to be provide through Monitoring Service Provider (MSP)	Perth, WA	
		Vessels of Opportunity, Santos WA contracted vessels	In the area of Operations	
Personnel		Monitoring Service Providers (MSPs), vessel crew	Perth, WA, in the area of operations,	
Maintenance of response		Response to be maintained through rotation of monitoring teams/vessel crew as required with monitoring action plan reviewed and assessed each operational period as part of IAP revision.		

Table 9-15: 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. The sampling will occur within the predicted or observed position of the spill on surface or the underwater plume. The positioning of water quality locations will be informed by other operational monitoring inputs (for example spill fate modelling, aerial surveillance).
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 reploicates. + 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;

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

9.7.2 Continuous Fluorometry Surveys

In addition to operational water sampling and sensor deployment at discrete locations, a continuous fluorometry survey(s) may be run across the expected 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.

Table 9-16 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this tactic. **Table 9-17** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-16 Fluorometry Surveys - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Fluorometry surveys		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	Continuous fluorometry surveys will continue for 24 hours following control of the source provided oil is no longer detectable.	
Refer to **Section 9.11** for relevant Performance Objectives, Standards and Measurement Criteria.		

Sub surface gliders containing fluorometers built into the body of the glider will be used preferentially for this monitoring. 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.

In the event that sub surface fluorometers are unavailable, towed fluorometers towed behind vessels will be used as an alternative or complementary approach.

Santos WA has access to a local provider (Blue Ocean Monitoring) of subsea gliders with fluorometer sensors for the monitoring of entrained oil following an oil spill. This service, as well as access to multiple towed fluorometers are available from OSRL through Santos WA's Associate Member Contract.

The fluorometry implementation guide is detailed in **Table 9-17**.

Table 9-17 Fluorometry Surveys – Implementation guide

Continuous Fluorometry Surveys				
Activation time		Within 24 hours of request by IMT. Deployment within 5 days of activation.		
	Action	Consideration	Responsibility	Complete
Initial Actions	Activate OSRL/Blue Ocean monitoring and determine availability of subsea gliders and towed fluorometry equipment.		Incident Commander Environment TL	❑
	If gliders and pilot/s available, engage Blue Ocean Monitoring to develop Monitoring Action Plan.	Arrange joint meeting with spill modelling provider (RPS) and Blue Ocean to develop monitoring design and ongoing data transfer protocols to meet objective of model validation.	Environment TL	❑
	If gliders unavailable and towed flurometers to be used, engage Monitoring Service Provider to develop Monitoring Action Plan for towed fluorometry as part of Operational Water Sampling and Analysis – refer Table 9-13 for actions.	OSRL can provide specialist technical advice on operation of towed flurometers. Consider: Engaging OSRL for review and input into monitoring Action plan for towed fluorometry Mobilising OSRL responder to assist with towed fluorometry survey.	Monitoring Service Provider Environment TL OSRL Technical Adviser/ responder	❑
	Source vessel for deployment of glider	Deployment may be achieved by Monitoring Service Provider using vessel tasked for operational monitoring.	Logistics TL Operations TL	❑
	Deploy glider near intended monitoring location	Deployment may be achieved by Monitoring Service Provider using vessel tasked for other operational water quality monitoring activities.	Operations Team Leader Monitoring Service Provider/ Blue Ocean Monitoring	❑
	Pilot glider remotely along glide path considering daily		Blue Ocean monitoring	❑

Continuous Fluorometry Surveys				
Activation time		Within 24 hours of request by IMT. Deployment within 5 days of activation.		
Action		Consideration	Responsibility	Complete
	predictions of spill trajectory provided by modelling provider			
	Provide real time data uploads from sub surface gliders to be available to IMT/ Spill Modelling Provider through web portal.		Blue Ocean monitoring	❑
	Monitoring results to be incorporated into common operating picture		Planning TL GIS Support Environment TL	❑
Resources			Location	
Equipment		Sub surface gliders, remote support system, pilot and deployment personnel	Blue Ocean Monitoring (Perth)	
		Towed fluorometers	OSRL (Singapore)	
		Santos WA Vessel/s for glider deployment or towed fluorometry	Santos WA Operational areas Dampier port	
Personnel		Blue Ocean Monitoring (Perth)	Perth	
		Monitoring Service Provider	Perth	
		OSRL Technical Adviser (fluorometry)	Singapore	
Maintenance of response		Response to be maintained through rotation of monitoring personnel/vessel crew as required with monitoring action plan reviewed and assessed each operational period as part of IAP revision.		

9.8 Low Flow Well Leak Monitoring

Table 9-18 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this activity.

Table 9-18: Low Flow Leak Monitoring - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Low Flow Well Leak Monitoring		
Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.	
Initiation criteria	Subsea inspection activities identify a low flow well leak.	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	x
Termination criterion	Operational monitoring will terminate when risk assessment indicates negligible risk to the environment and well integrity risk assessment indicates no risk of escalation.	

The Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; EA-14-RI-10002.01) outlines the potential for a very low flow leak to occur from a subsea well (Reindeer-1 well) in Commonwealth waters. While other worst case oil spills are identified and reacted upon immediately due to their size, there is the potential for a low flow subsea well leak (gas and/or liquid hydrocarbon) to go undetected until subsea inspection activities (e.g. ROV surveys) identify the leak. These low flow leaks are not detectable by remote subsea systems (e.g. pressure monitoring systems), or remote monitoring systems are not in place, and may not be observable by visual surveillance at the water surface.

Where a subsea low flow well leak is detected through inspection activities the following will occur:

- A subsea operational monitoring survey (e.g. by ROV) will be undertaken to characterise the volume and composition of hydrocarbon released.
- Where there is potential for liquid hydrocarbon to be released, water quality monitoring will also occur at the release site to determine if detectable hydrocarbons in the water column.
- An environmental risk assessment will be undertaken, informed by survey results, which will consider the following aspects of the leak:
  - Rate of flow,
  - Worst case length of time leak undetected and worst case volume released,
  - composition of hydrocarbon,
  - water quality monitoring results (as applicable),
  - potentially impacted nearby environmental receptors
- An updated well integrity risk assessment will be carried out based on the outcomes of the operational monitoring survey to assess the risk of escalation and establish appropriate action to manage well integrity risk to ALARP.
- Pending the outcomes of the environmental risk assessment and updated well integrity risk assessment, further operational monitoring will be repeated to characterise the change in release rate (and change in water quality as applicable).
- The operational monitoring program and environmental assessment will be documented in an incident action plan, updated to reflect ongoing survey planning and results.

Section 8.4 of the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; EA-14-RI-10002.01) outlines the Environmental Performance Standard and Measurement Criteria for this activity.

The low flow leak environmental risk assessment and water quality monitoring results (as applicable) will determine if initiation criteria for oil spill scientific monitoring as outlined within **Section 16** have been met. If initiation criteria have been met scientific monitoring as per the SMP will occur.

9.9 Shoreline and Coastal Habitat Assessment

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 Controlling 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 9)**.

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, the actual survey objectives, methodology, deployment locations and resource allocation will be controlled by DoT, as the Controlling Agency (with Santos WA acting as a Supporting Agency) and therefore may differ from that included below.

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

Table 9-19 provides the Environmental Performance Outcome, initiation criteria, termination criteria and other key aspects for this tactic. This table also 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. The implementation guide for Shoreline and Coastal Habitat and Assessment is found in **Table 9-20**.

Section 9.11 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 9-19 Shoreline and Coastal Habitat Assessment - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Shoreline and Coastal Habitat Assessment		
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	As directed by DoT	

Table 9-20: Shoreline and coastal Habitat Assessment Implementation Guide.

Shoreline and Coastal Habitat Assessment				
Activation time		On initiation criteria		
Action		**Consideration**	**Responsibility**	**Complete**
Initial Actions	Ensure initial notifications to WA DoT have been made	Refer to Section 6 for reporting requirements	Environment Team Leader	❑
	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Controlling Agency for assistance in identification of priority protection areas and NEBA.		Environment Team Leader Planning Team Leader	❑
	Actions below are indicative only and are at the final determination of DoT as the Control Agency			
	Mobilising the AMOSC core group responders.		Incident Commander Operations Team Leader Logistics Team Leader	❑
	Assessment of shoreline character, habitats and fauna.	Assessment includes: + shoreline structured biotic habitats + distribution of fauna + shoreline energy and processes (e.g. wave energy, tidal flows + shoreline substrate (e.g. mud, sand, pebble, rock) + shoreline form (e.g. width, shape and gradient) access/ safety constraints	AMOSC Core group and DOT	❑
	Assessment of shoreline oiling (if present).	Assessment includes: + surface distribution and cover + subsurface distribution	AMOSC Core group and DOT	❑

Shoreline and Coastal Habitat Assessment				
Activation time		On initiation criteria		
	Action	Consideration	Responsibility	Complete
		+ oil type, thickness, concentration and physical character + sampling of oil for laboratory analysis		
	Recommendations for response strategies.	Considerations include: + applicable strategies based on oil type and habitat + potential access, safety and environmental constraints + likely resourcing (personnel and equipment) requirements	AMOSC Core group and DOT	❑

Resources		Location
Equipment	Santos WA contracted vessels and vehicles as required for shoreline access.	Karratha, Exmouth etc (dependent upon spill trajectory).
	Santos WA aerial surveillance reports	Aerial surveillance monitor and evaluate tactic
Personnel	Shoreline clean-up specialists and other trained oil spill responders	Perth, WA
	AMOSC Core Group	Provided by AMOSC
	DoT State Response Team	Provided by DoT
	AMSA National Response Team	Provided by AMSA
Documentation	DOT Shoreline Assessment guide and forms.	DoT
Maintenance of response	Santos maintains internal resources, and has contracts with external service providers, by which shoreline and coastal habitat assessment can be maintained for the duration of a spill response. Assessment teams will be supported by Santos' existing logistics and supply arrangements (e.g. vessel providers, freight etc.)	

9.10 Operational Monitoring Data Collection and Frequency

Table 9-21 outlines details of operational monitoring data that will be collected. This includes details on frequency of collection and reporting/data transfer back to the IMT. Operational monitoring informs situational awareness, which feeds into the Incident Action Planning/NEBA process carried out for each operational period. This is typically on a daily basis during the initial stages of incident response where information is changing rapidly and response strategies are being initiated. Section 6 provides further detail on how situational awareness information is used through the IAP process.

Table 9-21 Details of Operational Monitoring Data Collection and Transfer

Strategy	Initiation	Platform	Data Provided	Tools	Field Personnel	IMT Reporting Contact	Frequency
Vessel surveillance	Within 90 minutes of spill	Santos WA contracted support vessels Vessels of opportunity	Spill location Weather conditions Slick appearance Marine fauna presence	Digital imagery GPS Vessel surveillance forms Bonn agreement code	Vessel crew Company site representative	Operations TL Planning TL	Collection: Minimum daily while surveillance is undertaken Reporting: minimum daily while surveillance is undertaken
Aerial surveillance	Initiated within 3 hours of notification of Level 2/3 spill	Santos WA contracted helicopter provider	Spill location Slick appearance Marine fauna presence	Imagery and video GPS Aerial surveillance forms and map templates Bonn agreement code	Pilots Trained Aerial Observers	Operations TL Planning TL	Deployment: 2 overpasses per day (am/pm) while surveillance is undertaken Reporting: 2 reports per day (am/pm) while surveillance is undertaken
Tracking buoys	Mobilisation within 2 hours of notification of Level 2/3 spill Mobilisation at discretion of On-scene Commander for Level 1 spill	Santos WA contracted support vessel	Current direction/ spill front movement	Satellite tracking buoys Satellite tracking website	Vessel crew	Operations TL Planning TL	Deployment: As required – nominally up to 4 per day Reporting: Position updates every 30 minutes
Spill trajectory modelling	Level 2/3 spill	N/A – office based	Spill trajectory predictions Oil weathering predictions Shoreline loading predictions	Trajectory modelling request form Modelling provider data portal	N/A – office based	Environment TL Planning TL	Reporting: minimum daily updates Trajectory modelling to be provided within 2 hours of initial request.
Satellite imagery	Level 2/3 spill	Satellites	Spill size and location	Satellite imagery data portal	N/A – office based	Environmental TL Planning TL	Reporting: Subject to satellite overflight schedule
Initial oil characterisation	Level 2/3 spill	Vessels of opportunity Santos WA contracted vessels	Oil physical and chemical characteristics Oil ecotoxicity	Digital imagery GPS Oil sampling equipment Ecotoxicology and oil analysis laboratories	Monitoring provider Vessel crew	Operations TL Planning TL Environment TL	Oil collection: Daily for 14 days if possible (physical and chemical characteristics) Field reports: Daily Lab reporting: As results available
Operational water sampling and analysis	Initiated on Level 2/3 spill Mobilisation within 72 hours of accepted SoW	Santos WA contracted vessels	Water quality samples (surface and at depth) – oil detection and related parameters Real-time CTD readings - oil detection and related parameters	Water sampling equipment CTDs GPS WQ analysis laboratories	Monitoring provider Vessel crew	Operations TL Planning TL Environment TL	Sampling: Daily Field reports: Daily Lab reporting: As results available

Strategy	Initiation	Platform	Data Provided	Tools	Field Personnel	IMT Reporting Contact	Frequency
Continuous fluorometry surveys	Initiated on Level 2/3 spill	Santos WA contracted vessels (towed fluorometry) Vessels of opportunity (glider deployment)	Fluorometry – subsea oil detection	Towed fluorometers Subsea gliders with fluorometry Calibration standards	Vessel crew Monitoring provider Subsea glider deployment and monitoring personnel	Operations TL Planning TL Environment TL	Field reports: Daily Data reports: daily during survey period
Shoreline and coastal habitat assessments	Operational monitoring predicts or observes shoreline contact from surface oil; or As directed by DoT	Vehicles Santos WA contracted vessels By foot	Shoreline character Access constraints Distribution flora and fauna Degree of oiling	Shoreline survey forms Digital imagery and video GIS mapping	AMOSC core group responders State and National Response Teams	Operations TL Planning TL	Field reports: Daily

9.11 Monitor and Evaluate Plan Environmental Performance

Table 9-22 indicates the Environmental performance outcomes, controls and performance standards for the Monitor and Evaluate response strategy.

