Prelude FLNG

Oil Pollution Emergency Plan (OPEP)

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REVISION HISTORY					
Ver.	**Change Description**	**Date**	**Originator**	**Reviewed by**	**Approved by**
3.0	Original document	6th February 2020	Consultant/ Shell Australian Environment Lead	Prelude Environment Lead Emergency Repsonse Coordinator Prelude OIM Prelude HSSE Advisor Prelude Production Manager Head of Marine Senior Subsea IMR Engineer WA DoT AMOSC	Prelude Asset Manager

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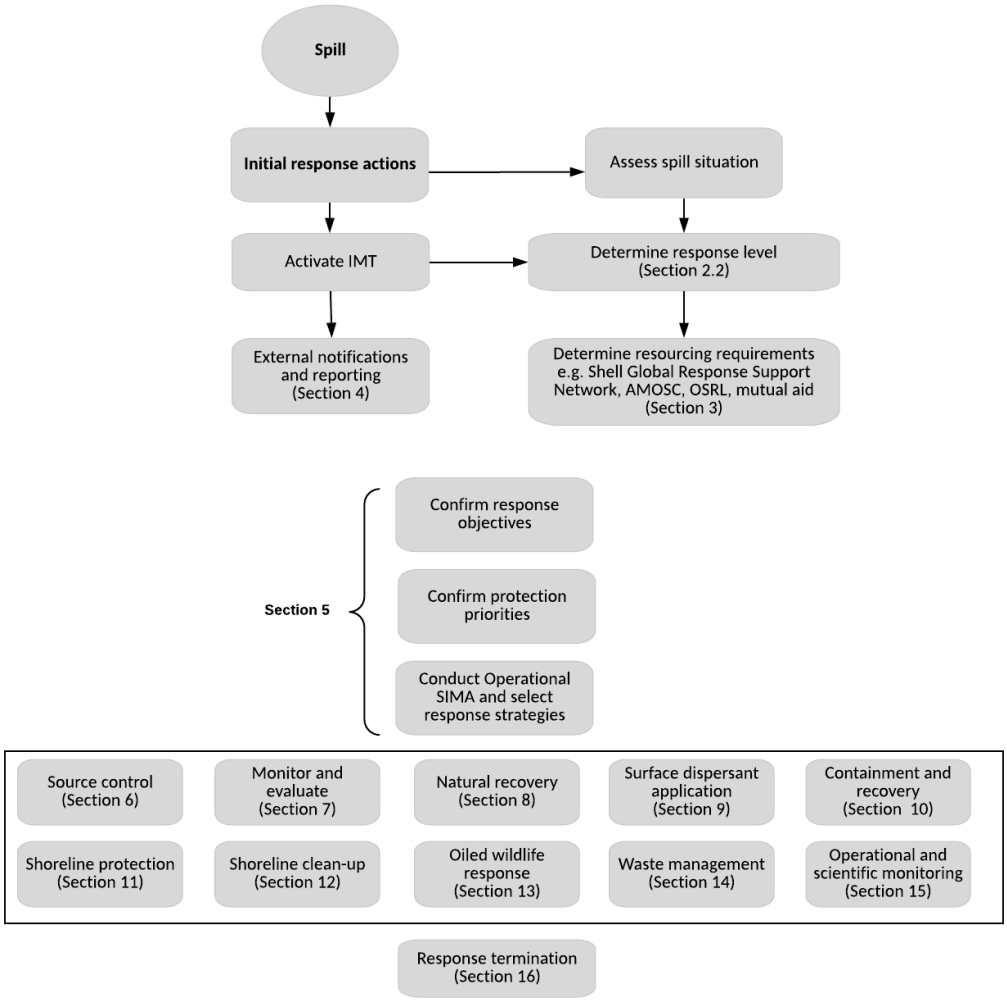
Quick Reference Information

In the event of an emergency situation where human safety is at significant risk, tasks included in this OPEP may not be implemented, and the International Convention for the Safety of Life at Sea (SOLAS) 1974 may take precedence.