Table 9-22 Environmental performance outcomes, controls and performance standards for the operational monitoring response strategy

Environmental Performance Outcome	**Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.**		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Monitor and Evaluate	**Surveillance**	**Response Preparedness**	
	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
	Surveillance	**Response Implementation**	
	Vessel Surveillance	Vessel Surveillance strategy initiated within 90 minutes following request from IMT (i.e. begin to source vessels for surveillance)	Incident log
		Daily observation reports submitted to IMT until termination criteria is met	Incident log
	Aerial Surveillance	Aerial Surveillance initiated within 3 hours	Incident log

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
		following request from IMT	
		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 observer log following completion of flight	Aerial Observer Logs
		Aerial surveillance continues until termination criteria are met	Incident log
	Tracking Buoys	**Response Preparedness**	
	Tracking Buoys available	Maintenance of 12 tracker buoys throughout the activity	Computer tracking software Tracker buoy tests
		Response Implementation	
		Tracking buoys mobilisation within 2 hours of request from On-Scene Commander or Operations Team Leader	Incident log
		Tracking buoys utilised until termination criteria met	Incident log
	Oil Spill Modelling	**Response Preparedness**	
	Maintenance of contract for emergency response modelling	Maintenance of contract for forecast spill trajectory modelling services throughout activity	Modelling services contract

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Oil Spill Modelling	**Response Implementation**	
	Oil Spill Modelling available	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
		Modelling continues until termination criteria are met	Incident Log
	Satellite Imagery	**Response Preparedness**	
	Satellite imagery available	Contract in place with third party provider to enable access and analysis of satellite imagery	Contract with service provider
	Satellite Imagery	**Response Implementation**	
	Satellite imagery available	Data incorporated into common operating picture and provided to spill modelling provider	Incident Log and Incident Action Plan
	Oil and Oil in Water Monitoring	**Response Preparedness**	
	Maintenance of Monitoring Service Provider contract for water quality monitoring services	Maintain access to specialist monitoring personnel and equipment by maintaining contract with Monitoring Service Provider throughout activity	Contract with monitoring service provider
	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 flurometry equipment

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Oil and Oil in Water Monitoring	**Response Implementation**	
	Initial Oil Characterisation	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 (minimum 5 species' tests) within 24 hours of receiving all results	Incident Log
	Operational Oil and Oil in Water Monitoring	Identify if water quality monitoring is required within 2 hours of receiving spill and receptor information	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
	Shoreline Assessment	**Response Preparedness**	
	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

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	Shoreline Assessment	**Response Implementation**	
	Shoreline assessment	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 maximise effective utilisation of resources	Incident Log
	Use of shallow draft vessels for shoreline and nearshore operations	Shallow draft vessels are used for shoreline and nearshore operations unless directed otherwise by the designated Control Agency (i.e. DoT).	Vessel specification documentation contained in IAP.
	OSR Team Leader assessment/selection of vehicle appropriate to shoreline conditions	OSR Team Leader assess/select vehicles appropriate to shoreline conditions	IAP demonstrates requirement is met
	Conduct shoreline/nearshore habitat/bathymetry assessment	Unless directed otherwise by the designated Control Agency (i.e. DoT) a shoreline/ nearshore habitat/ bathymetry assessment is conducted prior to nearshore activities.	IAP records assessment records
	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.

Environmental Performance Outcome	Implement monitor and evaluate tactics in order to provide situational awareness to inform IMT decision making.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
	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.

10 Mechanical Dispersion Plan

In the event of thin oil sheens resulting from an oil spill following weathering, vessel based mechanical dispersion can be used to assist with the natural dispersion process, encouraging localised areas of an oil slick to mix and suspend within the water column where it can be more easily biodegraded. This is especially beneficial if patches of floating oil are in close proximity to sensitivities at risk from floating oil (e.g. birdlife, mangrove habitat). To do this vessels are deployed to implement mechanical dispersion by way 'prop washing' through the slick. As with other vessel based techniques the health and safety risks of operating over condensate spills in terms of potential gas and Volatile Organic Compounds (VOCs) exposure must be considered.

Table 10-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 10-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 10.1 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 10-1 Mechanical Dispersion - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Mechanical Dispersion Plan		
Environmental Performance Outcome	Implement mechanical dispersion to reduce the concentration of surface hydrocarbons to reduce contact with protection priorities.	
Initiation criteria	Monitoring by the IMT 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. Assessment by the IMT indicates the oil is thin enough on the surface of the water to be dispersible using vessel prop-washing techniques	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	✓

Termination criterion	There is no further environmental benefit or observed effectiveness in dispersing floating oil underwater through mechanical dispersion. Vessel surveillance will terminate if there are unacceptable safety risks associated with gas and VOCs at the sea surface.
Refer to **Section 10.1** for relevant Performance Objectives, Standards and Measurement Criteria.	

Mechanical dispersion can be initiated through use of vessels currently on hire to Santos WA in addition to vessels of opportunity (VOO) that may be involved with the spill response.

Assessment for the applicability of mechanical dispersion will continue throughout the spill response, and utilised when weather and sea conditions are not conducive to natural dispersion of thin oil sheens, and shorelines or wildlife are under threat.

First-strike actions to be initiated by Santos WA as detailed below.

Table 10-2 Mechanical Dispersion – Implementation Guide

Mechanical Dispersion				
Activation time		As directed by the IMT.		
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	Operations Team Leader Environment Team Leader Planning Team Leader	❑
	Safety team lead to develop a safety plan for the activity with respect to dangerous gasses and VOC's (including applicable controls).		Operations Team Leader Safety Team Leader	❑
	Notify Vessel Master of nearest available Support Vessel to commence 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 the Operational NEBA.		Vessel Master/s Santos WA AMOSC Core Group Responders	❑
	Source additional contracted vessels if possible need for assistance.		Operations Team Leader Logistics Team Leader	❑
Resources			Location	
Equipment		Deployment vessels Vessel availability accessed through Santos WA Emergency Response Intranet Site	Santos WA Operational sites	
Personnel		Santos WA Facility Incident Response Team members Santos WA AMOSC Core Group Responders	Santos WA Operational sites (including Devil Creek and Varanus Island)	
		Vessel Personnel	With Vessel	
Maintenance of response		Santos has access to vessel service providers by which this response strategy can be maintained. Vessel availability may be restricted by other needs (e.g. implementing more effective response tactics).		

10.1 Mechanical Dispersion Plan Environmental Performance

Table 10-3 indicates the Environmental performance outcomes, controls and performance standards for the Mechanical Dispersion response strategy.

Table 10-3 Environmental performance outcomes, controls and performance standards for the mechanical dispersion response strategy.

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

11 Shoreline Protection and Deflection Plan

Booms can be used to create physical barriers on the water surface to protect sensitive receptors in intertidal and nearshore environments with the intent of taking the oil plume off its trajectory path. Booms can also be used to deflect the oil spill to locations easier for shoreline clean-up, for example moving oil from rocky shorelines to sandy shorelines.

The effectiveness of this response will be dependent on sea, current, and wind conditions. Deployment is subject to safety concerns of operation in shallow waters and possible grounding issues of vessels.

Protection and deflection is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Controlling Agency. Santos WA will undertake first-strike protection and deflection activities if required. Upon assumption of Controlling 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 9).

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 Controlling Agency and therefore may differ from that included below.

Table 11-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 11-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Section 11.3 lists the Environmental Performance Standards and Measurement Criteria for this tactic.

Table 11-1 Protection and Deflection - Environmental Performance Outcome , Initiation Criteria and Termination Criteria

Protection and Deflection Plan		
Environmental Performance Outcome	Implement shoreline protection and deflection tactics to reduce hydrocarbon contact with coastal protection priorities.	
Initiation Criteria	Monitor and evaluate activities predict potential contact from surface oil to key shoreline sensitive receptors; or As directed by DoT	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	As directed by DoT	
Refer to Section 11.3 for relevant Performance Objectives, Standards and Measurement Criteria.		

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:

+ The utilisation of earthen booming and sandbags where needed to prevent ingress of oil into tidal creeks;

- Nearshore booming using vessel-based operations while the spill remains on a predicted shoreline impact trajectory; and
- Placement of shoreline boom around areas to protect and to deflect the oil back to ocean or to easier locations for shoreline clean-up.

The effectiveness of these techniques will be dependent on local bathymetry, sea state, current and wind conditions.

The implementation guide will be implemented Santos WA as detailed in **Table 11-2** below.

Table 11-2 Protection and Deflection – Implementation Guide

<table>
<tr><th colspan="5">Shoreline Protection</th></tr>
<tr><td colspan="2">Activation time</td><td colspan="3">Where monitor and evaluate activities predict potential contact to key sensitive receptors as risk from surface oil; or
As directed by DoT</td></tr>
<tr><th colspan="2">Action</th><th>Consideration</th><th>Responsibility</th><th>Complete</th></tr>
<tr><td rowspan="5">Initial Actions</td><td>Ensure initial notifications to WA DoT have been made</td><td>Refer to 0 for reporting requirements</td><td>Environment Team Leader</td><td>❑</td></tr>
<tr><td>Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Controlling Agency for assistance in identification of priority protection areas and NEBA.</td><td></td><td>Environment Team Leader
Planning Team Leader</td><td>❑</td></tr>
<tr><td colspan="4">Actions below are indicative only and are at the final determination of DoT as the Control Agency</td></tr>
<tr><td>Conduct operational NEBA to determine if protection and deflection is likely to result in a net environmental benefit</td><td></td><td>Environment Team Leader</td><td>❑</td></tr>
<tr><td>If NEBA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area using information from shoreline assessments (Section 9.8) and any tactical response plans for the area.</td><td>Shoreline Protection Plan may include (but not be limited to):
+ Priority nearshore and shoreline areas for protection (liaise with Control Agency for direction on locations)
+ Locations to deploy protection and deflection equipment
+ Permits required (if applicable)
+ Protection and deflection tactics to be employed for each location</td><td>Operations Team Leader
Planning Team Leader</td><td>❑</td></tr>
</table>

Shoreline Protection				
		+ 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 zones (to minimise disturbance to sensitive receptors)		
	Identify resources for shoreline protection activities based on nominated deployment locations.		Operations Team Leader	❑
	Mobilise protection and deflection equipment to designated location for deployment	Potentially contacted locations include: + Montebello Islands + Lowendal Islands + Dampier Archipelago + Northern Island Coast	Logistics Team Leader	❑
	Identify vessels with relevant capabilities (e.g. shallow draught) for equipment deployment in consultation with Controlling 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	❑

Shoreline Protection				
	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	❑
	Response teams to conduct daily inspections and maintenance of boom arrays		Operations Team Leader	❑
	Report to the Operations Team Leader on the effectiveness of the boom arrays		Shoreline Response Team Leader – AMOSC core group responder	❑

Resources		Location
Equipment	Sea Curtain, Near-shore and Beach Guard Booms and associated equipment	AMOSC Santos WA (VI) Other Operators through AMOSC mutual aid
	General purpose containment boom; inflatable general-purpose boom	AMSA (Dampier)
	Vessels	Santos WA Operational sites
Personnel	Santos WA Facility Incident Response Team members AMOSC Core Group Responders	Santos WA Operational sites
	AMOSC Core Group Responders	Mobilised through AMOSC
	Logistics personnel	Exmouth Freight & Logistics
	National Response Team (NRT)	Mobilised through AMSA
	State Response Team (SRT)	Mobilised through DoT
Documentation	Tactical Response Plans	Santos WA Procedures Index

Shoreline Protection	
Maintenance of response	Conduct daily re-evaluation of NEBA to assess varying net benefits and impacts of continuing to conduct shoreline protection and deflection activities. Shoreline protection efforts will be maintained through the forward operation(s) facilities setup at mainland locations under direction of DoT. Equipment will be installed and maintained by response crews who will be rotated on a roster basis from the forward operations centres, with new personal procured on an as-need basis from existing human resource suppliers. The protection and auxiliary equipment (dinghies, tools etc.) will be maintained and replaced if necessary through existing suppliers of this equipment or through supplies from existing stockpiles.

11.1 Equipment and Personnel

Protection and deflection equipment available for use by Santos WA is a combination of Santos WA owned, AMOSC, AMSA, DoT and OSRL equipment as well as other operator resources available through the AMOS Plan mutual aid arrangements.

Using these stockpiles, the range of protection and deflection methods include near-shore booms (beach guardian, zoom boom, curtain boom and sorbent boom) anchored close to the identified protection priority areas, or open water booms (deep curtain ocean boom) placed at significant distances from shorelines to deflect the open water pathway of the oil to force the oil to miss the predicted shoreline requiring protection.

Protection and deflection personnel available to Santos WA is a combination of Santos WA Facility Incident Response Team members, AMOSC Core Group Responders (comprising AMOSC trained Santos WA and Industry personnel), Santos WA trained Vessel Crew, State Response Team members and National Response Team members.

Deployment of equipment and personnel will be commensurate to the severity of the spill and timing/ location of potential shoreline impact.

First-strike deployment of protection and deflection equipment for a release along the offshore pipeline route or at the Reindeer WHP will be from Dampier (Santos WA and AMSA stockpiles) and/or Varanus Island (Santos WA) with further mobilisation of equipment from Exmouth stockpiles (AMOSC) and from Industry Mutual Aid Resources (Dampier, Onslow and Barrow Island). As a backup to AMOSC stockpiles, significant quantities of shoreline protection boom are available through OSRL out of Singapore. Given the worst-case spill for shoreline protection is a diesel spill of maximum volume of 329 m^3 local and national stockpiles of equipment are expected to be sufficient.

First-strike deployment of personnel for a release along the offshore pipeline route or at the Reindeer WHP will be from Devil Creek and Varanus Island Incident Response Teams, Santos WA Core Group members and Vessel Crew from Dampier (incl. Santos WA trained as available). Escalation of the response will be through Industry AMOSC Core Group Members and State/National Response Teams.

Santos WA's boom deployment exercises have demonstrated in-water deployments of equipment are possible in a timeframe of 4-5 hours from activation from both Dampier and Varanus Island stockpiles, protecting coastlines at Montebello/ Lowendal Islands and Dampier region, respectively.

Tactical response plans are available for several of the key protection priorities with predicted impact.

11.2 Deployment Locations

Santos WA will direct first strike deployments of protection and deflection resources, as required based on spill trajectory mapping and operational monitoring. DoT will assume control of the response as the relevant Controlling Agency for shoreline response activities and will direct deployment following hand-over of control.

During a spill response, locations identified or predicted to receive shoreline loading (based on operational monitoring), are to be cross-referenced with the shoreline sensitivity information acquired from the following resources:

+ Santos WA GIS Mapping;
+ OSRA WMA;
+ Pilbara Region Oiled Wildlife Response Plan; and
+ Aerial Surveillance and Shoreline Assessment records where available.

Stochastic spill modelling already undertaken for worst-case spill scenarios was assessed for shoreline-accumulation, with the results indicating that oil from a worst case hydrocarbon spill scenarios may potentially accumulate on the shorelines of, Montebello islands, Northern Island Coast, Dampier Archipelago and Lowendal Islands (refer Section 3.3).

Of these areas Northern Island Coast have the shortest potential contact time of floating oil (1 hour for oil >10 g/m^2), and highest potential loading of oil (173 m^3). Monitor and Evaluate information and NEBA will help validate contact to this and other Protection Priority areas, identify other contacted areas and prioritise shoreline sites for protection. Shoreline sensitivity and mapping data provided in the following data sources will be used to assist in evaluation of priority protection areas for response:

+ Santos WA GIS;
+ DoT Oil Spill Response Atlas –Web Map Application (OSRA WMA);
+ Pilbara Region Oiled Wildlife Response Plan;
+ Spill trajectory modelling;
+ Aerial Surveillance and Shoreline Assessment records where available; and
+ the EP.

Santos WA GIS and the OSRA WMA, provides detailed information on shoreline features, sensitive receptors, and potential spill response equipment mobilisation locations in the North West Shelf region

In all areas, the primary shoreline protection priorities are mangrove environments and shorelines identified as important for turtle nesting and hatching and shorebird/seabird nesting, roosting or foraging. Key areas for these shoreline sensitivities are outlined in **Section 3.5**

11.3 Protection and Deflection Plan Environmental Performance

Table 11-3 indicates the Environmental performance outcomes, controls and performance standards for the Protection and Deflection response strategy.

Table 11-3 Environmental performance outcomes, controls and performance standards for the protection and deflection response strategy.

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
	Response Implementation		
	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 to determine if response strategy is continuing to have a net environmental benefit. NEBA included in development of following period Incident Action Plan	IAP/Incident Log
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy	Incident Log IAP

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**
		implementation which may include secondary contamination	
	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

12 Shoreline Clean Up Plan

Clean-up of shorelines may be required for a worst case spill of diesel and to a lesser extent a spill of Reindeer condensate. Both types of hydrocarbon are light and volatile with a very low proportion of residue following weathering. These hydrocarbons are difficult to handle for removal given their light nature but are readily washed from sediments by wave and tidal flushing; contaminated sand and debris the likely waste products from a shoreline response.

Shoreline clean-up is part of an integrated nearshore/ shoreline response to be controlled by DoT as the relevant Controlling Agency. Santos WA will undertake first-strike clean-up where required. Upon assumption of Controlling Agency responsibilities, DoT will direct resources (equipment and personnel) provided by Santos WA for the purposes of shoreline clean-up. 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 9).

Table 12-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for this tactic. **Table 12-2** provides guidance to the IMT on the actions and responsibilities that should be considered when selecting this tactic. This table also 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.

Refer to **Section 12.4** for relevant Performance Objectives, Standards and Measurement Criteria.

Table 12-1 Shoreline Clean up - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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.	
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	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	As directed by DoT	
Refer to **Section 12.4** for relevant Performance Objectives, Standards and Measurement Criteria.		

First-strike actions to be initiated by Santos WA IMT are as detailed below.

Table 12-2 Shoreline Clean up – Implementation Guide

Shoreline Clean-up				
Activation time	+ 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			
Action		**Consideration**	**Responsibility**	**Complete**
	Undertake shoreline assessment as outlined **Section 9.8**		Refer to **Section 9.8**	❑
	Identify resources for shoreline clean-up activities based on nominated deployment locations, recommendations from shoreline assessments and requests from the Controlling Agency. Equipment stockpile information accessed through Santos WA Emergency Response Intranet Site	Equipment list to support forward operational areas, decontamination systems, welfare infrastructure, and operation deployments are located in **Appendix H: Shoreline Clean-up Equipment**. These are for reference for procurement plans, and must be modified to suit actual deployment numbers and locations, which will be dependent on incident specific circumstances. Tactical Response Plans also contain information outlining shoreline clean-up resources for some protection priority areas.	Operations Team Leader	❑
	Identify vessel requirements for transferring personnel, equipment, and waste to/from offshore islands		Logistics Team Leader Operations Team Leader	❑
	In consultation with the Controlling Agency procure and mobilise resources to a designated port location for deployment, or directly to location via road transport.		Logistics Team Leader	❑
	Deploy shoreline clean-up response teams to each shoreline location selected to begin operations under direction of the Controlling Agency.		Operations Team Leader	❑

Shoreline Clean-up				
	Monitor progress of clean-up efforts and report to the Controlling Agency		Operations Team Leader On-Scene Commander	❑
Resources			**Location**	
Equipment		Mobile plant (if required)	Karratha/ Exmouth/ Perth	
		Vessels for personnel, equipment and waste transfer to/from offshore islands	Santos WA contracted vessel providers	
		Shoreline Clean-up Equipment (Decontamination, Beach Wash Down, Beach Clean-up kits and Temporary Waste Storage)	Santos WA (Varanus Island)/ AMOSC / AMSA/ OSRL / Spot purchase from various suppliers	
		Waste skips and associated waste equipment (as defined in **Section 15**)	North West Alliance	
		Beach Clean-up equipment and PPE	Perth Petroleum Services/ PPE specialists/ Hardware stores	
Personnel		Shoreline Clean-up specialists	AMOSC, NRT (AMSA), SRT (DoT), OSRL	
		Santos WA Core Group and IRT Personnel	Santos WA Facilities	
		Logistics personnel	Exmouth Freight & Logistics	
		Waste handling and transportation personnel	Through North West Alliance contract	
		Manual clean-up personnel	Santos WA labour hire	
Maintenance of response		This response will be maintained through Santos WA's existing contractual arrangements with equipment and personnel suppliers, which will ensure that clean-up activities can be maintained. Santos maintains waste management arrangements that can be scaled dynamically to accommodate potential wastes generated during the clean-up.		

12.1 Equipment and Personnel

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 operator resources available through the AMOSPlan mutual aid arrangements. Shoreline consumables are available through hardware, PPE and specialist oil/chemical spill suppliers and mobile plant 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 Santos WA Facility Incident Response Team members, AMOSC Core Group Responders (comprising AMOSC trained Santos WA and Industry personnel), 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. 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 9.8) and available TRPs will provide information to guide the clean-up strategy and deployment of resources.

Modelling conducted for a worst case hydrocarbon release from a vessel fuel tank during Devil Creek operations shows that highest loading of diesel at above the designated response threshold a shoreline was modelled at 173 m^3 at Northern Islands Coast (refer **Figure 3-1**) (assuming a 329 m^3 spill). Lesser amounts were modelled as potentially arriving at Dampier Archipelago (73 m^3). Minimum arrival time for shorelines of Northern Islands Coast (including the shoreline adjacent to the pipeline shore crossing) is 1 hour. Minimum arrival time at Dampier Archipelago is 16 hours.

The condensate worst case credible scenario shows shoreline accumulation >100 g/m^2 at multiple receptors including, Lowendal and Montebello Island, with a maximum accumulation of 8 m^3.

Given that diesel and condensate will continue to weather on arrival to shorelines through evaporation and dispersion from wave and tidal movements the modelled arrival volumes (loading volumes) do not represent a true reflection of the volumes potentially requiring clean-up. The known properties of diesel indicate that persistent remnants of the hydrocarbon will be less than 5% of the volume. For a worst case spill of 329 m^3 this indicates a persistent volume of less than ~15 m^3. Assuming a bulking factor of 10x to account for contamination of sediments and organic matter a potential worst case clean-up volume for planning is 150 m^3. Assuming this contamination was on an accessible area of beach and removal of contamination was deemed to provide the highest net environmental benefit this volume could be theoretically removed using manual clean-up personnel at an indicative rate of 1 m^3 per person per day or mechanical aids (e.g. dozers, diggers) at 50 m^3 per day.

12.2 Clean-up Activities

All shoreline clean-up operations will be conducted under the guidance of the DoT as the relevant Controlling Agency.

Each shoreline location will be assessed for the most appropriate response activity or activities based on the principles of NEBA and utilising information collected from Shoreline and Coastal Habitat Assessment (**Section 9.8**). Clean-up teams will be led by an AMOSC Core Group Responder trained in shoreline clean-up or a trained member of AMSA administered NRT and DOT administered State Response Team (SRT).

Team leaders shall communicate regular reports to the DoT IMT Operations unit to inform of proposed shoreline response tactics, effectiveness of previously conducted activities and required resources. IMT Operations personnel shall work with the Planning unit to incorporate recommendations into the Incident Action Plans for the following operational period, and ensure all required resources are released and activated through Supply and Logistics personnel.

A number of shoreline types are found within the area potentially contacted by a spill during Devil Creek 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 the type of shoreline sensitivities is provided within **Appendix I: Shoreline Response Strategy Guidance**.

Operational guidelines for shoreline response activities including worksite preparation, manual and mechanical oil removal and vessel access for remote shorelines are included in **Appendix J: Operational Guidelines for Shoreline Response**. Specific guidance for some protection priorities are provided in TRPs.

The DoT OSCP (2015) also provides guidance on shoreline clean-up techniques.

12.2.1 Onsite Waste Management

Waste consolidation and storage at forward operations areas is an important aspect of the shoreline clean-up response and will have implications for the management of waste by the Waste Service Provider (WSP). DoT as the Controlling Agency for shoreline response is responsible for overseeing the consolidation and storage of collected waste prior to collection of the waste by the WSP.

The DoT Waste Management Sub-Plan to the DoT OSCP (2015) provides guidelines to assist DoT with preparing site-specific waste management plans for clean-up activities controlled by DoT.

Santos WA will provide a contracted WSP for the collection, treatment and disposal of waste from an oil spill response as detailed in Section 15.

12.3 Deployment Locations

Deployment of personnel and equipment for shoreline clean-up will be preceded by Shoreline Assessments and directed by DoT as the relevant Controlling Agency. Deployments of shoreline assessment teams and subsequent clean-up teams will be informed by the following information sources:

+ Spill trajectory modelling;
+ Aerial Surveillance;
+ Sensitive receptor mapping from;
+ Santos WA GIS Mapping;
+ OSRA WMA; and
+ Pilbara Region Oiled Wildlife Response Plan.

Stochastic spill modelling already undertaken for worst-case spill scenarios was assessed for shoreline-accumulation, with the results indicating that oil from a worst-case spill may potentially accumulate above a response threshold of 100g/m^2 on the shorelines of Montebello Islands, Northern Island Coast, Dampier Archipelago and/or Lowendal Islands (refer Section 3.3).

In all areas, the primary shoreline protection priorities are mangrove environments and shorelines identified as important for turtle nesting and hatching and shorebird/seabird nesting, roosting or foraging. Key areas for these shoreline sensitivities are outlined in Section 3.4.

12.4 Shoreline Clean Up Plan Environmental Performance

Table 12-3 indicates the Environmental performance outcomes, controls and performance standards for the Shoreline Clean Up response strategy.

Table 12-3 Environmental performance outcomes, controls and performance standards for shoreline clean up response strategy.