Parameter	Information		Further Information
Facility Name	(Provide facility name e.g. Prelude Floating Liquid Natural Gas (FLNG))		
Location (Lat/Long and Easting Northing)	Latitude: 13° 47'10.93" S Longitude: 123° 19'03.14" E	Easting: 534322.84 Northing: 8475877.35	
Title/s (Block/s)	WA-44-L (Production Licence)	WA-3-IL (Infrastructure Licence)	
Installation Type	FLNG and subsea production wells		
Water Depth	237m (approximate)		
Hydrocarbon Type/s	Condensate Marine Diesel Oil (MDO) Heavy Fuel Oil (HFO)		Appendix A - Types/characteristics of oils
International Tanker Owners Pollution Federation (ITOPF) Classification	Prelude Condensate: Group 1 Marine Diesel Oil (MDO): Group 2 Heavy Fuel Oil (HFO): Group 3 - 4		Appendix A- Types/characteristics of oils
Weathering Potential	**Prelude Condensate** is a low viscosity hydrocarbon with minor quantities of persistent components. As a Group 1 hydrocarbon product, it evaporates quickly with test conditions showing 36% was lost in 2 hours and 58% lost in first 48 hours. **MDO** is a mixture of volatile and persistent hydrocarbons with low viscosity. It will spread quickly and thin out to low thickness levels, thereby increasing the rate of evaporation. Up to 60% will generally evaporate over the first two days. Approximately 5% is considered "persistent hydrocarbons", which are unlikely to evaporate and will decay over time. Strong tendency to entrain into the upper water column (0–10 m) (and consequently reduce evaporative loss) in the presence of moderate winds (> 10 knots) and breaking waves. MDO re-		Appendix A - Types/characteristics of oils

Parameter	Information	Further Information
	surfaces when the conditions calm. It does not form mousse. **HFO** is a persistent, high viscosity Group 3-4 hydrocarbon with a low content of volatile compounds, meaning that it has a low potential to evaporate or naturally disperse. HFO tends to have a high water uptake, resulting in emulsification (formation of mousse), which can generate considerable additional waste.	
Highest Unconstrained Well Flowrate	~10,138 bbl/day (~1,611 m^3/day) of condensate; subsea well blowout	
Max Flowrate of Condensate Offloading	5,000 m^3 per hour	
Worst Case Scenarios/ Maximum Possible Hydrocarbon Inventory (Refer to Prelude FLNG Environment Plan for further details)	Condensate (Subsea well blowout): An uncontrolled blowout of Prelude Condensate at the seabed (237 m depth), releasing for a period of 80 days at a constant rate of 10,138 bbl/day (~1,611 m^3/day), yielding a total release volume of 811,040 bbl (~128,944 m^3). Condensate (At Prelude FLNG facility): A 2-hour release of 42,000 m^3 of Prelude Condensate at the surface following a complete rupture of a vessel storage tank after a vessel collision. Heavy fuel oil (HFO): A 1-hour release of 1,000 m^3 of HFO at the surface following a complete rupture of a vessel storage tank after a vessel collision. Marine Diesel Oil (MDO): A 1-hour release of 750 m^3 of marine diesel at the surface following a complete rupture of the FLNG storage tank.	Table 5-1
Protection Priorities	The Prelude FLNG is not located in a sensitive area. Browse Island is the nearest, most significant sensitive receptor (40km to the SE of Prelude). This could be impacted in the event of a large spill.	Section 5.4
Neighbouring Installation/s	Icthys Central Processing Facility (CPF) and Floating Processing Storage and Offloading Facility (FPSO) (Inpex) 15 km South; Montara (PTTEP) 175 km NE	



Oil spill response process flowchart

Initial Response Actions

Tables A & B have been developed to guide response personnel through the key steps of this OPEP during a Level 2 (Tier 2) or Level 3 (Tier 3) spill.

An overview of initial (first strike) actions for **vessel spills are in Table A**. **Table B** contains initial (first strike) actions for the **FLNG facility**.

Vessels Spills: Australian Maritime Safety Authority (AMSA) is the Control Agency for vessel based spills in Commonwealth waters; Shell may be directed to undertake initial response actions (except dispersant) and support AMSA in accordance with its MOU. The Shell IMT will seek early engagement with AMSA's Liaison Officer.