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.
	Response Implementation		
	Shoreline Clean-Up Plan	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
		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
		Shoreline clean-up response continues until termination criteria is met, as outlined within the Shoreline Clean-up Plan.	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.

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**
	Soil profile assessment prior to earthworks	Unless directed otherwise by the designated Control Agency (i.e. DoT) a soil profile assessment is conducted prior to earthworks	Documented in IAP and Incident Log.
	Pre-cleaning and inspection of equipment (quarantine)	Vehicles and equipment provided by Santos are verified as clean and invasive species free prior to deployment to offshore islands	Documented in IAP and Incident Log.
	Use of Heritage 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.
	Competent IMT and Oil Spill Responder personnel	Spill response personnel trained	Company IAP documents personnel competencies
	Use of competent vessel crew/personnel	Vessel Masters have up to date qualifications	Vessel training register or vessel inspection document demonstrates requirement is met
	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	Consultation records

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

13 Onshore Response

There is the potential for a leak or rupture of the buried export pipeline (Reindeer 16" pipeline) between the shoreline and the boundary of the Devil Creek Gas Plant (DCGP). The worst case credible spill is a release of 275 m^3 of Reindeer condensate. This represents the entire pipeline inventory and is considered a conservative volume given the significant length of pipeline grading away from the buried shoreline section to the WHP. As per HAZMAT, direct on-site recovery and clean-up of hazardous materials and infrastructure is the responsibility of the owner of the hazardous materials (Santos WA). Under the Environmental Protection Act 1986, DWER would issue a pollution notice to the owner of hazardous materials that are involved in an emergency situation, requiring clean-up. Remediation of contamination at the spill site will be required as per the Contamination Sites Act 2003 and Contamination Sites Regulations 2006.

Table 13-1 provides the Environmental Performance Outcome, initiation criteria and termination criteria for 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. The implementation guide for the on-shore response plan is found in **Table 13-2.**

Refer to **Section 12.4** for relevant Performance Objectives, Standards and Measurement Criteria.

Table 13-1 Onshore Response Plan - Objectives, Initiation Criteria and Termination Criteria

On-Shore Response Plan		
Environmental Performance Outcome	Assist DFES in the control of hazardous material Remediate the site as directed by the Jurisdictional Authority.	
Initiation criteria	Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	X
Termination criterion	The site has been cleaned and remediated to the satisfaction of DWER	
Refer to **Section 19** for relevant Performance Objectives, Standards and Measurement Criteria.		

Table 13-2: Onshore Response Implementation Guide

Onshore Response				
Activation time		Level 2 or 3 spills – may be deployed in a Level-1 incident (to be determined by On-Scene Commander)		
Action		Consideration	Responsibility	Complete
Initial Actions	In the event that a loss of condensate and gas from the onshore buried pipeline section is detected (either automatically or manually), ESD will be activated		Devil Creek On Scene Commander	❑

Onshore Response				
	Site will notify DFES as applicable as per the Devil Creek Incident Response Plan (DC-40-IF-00096)		Devil Creek On Scene Commander	❑
	The Devil Creek Incident Response Team will respond under the advice of DFES and the On-Scene Commander, as per the Devil Creek Incident Response Plan (DC-40-IF-00096)		Devil Creek On Scene Commander	❑
	In the event of an onshore spill with the potential for groundwater contamination DWER and relevant land owner will be contacted regarding the potential for interaction with groundwater bores and advice on any isolations of water supply required.	Landowners bordering the pipeline corridor and contact details are outlined within the Devil Creek Stakeholder Management Plan for the Gas Plant and Associated Facilities (DC-00-RG-00018)	IMT Incident Commander/ Government Relations/Media Advisor	❑
	If liquid hydrocarbon expressing at surface and/or contaminating surface water consider deploying spill response equipment	Consider use of sorbent materials and booms to contain and recover surface hydrocarbon if safe to do so	Devil Creek On Scene Commander Operations Team Leader	❑

<table>
<tr><th colspan="5">Onshore Response</th></tr>
<tr><td>Escalation and Ongoing Response Actions</td><td>Conduct remediation of soil and groundwater affected by hydrocarbon contamination. The relevant Jurisdictional Authority for remediation is DWER and relevant legislation being the Contaminated Sites Act and Contaminated Site Regulations.</td><td>Available remediation options to reduce source contamination include methods such as:
+ use of down-well sorbent materials
+ use of down-well and trench skimmers
+ single/dual-phase extraction
+ vacuum extraction
+ Thermal and chemical flushing treatments
Available remediation options to reduce the spread contamination include methods such as:
+ Bentonite slurry walls
+ Sheet pile walls
+ Permeable reactive barriers
+ Funnel and gate systems
+ Hydraulic containment systems</td><td>Santos WA Contaminated Sites Project Team</td><td>❑</td></tr>
<tr><th colspan="3">Resources</th><th colspan="2">Location</th></tr>
<tr><td colspan="2" rowspan="4">Equipment</td><td>Spill kits</td><td colspan="2">Throughout DC onshore facility</td></tr>
<tr><td>Sorbent booms, shore-sealing boom, nearshore boom, skimmer, shoreline clean-up container (shovels, sorbents, wheel barrows, PPE)</td><td colspan="2">VI storage shed</td></tr>
<tr><td>Additional booms (sorbent, shore-sealing and nearshore), shoreline flushing/ clean-up equipment and temporary waste storage</td><td colspan="2">Refer Sections 0 and 0.</td></tr>
<tr><td>Waste skips/containers for transportation</td><td colspan="2">North West Alliance</td></tr>
<tr><td colspan="2">Personnel</td><td>Incident Response Team Members</td><td colspan="2">Devil Creek</td></tr>
</table>

Onshore Response		
	Santos WA AMOSC Core Group Members	Santos WA operational sites
	Industry AMOSC Core Group Responders	Industry personnel mobilised through AMOSC
	National Response Team	Mobilised through AMSA
	State Response Team	Mobilised through DoT
Maintenance of response	Santos WA has equipment and personnel available to implement and maintain a onshore response at the DC facility. Santos WA has arrangements in place with service providers (e.g. AMSOC) that allows the response to be scaled and sustained beyond the limits of the equipment and personnel from the VI Hub if required.	

13.1 Initial Response

Given the onshore section of pipeline is buried to a depth of 1.2 m up to and beyond the boundary of the Devil Creek Gas Plant, there is an existing barrier to the rapid spread of condensate in the event of a rupture or leak. As described in Section 3.4 containment is expected to be within 200 m of the pipeline with resultant contamination of soil and groundwater within this zone of impact.

The greatest potential for surface expression of condensate through the movement of contaminated groundwater is at the area of saline flats (approx. 2 km from the shoreline along the pipeline route) where the groundwater table is at its lowest. In times of inundation after heavy rain this area can pool with water. A spill in this section could contaminate surface water which could be responded to using sorbent materials applied at the surface. Sorbent materials are available at the DCGP or through AMOSC stockpiles stored for use in coastal response (AMOSC and Santos WA stocks). Any surface water contamination in this area is not considered to be under tidal/marine influence and given the topography and proximity to waterways it is not expected that drainage of contaminated into defined waterways will occur.

13.2 Site Remediation

The type of activities that may be required are varied and will be guided by an initial and Detailed Site Investigation (DSI) under the review of a Contaminated Sites Auditor registered with DWER. The DSI will typically involve collection of groundwater and soil samples and the development of a conceptual site model. On the basis of the DSI, remediation activities will be evaluated and outlined within an approved Remediation Action Plan (RAP).

13.3 Onshore Response Plan Environmental Performance

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

Table 13-3 Environmental performance outcomes, controls and performance standards for shoreline Onshore response strategy.

Environmental Performance Outcome	Assist DFES in the control of hazardous material Remediate the site as directed by the Jurisdictional Authority.		
Response Strategy	**Control Measures**	**Performance Standards**	**Measurement Criteria**
Onshore Response	Onshore Response	Initial clean-up strategies will be implemented under the direction of DFES	Incident Log
		Santos WA will make available AMOSC Core Group Responders for onshore 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
		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
		Onshore response continues until termination criteria is met, as outlined within the Onshore response Plan.	Incident Log
	Remediation	Undertake remediation and monitoring as required under Contaminated Sites Regulations 2003	Contaminated Sites records incl. Detailed Site Investigation (DSI) and Remedial Action Plan RAP)

14 Oiled Wildlife Response

Santos WA will provide all necessary resources to assist Department of Transport (DoT) in an oiled wildlife response (OWR) 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 Controlling Agency/ Lead IMT through a combination of owned and operated equipment, call-off contracts with suppliers, and Oiled Wildlife response advice to industry through an Oiled Wildlife Response Advisor. Industry Oiled Wildlife responders are also available through AMOSC mutual aid arrangements. This team will work in conjunction with Department of Biodiversity, Conservation and Attractions (DBCA) OWR capability under the direction of the DoT Incident Command. Where Santos WA is the Controlling 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 Incident Command.

The key plan for 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, to define the minimum standards for OWR in WA as a sub-plan to the State Hazard: MEE. The WAOWRP can also be used for guidance to OWR in Commonwealth waters, noting that OWR requirements in State waters are typically greater. The Pilbara Region OWRP, which sits under the WAOWRP provides operational guidance to respond to injured and oiled wildlife in the Pilbara Region and covers the areas potentially contacted by a spill from Devil Creek operations.

The sections below provide guidance to the Santos IMT on OWR stages of response and implementation. In some cases, the implementation guidance (**Table 14-5**) includes detail which is additional to what is provided in the WAOWRP. The information below should be used in conjunction with the WAOWRP.

Note: For Spill contained solely in Commonwealth Waters, Santos WA is the Controlling Agency for OWR. DoT is the Controlling Agency and Department of DBCA is the Jurisdictional Authority for OWR within State waters. DoT is also the lead IMT for Oiled Wildlife Response where the spill covers both Commonwealth and State Waters. The OWR Environmental Performance Outcome, initiation and termination criteria are found in **Table 14-1**.

Table 14-1: Oiled Wildlife Response – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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	
Initiation criteria	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	+ Oiling of wildlife have not been observed over a 48 hour period; + Oiled wildlife have been successfully rehabilitated; and + Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response.	
Refer to Section 14.4 for relevant Performance Objectives, Standards and Measurement Criteria.		

14.1 OWR Stages of Response

The WAOWRP includes eight stages to an OWR, which are described in **Table 14-2.** If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 14-2: 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 monitor and evaluate tactics (Section 9) 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 Response 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, 2004)
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the cleaning and rehabilitation of affected animals. A vessel-based ‘on-water’ facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife Response Sub-plan.

Stage	Description
	This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

14.2 OWR Levels and Resourcing

An impact assessment threshold of 10 g/m^2 for impacts on fauna from floating hydrocarbons is provided in the in the Reindeer Wellhead Platform and Offshore Gas Supply Pipeline Operations Environment Plan (Reindeer EP; EA-14-RI-10002.01) and Devil Creek Gas Supply and Sales Export Pipeline Operations Environment Plan (Devil Creek EP; EA-14-RI-10001.01). 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, 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/m^2 may extend up to 18 km from the spill location. Conservative estimates for OWR planning predict a worst-case OWR for this activity will be an OWR Level 2, as defined in the WAOWRP (2014) (**Table 14-3)** In reality the degree of potential wildlife exposure in the Northern Island Coast and Dampier Archipelago would be highly season and location dependent. It is however anticipated to be low given the worst-case spill scenario of 329 m^3 of diesel and the likelihood that the oil would only be on the water surface for a short period, the degree of predicted shoreline loading, and the low amount of residual oil on the shoreline following weathering through evaporation and dispersion from wave and tidal movements.

For a Level 2 response, it is expected that up to 26 personnel will be required, with a range of skill levels (**Table 14-4**)– 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 14-3: 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	5–50	Habitat affected only

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
						habitats affected		
Level 5	116	> 4–14 days	10–100/ day > 200 total	10–50/day	> 20 juv/adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv/adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

Table 14-4: Oiled Wildlife Response Level and Personnel Numbers

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

14.3 Implementation Guidance

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. For a level 2 OWR, individuals may facilitate multiple roles/functions as 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 will form the key management system which will provide control and oversight over the response.

Table 14-5 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 14-5)** 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).

The Incident Commander of the Controlling 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 **Table 14-6 and Appendix K: Oiled Wildlife Response Personnel and Equipment.**

Table 14-5: Implementation Guidance – Oiled Wildlife Response

Action		Consideration	Responsibility	Complete
Activation time		Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill		
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 Incident Commander prior to activating AMOSC Oiled Wildlife Advisor (OWA) and/or DCBA OWR as outlined in Section 6-2 DoT will be the Control Agency for OWR in State waters	Environmental Team Leader	❑
	Notify DoEE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance (MNES))	Refer to Section 6.1 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 NEBA.	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution	Environmental Team Leader Wildlife Division Coordinator	❑

Action	Consideration	Responsibility	Complete
Activation time	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill		
Use this information to help determine: + Initial OWR Response Level (1-6), as defined in the WA OWRP + If OWR activities are likely to result in a net environmental benefit	alone. The Environmental Team Leader and Wildlife Division Coordinator will determine via an Operational NEBA whether capture and cleaning of oiled wildlife will result in a net environmental benefit. This should 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).		
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	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 Division Coordinator or delegate	❑
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 Liaise with personnel managing monitor and evaluate activities to ensure field activities are coordinated	Wildlife Division Coordinator Wildlife Reconnaissance Officer AMOSC OWA	❑

Action	Consideration	Responsibility	Complete
Activation time	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill		
		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 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 to 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 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 Rescue Officer AMOSC OWA DBCA OWA OWR field personnel Operations Team Leader	❑

Action	Consideration	Responsibility	Complete
Activation time	Operational monitoring shows that wildlife are contacted or are predicted to be contacted by a spill		
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 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	Wildlife Division Coordinator 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 temperature-controlled room. The room needs to be well ventilated to disperse the hydrocarbon fumes	Wildlife Division Coordinator Wildlife Veterinarian Wildlife Rehabilitation Officer AMOSC OWA DBCA OWA 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	❑

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Table 14-6: Oiled Wildlife Response - Resource Capability

Service Provider Capability	Location	Service Provider Activation Time
WA Oiled Wildlife Response Plan Pilbara Region OWR Plan	N/A	N/A
1. AMOSC oiled wildlife response container and kit (includes wash facility that may treat up to 150 OWR units) 2. AMSA OWR container and kits 3. DBCA OWR container and kit 4. OSRL equipment 5. Vessels via call off contracts	1. Fremantle, plus various locations around Australia (Refer to **Appendix K: Oiled Wildlife Response Personnel and Equipment**) 2. Various locations around Australia (Refer to **Appendix K**) 3. Kensington and Karratha 4. Various locations internationally (Refer to **Appendix K**) 5. NW Australia	1. 24 hours from Fremantle to Dampier 2. AMSA OWR container positioned in Dampier. 3. 24 hours from Kensington to Dampier 4. 48-72 hours from Singapore to Dampier. 5. 24 + hours
Santos is a participating member of AMOSC with access to Mutual aid arrangements. AMSA MoU and OSRL contracts enable access to national and international oiled wildlife expertise (Refer to **Appendix K: Oiled Wildlife Response Personnel and Equipment**)	Various locations around Australia and internationally (Refer to Appendix **K: Oiled Wildlife Response Personnel and Equipment**)	AMOSC Mutual Aid OWR Industry Team can be available within 3 days
Santos WA Capability	**Location**	**Santos Activation Time**
5 Santos WA trained Oiled Wildlife Responders	Perth	24 hours
Untrained resources through personnel-hire arrangements	Perth	~72 hours

14.4 Oiled Wildlife Response Plan Environmental Performance

Table 14-7 indicates the Environmental performance outcomes, controls and performance standards for the Oiled Wildlife Response strategy.

Table 14-7 Environmental performance outcomes, controls and performance standards for the Oiled Wildlife Responsestrategy.

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.
	Response Implementation		
	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

15 Waste Management Plan

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 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' Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053) provides detailed guidance to the WSP in the event of a spill.

Where DoT is the Controlling Agency, Santos WA will provide a Deputy Logistics Officer to the DoT IMT Logistics Unit to support the DoT IMT in coordinating waste management services. The Environmental Performance Outcome, initiation and termination criteria are found in **Table 15-1.**

Table 15-1: Waste Management – Environmental Performance Outcome, Initiation Criteria and Termination Criteria

Oiled Wildlife Response		
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 oily waste have been initiated. 2 hours for IMT to activate Waste Service Provider	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	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	
Refer to **Section 15.3** for relevant Performance Objectives, Standards and Measurement Criteria.		

15.1 Waste approvals

Site clean-up, removal and disposal of response waste should be conducted in accordance with Santos' Waste Management Plan – Oil Spill Response Support (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' Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053) provides detail on the regulatory requirements for each port/location likely to be used for waste management during any spill response operation associated with Santos' activities.

15.2 Waste Service Provider Capability

The current Santos WA contracted WSP is North West Alliance (NWA). Detailed guidance on NWA's responsibilities for spill response waste management is provided in the Santos' Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053).

NWA's key capabilities include:

+ NWA will maintain 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 NWA's 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)

15.2.1 Waste management resources

NWA has the capacity to deliver storage receptacles, remove, transport and dispose of all waste material from oil spill response activities to predetermined disposal points. Modelling conducted for a worst case hydrocarbon release shows that the highest shoreline loading was from a vessel fuel tank diesel spill (329 m^3) modelled at 173 m^3 at Northern Islands Coast (refer **Figure 3-1**). Lesser amounts were modelled as potentially arriving at Dampier Archipelago (73 m^3). Given that diesel and condensate will continue to weather on arrival to shorelines through evaporation and dispersion from wave and tidal movements the modelled arrival volumes (loading volumes) do not represent a true reflection of the volumes potentially requiring clean-up. The known properties of diesel indicate that persistent remnants of the hydrocarbon will be less than 5% of the volume. For a worst-case spill of 329 m^3 this indicates a persistent volume of less than ~15 m^3. Assuming a bulking factor of 10x to account for contamination of sediments and organic matter a potential worst-case clean-up volume for planning is 150 m^3. **Table 15-2** provides the capability of NWA for waste removal and storage, which is in excess of the waste management requirements for spill response activities associated with this OPEP, and has been developed based on a significant loss of well control event.

Table 15-2: NWA Vehicle and Equipment Availability

Plant and Equipment	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	630	4	3	3	2
Front Lift Trucks	10 28 m^3 Body	Servicing of Front lift bins	7	784	4	3	2	1
Side Loading Truck	10 18 m^3 Body	Servicing of MGB's	7	504	1	2	4	3
Hook Lift Truck	5 70 Tonne rated	Servicing of hook lift bins	7	980	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	48	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
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

Plant and Equipment	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		
Front Lift Bins	50 3 m^3	various waste streams	2	300	20	30	N/A	N/A
Front Lift Bins	25 4.5 m^3	various waste streams	2	225	10	15	N/A	N/A
Offshore Rated Front Load Bins	100 3 m^3	various waste streams	2	600	40	60	N/A	N/A
Offshore Rated Bins	45 7 m^3	various waste streams	2	630	20	25	N/A	N/A
Marrell Skip Bins	60 6-9 m^3	various waste streams	2	960	20	40	N/A	N/A
Hook Lift Bins	12 15-30 m^3	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

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Table 15-3: Implementation Guidance – Waste Management

Action		Consideration	Responsibility	Complete
Initial Actions	Contact WSP (Primary or Secondary Contact Person) and activate Waste Project Manager. Arrange for personnel to attend Emergency Control Centre	Refer to Incident Response Contacts Directory (QE-00-ZF-00025.20) for contact details	Logistics Team Leader (or delegate)	❑
	Provide briefing to WSP personnel once positioned in IMT		Logistics Team Leader (or delegate)	❑
	Using most recent monitor and evaluate data, estimate expected waste volumes to be generated by selected response strategies	It is better to overestimate volumes and scale back resources then to underestimate waste volumes	Logistics Team Leader (or delegate) 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 (or delegate) 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 Deputy Logistics Officer	❑

Action		Consideration	Responsibility	Complete
	Government Agencies (Refer to Waste Management Plan – Oil Spill Response Support (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' Waste Management Plan – Oil Spill Response Support (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 Refer to Cedre (2016) for technical guidance on waste management techniques	Logistics Team Leader (or delegate) Deputy Logistics Officer Planning Team Leader 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 Logistics Officer	❑
Ongoing Actions	Provide ongoing point of contact between IMT and WSP	If DoT is the Control Agency, the Deputy Logistics Officer (or delegate) shall be the point of contact between DoT and the WSP	Deputy Logistics Officer (or delegate) 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	WSP Location Responsible Person or Operations Supervisor	❑
	Ensure records are maintained for all waste management activities, including but not limited to:		WSP Location Responsible Person or Operations Supervisor	❑

Action		Consideration	Responsibility	Complete
	+ 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).			

Table 15-4: Waste Management- Resource Capability

Service Provider Capability	Location	Service Provider Activation Time
Processes		
Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	N/A	N/A
Equipment		
Refer to Table 15-2 NWA Waste handling and transfer depot	N/A Karratha	48 hours
Personnel		
2 x Project Manager 2 x Operations Supervisor	Perth Karratha	Within 24 hours of activation
Santos Capability	**Location**	**Santos Activation Time**
Processes		
Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	N/A	N/A
Equipment		
Evaporation ponds	Devil Creek Gas Plant	If/when required
Personnel		
Logistics Team Leader or delegate	Perth	On IMT activation
Deputy Logistics Officer		By 8 am of the day following DoT request

15.3 Waste Management Plan Environmental Performance

Table 15-5 indicates the Environmental performance outcomes, controls and performance standards for the Waste Management Response strategy.

Table 15-5: Environmental Performance outcomes, controls and performance standards for 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 Waste Management Plan – Oil Spill Response Support (QE-91-IF-10053)	Waste Service Provider to appoint a Project Manager within 24 hours of activation	Incident Log
		Ensure operational NEBA considers waste management, to ensure environmental benefit outweighs the environmental impact of strategy implementation which may include secondary contamination.	Incident Log IAP
		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
		Waste management to be conducted in accordance with Santos' Waste Management Plan – Oil Spill Response Support (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	Waste reports
	Compliance with controlled waste, unauthorised discharge and landfill regulations	Waste handling and disposal compliant with: Environmental Protection (Rural Landfill) Regulations 2002 Environmental Protection (Unauthorised Discharges) Regulations 2004 Environmental Protection (Controlled Waste) Regulations 2004	Waste tracking records demonstrate requirement is met

16 Scientific Monitoring Plan

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

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

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 SMP unless directed otherwise by the relevant Control Agency/s.

Table 16-1 Scientific Monitoring - Environmental Performance Outcome, Initiation Criteria and Termination Criteria

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 or affected by spill response	
Initiation criteria	Refer to individual SMPs – **Appendix L** for receptor specific initiation criteria. Monitoring Provider activated within 2 hours of notification from IMT	
Applicable hydrocarbons	**Reindeer Condensate**	**Diesel**
	✓	✓
Termination criterion	Refer to individual SMPs – **Appendix L: Scientific Monitoring Plans**	
Refer to **Section 16.7** for relevant Performance Objectives, Standards and Measurement Criteria.		

16.1 Scope

Santos WA will implement its SMPs, as applicable, for Devil Creek spill scenarios 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.

16.2 Relationship to Operational Monitoring

Operational monitoring (Section 9) 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.

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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.

Monitoring of soil and groundwater would be required in the event of an onshore pipeline release (Reindeer 16" Pipeline) whereby the site would be declared a Contaminated Site under Contaminated Sites Regulations 2003. This monitoring has specific objectives with regards to supporting a Detailed Site Investigation (DSI) and Remedial Action Plan (RAP) and is distinct to Operational Monitoring and Scientific Monitoring. The DSI and RAP undergo a separate assessment and approval process administered by DER and are not discussed further here.

16.3 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 Devil Creek Operations (**Table 16-2)**. These are detailed further in **Appendix L** each SMP has corresponding objectives, initiation/termination criteria, methodologies, baseline data sources and analysis and reporting requirements, noting that in a response controlled by DoT methodology, termination criteria and analysis/reporting requirements may differ.

Table 16-2 : Oil Spill Scientific Monitoring Plans relevant to Devil Creek 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 (including Whale Sharks)
SMP9	Marine Reptiles
SMP10	Seafood Quality
SMP11	Fish, Fisheries and Aquaculture
SMP12	Whale Sharks (Ningaloo Coast)

16.4 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.

There are scientific monitoring components that are suited to pre-impact baseline monitoring. 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. Understanding priority areas for reactive pre-impact baseline monitoring is important. **Section 3** uses stochastic modelling to indicate receptors likely to be contacted at certain thresholds within a specified timeframe. **Section 3** also uses this information to help determine priority protection areas, which would provide an initial focus for reactive pre-impact monitoring.

Santos WA periodically review the status, availability and suitability of existing baseline data sources related to high biodiversity value receptors in their EMBA (for the findings of the latest baseline review refer to **Appendix N**).

In addition to the baseline review, Santos WA is a participant in the Industry-Government Environmental Metadata (I-GEM) Project. The project is a collaborative approach between industry and government to share metadata on quantitative ecological data for key receptors in the mid to north-west of WA.

16.5 Monitoring Service Providers

Oil Spill Scientific Monitoring will be conducted on behalf of Santos WA by a principle contracted Monitoring Service Providers (MSPs) (Aston Environmental Services) and its sub-contracted service provider (BMT), providing capability for the implementation of SMPs 1-11.

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 by the Australian Institute of Marine Science (AIMS) 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.

As per Astron's Standby Services Manual (EA-00-RI-10162), Astron 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.

The specific resourcing requirements and capability for SMP 1-11 first strike monitoring for both Astron and BMT are outlined within 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 capability, and if required, how gaps have been filled. 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. The MSP also provides monthly capability statements outlining availability of resources to implement SMPs. Capability statements are reviewed and filed within the IMT Environment Team Leader folder set and are accessed via the Emergency Response intranet page.

Santos further ensures that its principle monitoring service providers capability and sub-contracting arrangements are adequate through its exercise and auditing program. Santos has conducted exercises and tests with Astron and BMT where the availability of resources has been checked against simulated spill and monitoring requirements. Santo WA has also recently undertaken a tier 2 audit of Astron in 2018 against its Standby Services Manual which demonstrated a high degree of compliance. This included a check of Astron's sub-contracting arrangements. To-date Astron has always demonstrated that it has the required capability in place to meet Santos WA's spill risk needs.