FLNG Spills: Shell is the Control Agency except for any part of the spill which enters State waters, where the Western Australian (WA) Department of Transport (DoT) becomes the Control Agency for the response in State jurisdiction (coordinated command). The Shell Incident Management Team (IMT) will seek early engagement with DoT's Liaison Officer, as per the latest DoT Industry Guidance Note (September 2018).

Unidentified spill sources, even for Level 1 (Tier 1) (minor) spills, ensure samples are taken for onshore fingerprint analysis as soon as possible. Sample bottles and analysis arrangements are coordinated through the Prelude FLNG Laboratory.

Table A: Vessel-based Spill - Initial (First Strike) Response Actions Checklist

Responsibility	Task	Comment	Complete
Vessel Master	Take immediate actions to control the source of the spill	Refer to vessel-specific Shipboard Oil Pollution Emergency Plan (SOPEP)	❑
	Monitor the safety of all personnel		❑
	If source control is not viable, ensure vessel safety by clearing the immediate vicinity of the spill, if possible		❑
	Notify Offshore Installation Manager (OIM) of threat		❑
	Verbally notify AMSA, **as soon as practicable**, to inform them of the incident	Refer to Table 4-1 for verbal and written reporting requirements, including links to POLREP forms. When preparing the POLREP[1], provide as much information as practicable, including: • Name and details of facility • Date and time the spill occurred or was first reported • How it was detected • Names of any witnesses • Hydrocarbon type (e.g. Marine Diesel Oil), any Material Safety Data Sheets • Cause and source of the spill • Approximate volume of spill (better to overestimate) • If the spill is controlled or continuous • Weather, tide and current details • Trajectory of the spill • If any fauna has been observed nearby	❑

[1] Some details may be limited in the initial POLREP. Aim to get the initial report submitted as soon as possible and follow up with more detail as it becomes available.

Responsibility	Task	Comment	Complete
	Continue to provide updated situation reports to the OIM and AMSA, as required	This task may eventually default to IMT	❑
	Take photos and send to the OIM and AMSA, if possible		❑
Offshore Installation Manager (OIM)	Confirm incident report and capture key details relating to the incident	Obtain POLREP	❑
	Initiate monitor and evaluate activities	Gain and maintain situational awareness. Deploy satellite tracking buoy as close to spill source as possible Refer to Table 7-2 for additional information on monitor and evaluate tasks	❑
	Classify the level of spill	Refer to Table 2-2 for classification guidance	❑
	Notify Incident Management Team Leader (West) of incident as soon as practicable		❑
	Verbally notify the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (within **2 hours** of spill) if spill is within Commonwealth waters. Follow up with written notification	Refer to Table 4-1 for reporting requirements and forms	❑
	Continue to provide updated situation reports to the IMT Leader, as required		❑
IMT (West) Leader (IMT Leader)	If mobilising IMT, contact Shell Australia Security to conduct activation		❑
	If spill is heading towards State Waters, contact Western Australian Department of Transport (DoT) Maritime Environmental Emergency Response Unit (MEER) Duty Officer **as soon as practicable**	Refer to Table 4-1 for reporting requirements and forms	❑
	For Level 2-3 spills, notify and activate Oil Spill Response Organisations (e.g. AMOSC, OSRL) and any other Support Organisations (e.g. monitoring providers)	Refer to Table 3-1 for activation instructions	❑

Responsibility	Task	Comment	Complete
	Immediate notification to Shell STASCo in the event of a spill to water from maritime transportation operations; or any Shell related marine incident	Refer to Table 3-2 for contact information Request GRSN mobilisation if required (Level (Tier) 3)	❑
	Ensure all external notifications are completed in the specified timeframes	Refer to Table 4-1 for reporting requirements and forms	❑
	IMT Leader to engage with appropriate Business Executive who will in turn liaise with Crisis Management Team (CMT) Notify the CMT of incident		❑
Safety Officer	Conduct hazard assessment and advise OIM of recommended safety actions and safe approach routes		❑
Environment Unit Lead (EUL)	Review OMP initiation criteria and activate OSMP where required.	See OSMP services provider activiation requirements in Table 11-1 of the Operaitonal and Scientific Monitoring (OSM) Bridging Implementaiton Plan (HSE_PRE_16370)	❑