Appendix N 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 Devil Creek pipeline and Reindeer well head platform activities.

16.6 Activation

The SMP Activation Process is outlined in **Appendix M: SMP Activation Process**. SMPs are activated as per the initiation criteria for each as outlined in **Appendix L: Scientific Monitoring Plans.** The SMP Activation Form is available on the Santos WA Procedures Index.

The Santos WA IMT Environment Team Leader (ETL) with support from IMT Environment Team members is responsible for activating Astron as the primary MSP. The Santos WA Environment Team will assist the Astron MCT 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.

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.

16.7 Scientific Monitoring Plan Environmental Performance

Table 16-3 indicates the Environmental performance outcomes, controls and performance standards for the Scientific Monitoring program.

Table 16-3: Environmental performance outcomes, controls and performance standards for 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 or affected by spill response		
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	Undertake a review of the status, availability, and suitability of existing baseline data sources every 2 years	Baseline data review report
	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 in finalising monitoring study design, monitoring locations and field methodologies based on operational monitoring information, relative location of sensitive receptors to the spill and the timing of the spill with respect to seasonality of sensitive receptors	Incident Log and Monitoring Service Provider records

17 Forward Operations Plan

17.1 IMT/CST Rooms

The CST and IMT operate from Perth within the Santos WA CST and IMT rooms. These rooms are equipped and subject to regular check.

17.2 Forward Operating Base (FOB)

For a Commonwealth waters response, Santos WA will establish a FOB. For a State waters response the DoT will establish a FOB. For cross-jurisdictional spills there will be two FOBs working in collaboration.

For the initial stages of a response to spills associated with the wellhead platform (WHP) and pipeline activities, the Devil Creek Incident Response Centre at the DCGP will be used as the FOB.

For an ongoing response to spills from the offshore pipeline or the WHP, a FOB would likely be set-up in Santos WA's Dampier facilities leased from Toll Energy. These facilities are located in Toll Energy's Yard 1 and Yard 2 on Streckfuus Road Dampier; the facilities consist of a conference room and multiple offices that could be used as break-out rooms.

The DCGP and the Toll Energy Dampier facilities are already connected to the Santos WA internet and telephone system. These facilities are also available to the DoT to establish a FOB for State based response.

17.3 Local Facilities

Table 17-1 lists the local facilities around Dampier/ Karratha that may potentially be utilised for response uses.

Table 17-1 Dampier facilities with operational value for response

Facility	Owner/Operator	Potential Uses
Dampier Cargo Wharf	Pilbara Ports Authority	Staging area for vessel loading for spill response equipment and waste management Storage of oil spill response equipment Vessel loading for spill response equipment and waste management

Facility	Owner/Operator	Potential Uses
		Office facilities for Marine-based Command Centre
Toll Dampier Supply Base	Toll Energy Logistics Pty Ltd	Staging area for vessel loading for spill response equipment and waste management
Karratha Airport	Australian Government Department of Defence	Air freight spill response equipment
Devil Creek accommodation Searipple Village	Santos WA/Sodexo Searipple Karratha	Spill responders and IMT accommodation Accommodation & messing for clean-up crew
Toll Energy Yard	Toll Energy Logistics Pty Ltd	Transfer yard for truck-based equipment deliveries and waste management, Boom Maintenance and Cleaning Facility Materials consolidation Marine equipment storage, staging & repairs Oiled wildlife response centre Laydown / storage area Bunded washing facility for oil booms
Local boat ramp at Dampier Yacht Club	Leased to Dampier Yacht Club	Load out for near-shore marine based operations Boat launching

17.4 Staging Areas

Staging Areas for shoreline operations will be set up at shoreline response locations under the direction of the DoT as the Controlling Agency for shoreline response activities.

17.5 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.

17.6 Mobile Plant

Mobile plant and equipment for mechanical clean-up in initial response can be provided from suppliers in Karratha, Exmouth, Port Hedland, Broome or directly from Perth as required.

17.7 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 Controlling 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.

17.8 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
+ 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.

17.9 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.

17.10 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.

17.11 Freight Movement

The transportation of all equipment and services out of Karratha, Perth or other locations, as arranged and required by Santos WA, will be through Santos WA's third party logistics providers.

17.12 Cleaning and Repair

Cleaning and repair of booms and other operational equipment this can be carried out in bunded areas at the supply base facilities.

17.13 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.

17.14 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.

Accommodation is available at the Devil Creek Accommodation Camp located adjacent to the Devil Creek Gas Plant and Onshore pipeline.

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.

Santos WA has access to transportable accommodation and messing facilities supplied through Sodexo and its subcontractors.

Where additional support and remote accommodation is required, Santos WA would engage the services of ASCO Transport and Logistics, who provide a complete service for remote messing and accommodation; inclusive of transportation, laundry, potable water etc.

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.

17.15 Providoring

Providoring arrangements when utilising local facilities would be covered under Service Orders / Purchase Order Terms and Conditions. Santos WA has existing contracts with local supplies in Karratha who could be used for additional support for providoring. These supplies would be transported to the respective spill response staging area by one of Santos WA's third party logistics providers.

For transportable and remote messing, the providoring requirements would be provided directly through Sodexo and Bonnie Rock Transport respectively including the transportation thereof.

17.16 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 Santos WA'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 Safety Management Manual (QE-91-RF-10016).

17.17 Response Personnel Clean-up Crew

Santos WA can provide an initial clean-up workforce from existing Santos WA and AMOSC staff and contractors. This could provide up to 150 personnel immediately from Varanus Island, Dampier Supply Base, Karratha and Perth office, and AMOSC core group responders from around Australia.

Santos WA has arrangements in place with a number of service providers for providing work-force for its day-to-day operations which would be utilised for providing spill response personnel. Additionally, Santos WA would access labour hire arrangements for untrained work force required for low skill labour intensive operations, including shoreline clean-up and roles within an oiled wildlife facility. On the job training and inductions would be provided to enable personnel to perform their functions safely and effectively.

17.18 Radio Communications

Santos WA would either utilise the services of a specialist communication provider, mutual aid arrangements, or control agency arrangements to access 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.

18 Spill Response Termination

The decision to terminate the spill response is made in consultation with the relevant Controlling 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.

19 OPEP Administration

19.1 Document Review and Revision

In line with regulatory requirements, this document shall be reviewed, updated and submitted to DMIRS within every 2.5 years from date of acceptance and submitted to NOPSEMA within 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 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 State and Commonwealth regulations, i.e. the OPGGS (E) Regulations, P(SL)(E) Regulations and PP(E) Regulations.

19.2 OPEP Custodian

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

Position:	Senior Spill Response Adviser
Location	Santos WA Perth Office

20 References

AMOSC (2011). Oil pollution emergency plan: guidelines for the Australian marine petroleum exploration and production industry. Prepared by the Australian Marine Oil Spill Centre, November 2011.

ANZECC/ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 4. Prepared by the Australian and New Zealand Environment and Conservation Council and the Agriculture and Resource Management Council of Australia and New Zealand.

APASA (2014). Memorandum: Reindeer – Devil Creek OSRA. Asia-Pacific Applied Science Associates (APASA) for Santos WA Energy Ltd. January 2014.

APASA (2013). Memorandum: Advice on the properties of Lube and hydraulic oils. Asia-Pacific Applied Science Associates (APASA) for Santos WA Energy Ltd. November 2013.

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French McCay, D.P. (2016) Potential Effects Thresholds for Oil Spill Risk Assessments in Proceedings of the 39th Arctic and Marine Oil Spill Program (AMOP) Technical Seminar on Environmental Contamination and Response, Emergencies Science Division, Environment Canada, Ottawa, ON, Canada

ITOPF (2011). ITOPF Members Handbook 2011/12. Prepared by the International Tanker Owners Pollution Federation Ltd. http://www.itopf.com/news-and-events/documents/itopfhandbook2011.pdf (Accessed: 2 December 2011).

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

Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAMCME). 1997. The CERCLA Type A Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAMCME) Technical Documentation Vol 4.

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Appendix A: POLREP

Department of
Transport

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

Marine Pollution Report (POLREP)

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 B: 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 C: 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 D: Aerial Surveillance Observer Log

Santos

Aerial Surveillance Observer Log – Oil Spill

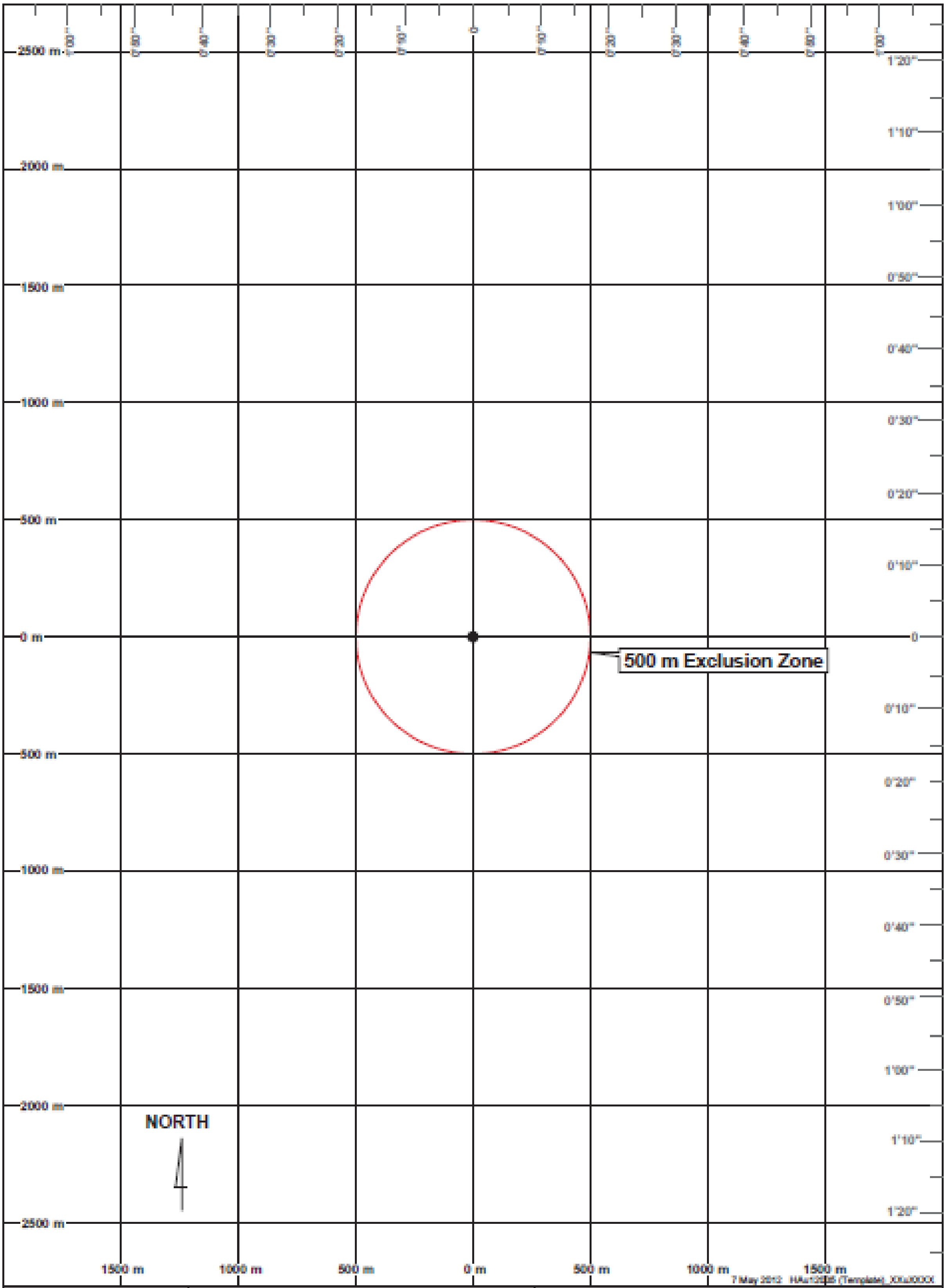
<table>
<tr><th colspan="5">Survey Details</th></tr>
<tr><td>Date:</td><td>Start time:</td><td>End Time:</td><td colspan="2">Observer/s:</td></tr>
<tr><td colspan="3">Incident:</td><td colspan="2">Area of Survey:</td></tr>
<tr><td>Aircraft type:</td><td colspan="2">Call sign:</td><td>Average Altitude:</td><td>Remote sensing used:</td></tr>
<tr><th colspan="5">Weather Conditions</th></tr>
<tr><td colspan="2">Wind speed (knots)</td><td colspan="3">Wind direction</td></tr>
<tr><td colspan="2">Cloud base (feet)</td><td colspan="3">Visibility</td></tr>
<tr><td colspan="2">Time high water</td><td colspan="3">Current direction</td></tr>
<tr><td colspan="2">Time low water</td><td colspan="3">Current speed (nM)</td></tr>
</table>

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 E: Aerial Surveillance Surface Slick Monitoring Template

AERIAL SURVEILLANCE SURFACE SLICK MONITORING TEMPLATE



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

Appendix F: Aerial Surveillance Marine Fauna Sighting Record

Santos

OIL SPILL SURVIELLANCE - MARINE FAUNA SIGHTING RECORD SHEET

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

MARINE FAUNA ID GUIDE

○ Humpback whale

○ Blue whale

○ Minke whale

○ Sperm whale

○ Killer whale

○ Bryde's whale

○ Whale species unknown

○ Bottlenose dolphin

○ Spinner dolphin

○ Dolphin species unknown

○ Whale shark

○ Dugong

○ Hawksbill turtle

○ Loggerhead turtle

○ Green turtle

○ Flatback turtle

○ Leatherback turtle

○ Turtle species unknown

FAUNA DETAILS					
Category	**Type/species?** **Adult/juvenile?** **ID confidence?**	**Number**	**Date/Time**	**Photo/ video taken?** **Reference No.**	**<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 G: Aerial Surveillance Shoreline Observation Log

Santos

Aerial Surveillance Reconnaissance Log – Oil Spill

<table>
<tr><td colspan="6">Survey Details</td></tr>
<tr><td colspan="2">Incident:</td><td>Date:</td><td>Start time:</td><td>End Time:</td><td>Observer/s:</td></tr>
<tr><td colspan="6">Area of Survey</td></tr>
<tr><td colspan="3">Start GPS
LATITUDE:

LONGITUDE:</td><td colspan="3">End GPS
LATITUDE:

LONGITUDE:</td></tr>
<tr><td colspan="2">Aircraft type</td><td>Call sign</td><td colspan="2">Average Altitude</td><td>Remote sensing used (if any)</td></tr>
<tr><td colspan="6">Weather Conditions</td></tr>
<tr><td colspan="2">Sun/Cloud/Rain/Windy</td><td colspan="2">Visibility</td><td colspan="2">Tide Height
L/M/H</td></tr>
<tr><td colspan="2">Time high water</td><td colspan="2">Time low water</td><td colspan="2">Other</td></tr>
<tr><td colspan="6">Shoreline Type - Select only ONE primary (P) and ANY secondary (S) types present</td></tr>
<tr><td></td><td>Rocky Cliffs</td><td></td><td>Boulder and cobble beaches</td><td></td><td>Sheltered tidal flats</td></tr>
<tr><td></td><td>Exposed artificial structures</td><td></td><td>Riprap</td><td></td><td>Mixed sand and gravel beaches</td></tr>
<tr><td></td><td>Inter-tidal platforms</td><td></td><td>Exposed tidal flats</td><td></td><td>Fine-Medium sand grained beaches</td></tr>
<tr><td></td><td>Mangroves</td><td></td><td>Sheltered rocky shores</td><td rowspan="2"></td><td rowspan="2">Other</td></tr>
<tr><td></td><td>Wetlands</td><td></td><td>Sheltered artificial structures</td></tr>
<tr><td colspan="6">Operational Features (tick appropriate box)</td></tr>
<tr><td></td><td>Direct backshore access</td><td></td><td>Alongshore access</td><td></td><td>Suitable backshore staging</td></tr>
<tr><td colspan="6">Other</td></tr>
</table>

Santos

Appendix H: 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 I: 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.	-

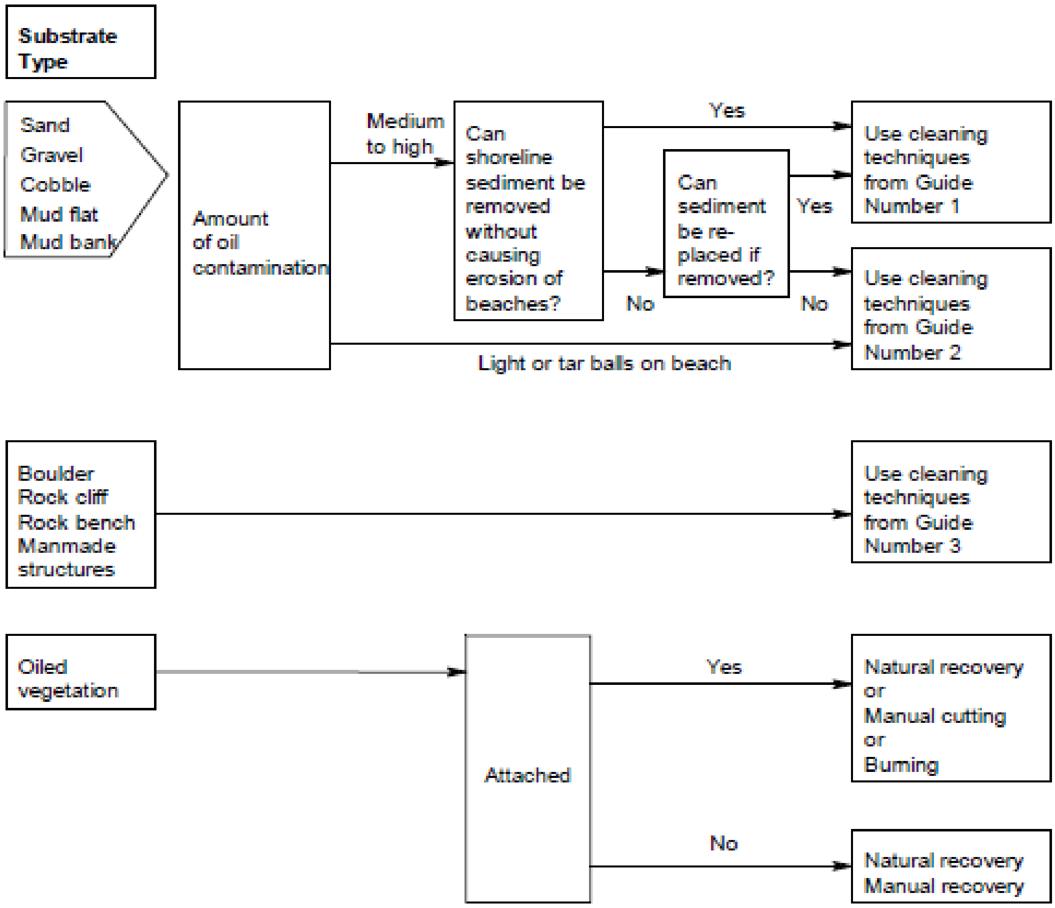


Figure 1: Shoreline Clean-up Master Decision Guide

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).	

Select most preferable technique

No

Use dragline or hydraulic grader or leave to natural recovery.

No

Go to next figure, Decision Guide Number 2, Question 4.

Figure 2: Shoreline Clean-Up Decision Guide 1

Shoreline Cleanup Decision Guide Number 2

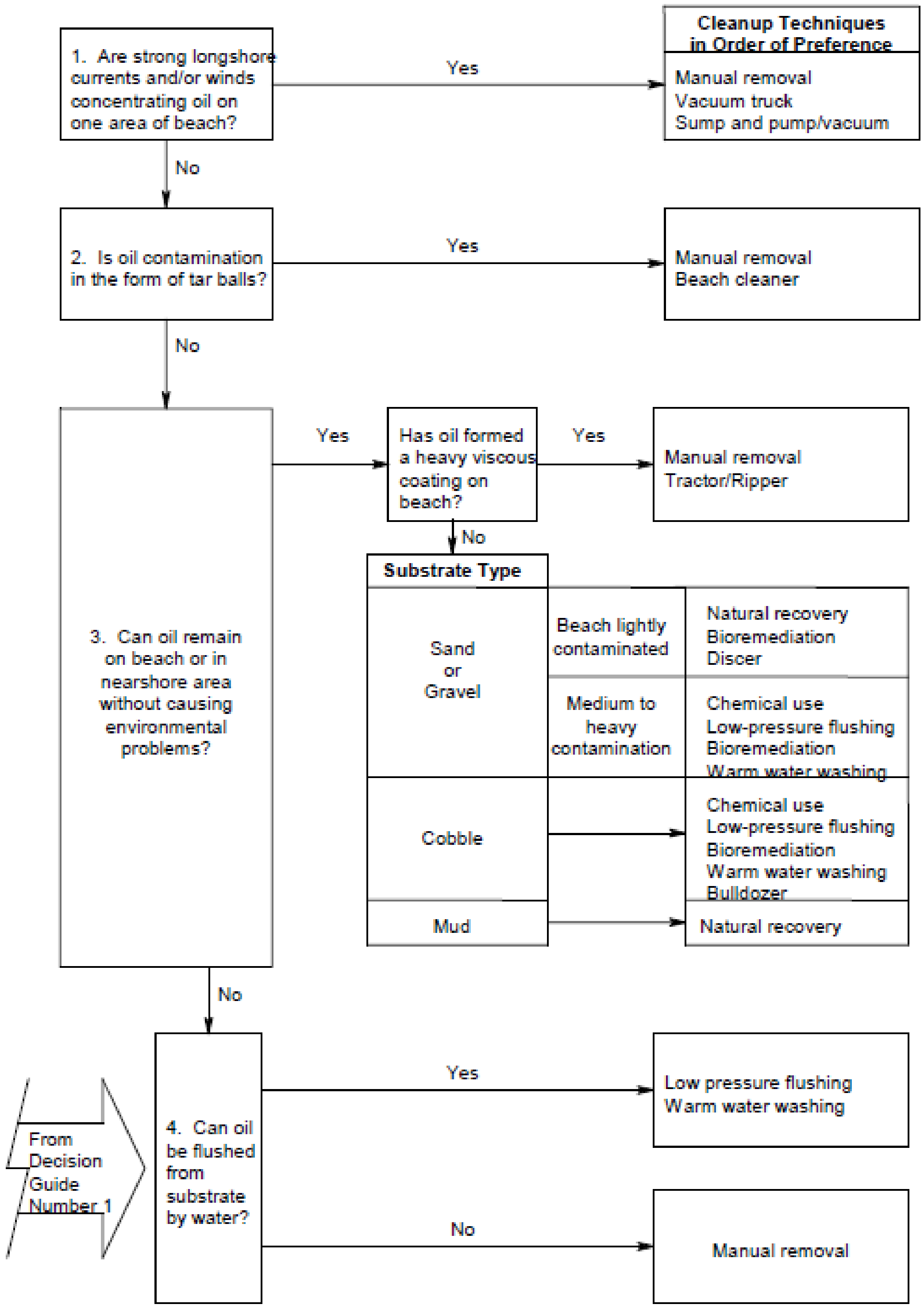


Figure 3: Shoreline Clean-Up Decision Guide 2

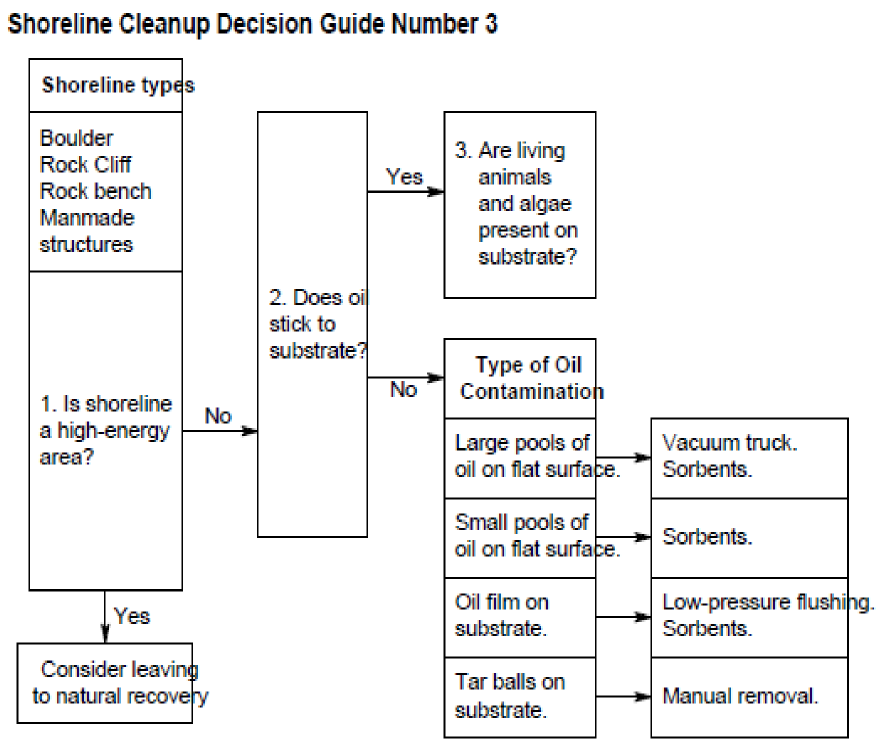


Figure 4: Shoreline Clean-Up decision Guide 3

Appendix J: Operational Guidelines for Shoreline Response

Operational Guidelines for Shoreline Clean-up activities

1.1.1 Worksite preparation guidelines

The following provides guidelines for the preparation of staging areas supporting shoreline clean-up operations.

Organisation and worksite set-up

The worksite does not only include the polluted areas that require cleaning. Several other specific areas must be identified and cordoned off and routes for pedestrians and vehicles should be signposted.

These specific areas are:

- The polluted area;
- The waste storage area, with different types of containers suitable for the different kinds of waste;
- The decontamination area: whatever the size of the spill, a decontamination phase for operational personnel, equipment and tools must be carried out in order to provide some comfort to personnel after each work session, avoiding oiling clean areas, and group together personal clean-up equipment and protective gear, to facilitate the management of the site (cleaning, storage, re-use);
- A rest area, with at least changing rooms, toilets, a first aid kit and cold and hot beverages. Cold or even hot meals can also be organised on the spot provided that a canteen tent or temporary building is available; and
- A storage area for tools and machinery (or equipment warehouse).

Access to the worksite should be restricted and traffic of vehicles should be strictly regulated to avoid accidents.

Preparation

- Prevent the general public from accessing the worksite;
- Delineate accesses for vehicles and machinery (check load-bearing capacity) and routes;
- Channel vehicle and pedestrian traffic;
- Protect the ground (geotextile, roll out mat system…) during operations in sensitive areas (dunes...);
- Prepare and signpost the different areas of activity (on the beach), living areas (locker room, meals, showers, toilets...) and stockpiling areas presenting a risk (fuel, equipment, waste pit....);
- Define a site for fluid storage away from the locker room:
  - Provide an extinguisher for each cabin
  - Set up a recovery system for fuel leaks
- Provide at least minimum lighting for installations and the surrounding area during the winter.

Basic Equipment	Extra Equipment
✓ Plastic liners, geotextiles ✓ Barrier tape and stakes ✓ Signposting equipment	✓ Bins, barrels, skips, tanks ✓ Hot and cold beverages Welfare) ✓ Cooking oil, soap (Welfare) ✓ Earthmoving equipment

PRIMARY STORAGE OF WASTE

A primary storage site is:

- ✓ An emergency staging area of the immediate deposit of the waste collected before its transfer to either an intermediate long term storage site or if possible directly to a treatment facility; and
- ✓ A key stage in the waste management process for sorting, labelling and quantifying the types and volumes of waste collected and when possible, reducing volumes to be transported by pre-treatment.

The storage site must be closed as soon as clean-up operations are completed.

The return of the site to its original condition implies:

- ✓ A contamination diagnosis made by an organisation specialised in ground pollution, decontamination operations if needed and the approval of the authorities; and
- ✓ In some cases, botanical evaluations to define a plant cover restoration operation.

✓ Segregate the different types of waste ✓ Protect containers from rain water and to contain odours ✓ Protect containers from prolonged exposure to sunlight if necessary ✓ Ensure security to prevent unauthorised dumping

Primary waste storage sites should meet certain criteria:

- ✓ Close proximity to the site of clean-up;
- ✓ Good access to roads for heavy lorries; and
- ✓ A flat area with enough space away from environmentally-sensitive areas (vegetation, groundwater) and out of reach of the sea tides and waves.

- ✓ Depending on the volume of waste, site characteristics and availability of containers, prepare:
  - 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 K: 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.

Further detail on OWR capacity accessed through AMOSC, OSRL/Sea Alarm and through Santos WA Workforce hire arrangements is provided below.

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="4">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 – 20 Trained in OWR management by Massey University through AMOSC</td><td>20</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>Perth Zoo – Duty Veterinarian</td><td>Wildlife care and rehabilitation advice,</td><td colspan="2">Personnel potentially available to petroleum industry (currently there is no formal arrangement)</td></tr>
</table>

	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 28 Feb 2019

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

Santos WA workforce hire arrangements

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 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	AMOSC Duty Officer	Fremantle
1 x AMOSC owned OWR container 1 x AMOSC owned box 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
1 x NatPlan/DBCA Box/trailer kit		Fremantle
WA DBCA OWR Equipment*	Activated through	Location
1 x DBCA OWR container	DoT Duty Officer	Kensington
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	OSRL Duty Officer	UK

2 x Cleaning and rehabilitation response package		
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		Fort Lauderdale, USA

* As per AMOSC Capacity Statement 28 Feb 2019

** As per OSRL Mobilisation Fact File. NB: 50% of equipment available to members.

Appendix L: 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)

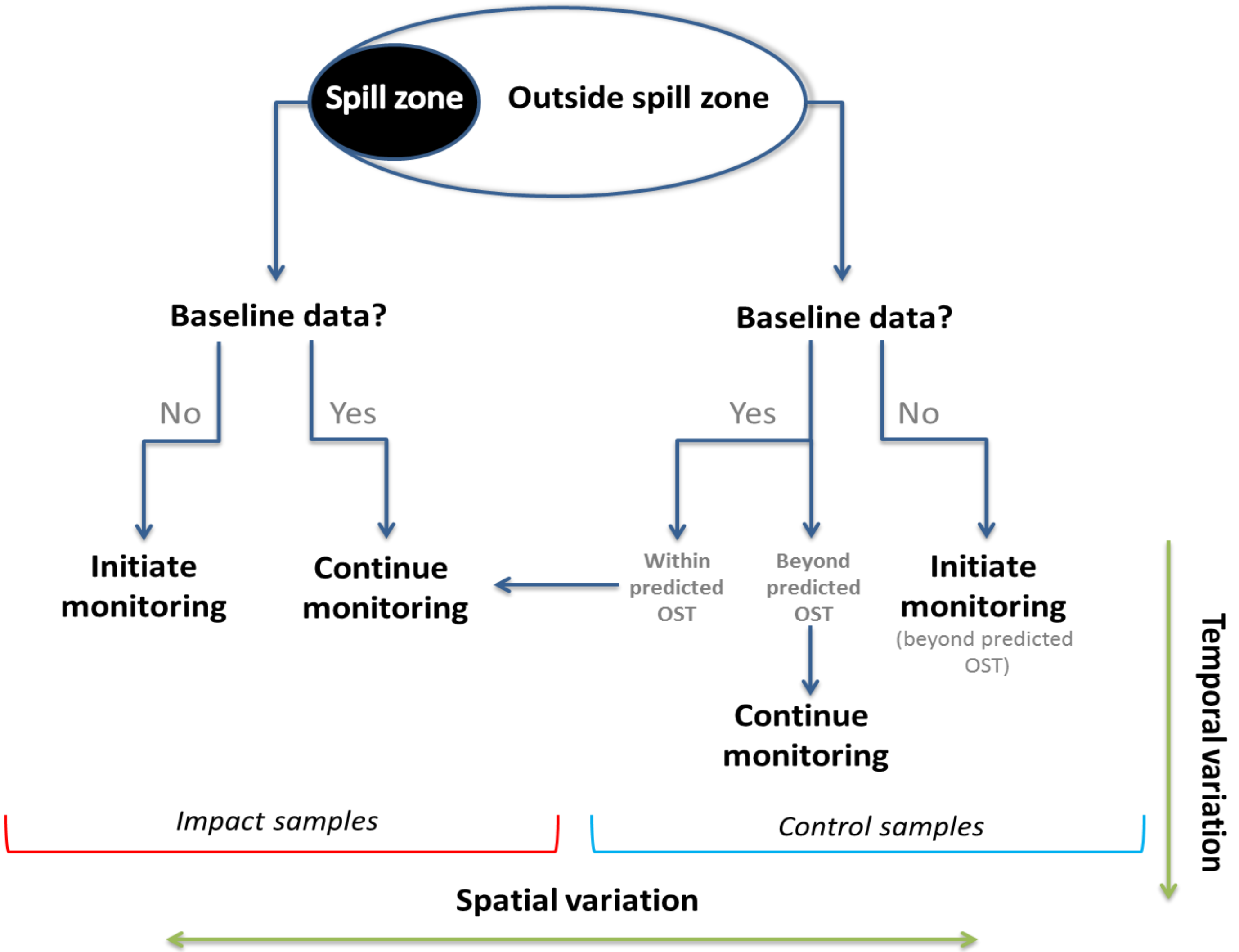


Figure 1: Structured decision making process based on Gregory et al. (2012) in reference to monitoring programs, the availability of baseline data, and oil spill trajectory. In an ideal design sampling would occur across a gradient of exposure rather than 'impact' and 'control' per se.

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.

SMP2 - Sediment Quality	
Termination criteria	Concentrations of hydrocarbons in marine benthic and shoreline sediments, attributable to the released hydrocarbon, are not significantly higher than baseline or similar non-impact sites. In the absence of baseline or similar non-impact sites data, concentrations are below marine sediment quality interim guideline levels within the ANZG (2018), or the relevant regulatory site-specific trigger level (where these exist), if this is lower. For infauna assemblages, abundance and species diversity/richness/composition are not significantly different from baseline (where baseline data exists) or are not statistically significantly different from comparable non-impacted benthic infauna assemblages. Forensic fingerprinting of the released hydrocarbon and sediment quality samples by way of GC/MS may be used to determine the source of contaminants where this is not otherwise clear from operational monitoring.
Receptor impact	Impact to sediment quality is measured through change in hydrocarbon content and concentration. Change to sediment quality is also reflected by changes to infaunal assemblages. Potential impact to infaunal assemblages are measured through change(s) in: • Taxonomic diversity • Assemblage composition • Abundance of indicator species. Other pressures to these states are: • Discharge of other toxicants • Physical disturbance including dredging • Sedimentation • Introduction of marine pests • Shading from marine infrastructure • Climate change

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

<table>
<tr><th colspan="2">SMP6 - Benthic Habitats</th></tr>
<tr><td>Rationale</td><td>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.</td></tr>
<tr><td>Aim</td><td>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.
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).
</td></tr>
<tr><td>Baseline</td><td>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.</td></tr>
</table>

<table>
<tr><th colspan="2">SMP6 - Benthic Habitats</th></tr>
<tr><td>Initiation criteria</td><td><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.</td></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

<table>
<tr><th colspan="2">SMP7 - Seabirds and Shorebirds</th></tr>
<tr><td>Rationale</td><td>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.</td></tr>
<tr><td>Aim</td><td>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.</td></tr>
<tr><td>Baseline</td><td>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.</td></tr>
<tr><td>Initiation criteria</td><td>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.</td></tr>
<tr><td>Termination criteria</td><td>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).</td></tr>
</table>

<table>
<tr><th colspan="2">SMP7 - Seabirds and Shorebirds</th></tr>
<tr><td>Receptor impact</td><td>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.</td></tr>
<tr><td>Methodological approach</td><td>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).</td></tr>
<tr><td>Scope of works</td><td>Prepared by monitoring provider for issue within 24 hours of SMP being activated.</td></tr>
<tr><td>Implementation</td><td>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.</td></tr>
</table>

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.
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).

SMP8 - Marine Megafauna	
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.
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.

SMP9 - Marine Reptiles	
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.
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.
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).

SMP10 - Seafood Quality	
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.
Termination criteria	The following termination criteria will be adopted in consultation with WA DPIRD-Fisheries, DAWR – Fisheries, AFMA and Department of Health. 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.

SMP10 - Seafood Quality	
Implementation	Service provider to be able to mobilise within 72 hours of the scope of work having been approved by Santos (this time allowing for costing, preparation of equipment and disposables and travel to site). Actual mobilisation time will depend on the decision to adopt post-spill pre-impact monitoring and spill timing requirements.
Analysis and reporting	Laboratories will be NATA-accredited for food standards analyses. Data will be stored in spatially explicit database and analysed 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).

SMP11- Fish, Fisheries and Aquaculture	
Receptor impact	Impact to fish, fisheries and aquaculture from pressures including hydrocarbon concentrations is measured through change in: • Species diversity • Abundance of indicator taxa • Assemblage structure • Health. Other pressures to these states are: • Accidental chemical spillage • Over fishing • Introduction of marine pests • Habitat disturbance • Climate change.
Methodological approach	Fish assemblages will be assessed using the stereo-baited remote underwater videos (BRUVs) following Shortis et al. (2009). Fish assemblages will be randomly sampled within discrete habitats at cross-shelf impact areas and non-impact areas. Sampling design for fish assemblages will be as follows: • 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.
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.

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 within Biologically Important Areas (BIAs) at the Ningaloo Coast and north Western Australian coastline.

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 M: 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 N: Scientific Monitoring Capability

Scientific Monitoring Assurance and Capability Assessment

1.1 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.

1.2 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.

1.3 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 (Ningaloo) (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 3 (Dampier Archipelago), and Astron's actual capability. When determining actual team capability, personnel were only allocated to a single SMP team.

The results of the Baseline Data Review document (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 3 capability assessment for rapid sampling of Dampier Archipelago area within seven days.

Receptors	Priority Protection Areas Dampier Archipelago	Required capability for rapid response (per Priority Protection Area)	Actual Team Capability
Water Quality (SMP1)	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		
Sandy Beaches/Rocky Shorelines (SMP3)	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		
Mangroves (SMP4)	Survey	Not required[3]	Not required
Benthic Habitats (SMP6)	Priority survey	1 teams of 2 personnel • at least one team member with experience in benthic habitat assessment • ROV operator or divers	2 teams of 2 personnel
Seabirds/ shorebirds (SMP7)	Priority survey	1 ground-based survey team of 2 personnel[2] • at least one member be experienced ornithologist	4 teams of 2 available
Marine megafauna (SMP8)	Survey	Not required	2 teams of 2 available (aerial)[1] 2 teams of 2 available (vessel)[1]

Receptors	Priority Protection Areas Dampier Archipelago	Required capability for rapid response (per Priority Protection Area)	Actual Team Capability
Marine reptiles (SMP9)	Survey	Not required	2 teams of 2 available (aerial)[1,4] 3 teams of 2 available (vessel)[1,4] 3 teams of 2 available (ground-based)[5]
Seafood Quality (SMP10)	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
Fish, Fisheries & Aquaculture (SMP11)	Priority survey		
Whale sharks (Ningaloo) (SMP12)	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]Ground based surveys for shorebirds/seabirds and marine reptiles at Montebello Islands could be conducted by the same survey team.

[3]Remote sensing data would be collected for mangroves, with no field team required to be mobilised.

[4]Two of these teams are those also assigned to SMP8

[5]One of these teams is also assigned to vessel-based surveys for the same SMP. They can be moved according to priority for either vessel-based or ground surveys.