Table B: FLNG Spill - Initial (First Strike) Response Actions Checklist

Responsibility	Task	Comment	Complete
Central Control Room (CCR)	Initiate General Alarm and Muster of facility	Refer to FLNG Emergency Response Plan HSE_PRE_005612 for additional detail	❑
	Immediately notify Offshore Installation Manager (OIM) of threat		❑
OIM	Take immediate actions to control the source of the spill	Refer to FLNG Emergency Response Plan HSE_PRE_005612 (Loss of Containment) for additional detail	❑
	Monitor the safety of all personnel by clearing the immediate vicinity of the spill, if possible		❑
	Notify Incident Management Team Leader (West) of incident **as soon as practicable**	Refer to FLNG Emergency Response Plan HSE_PRE_005612 (Loss of Containment) for additional detail	❑
	Prepare POLREP and submit to IMT	Refer to Table 4-1 for verbal and written reporting requirements, including links to POLREP forms. When preparing the POLREP, provide as much information as practicable, including: • Name and details of facility • Date and time the spill occurred or was first reported • How it was detected • Names of any witnesses • Hydrocarbon type (e.g. Marine Diesel Oil), any Material Safety Data Sheets • Cause and source of the spill • Approximate volume of spill (better to overestimate) • If the spill is controlled or continuous • Weather, tide and current details • Trajectory of the spill • If any fauna has been observed nearby	❑

Responsibility	Task	Comment	Complete
	Classify the level of spill	Refer to Table 2-2 for classification guidance	❑
	Verbally notify the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (within **2 hours** of spill) if spill is within Commonwealth waters. Follow up with written notification	Refer to Table 4-1 for reporting requirements and forms	❑
	Initiate monitor and evaluate activities	Gain and maintain situational awareness. Deploy satellite tracking buoy as close to spill source as possible Refer to Table 7-2 for additional information on monitor and evaluate tasks	❑
IMT Leader	If mobilising IMT, contact Shell Australia Security to conduct activation		❑
	If spill is heading towards State Waters, contact Western Australian Department of Transport (DoT) Maritime Environmental Emergency Response Unit (MEER) Duty Officer **as soon as practicable**	Refer to Table 4-1 for reporting requirements and forms	❑
	Immediate notification to Shell STASCo in the event of: a spill to water from maritime transportation operations; or any Shell related marine incident	Refer to Table 3-2 for contact information Request GRSN mobilisation if required (Level (Tier) 3).	❑
	IMT Leader to engage with the Business Executive who will in turn liaise with Crisis Management Team (CMT) Notify the Crisis Management Team (CMT) of incident		❑
	For Level 2-3 spills, notify and activate Oil Spill Response Organisations (e.g. AMOSC, OSRL) and any other Support Organisations (e.g. monitoring providers)	Refer to Table 3-1 for activation instructions	❑
	Ensure all external notifications are completed in the specified timeframes	Refer to Table 4-1 for reporting requirements and forms	❑
Safety Officer	Conduct hazard assessment and advise OIM of recommended safety actions and safe approach routes		❑

Responsibility	Task	Comment	Complete
Environment Unit Lead (EUL)	Review OMP initiation criteria and activate OSMP where required.	See OSMP services provider activiation requirements in Table 11-1 of the Operaitonal and Scientific Monitoring (OSM) Bridging Implementaiton Plan (HSE_PRE_16370)	❑

1. Introduction

The Shell Prelude Oil Pollution Emergency Plan (OPEP) supports the operations of the Prelude FLNG facility in the unlikely event of an oil pollution emergency during these operations.

This OPEP addresses the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth.) and forms a supporting document to the Prelude FLNG Environment Plan (2000-010-S001-SS01-U01000-UA-5880-00002).

This OPEP outlines preparedness and response arrangements for worst-case credible spill scenarios that may occur as a result of the activities for the Prelude FLNG project. It describes the environmental sensitivities within the area Zone of Potential Influence (ZPI), priorities for protection and appropriateness of available response strategies for each scenario. The plan also describes response arrangements, preparedness and capability, roles and responsibilities and competency associated with the response.

1.1. Objectives

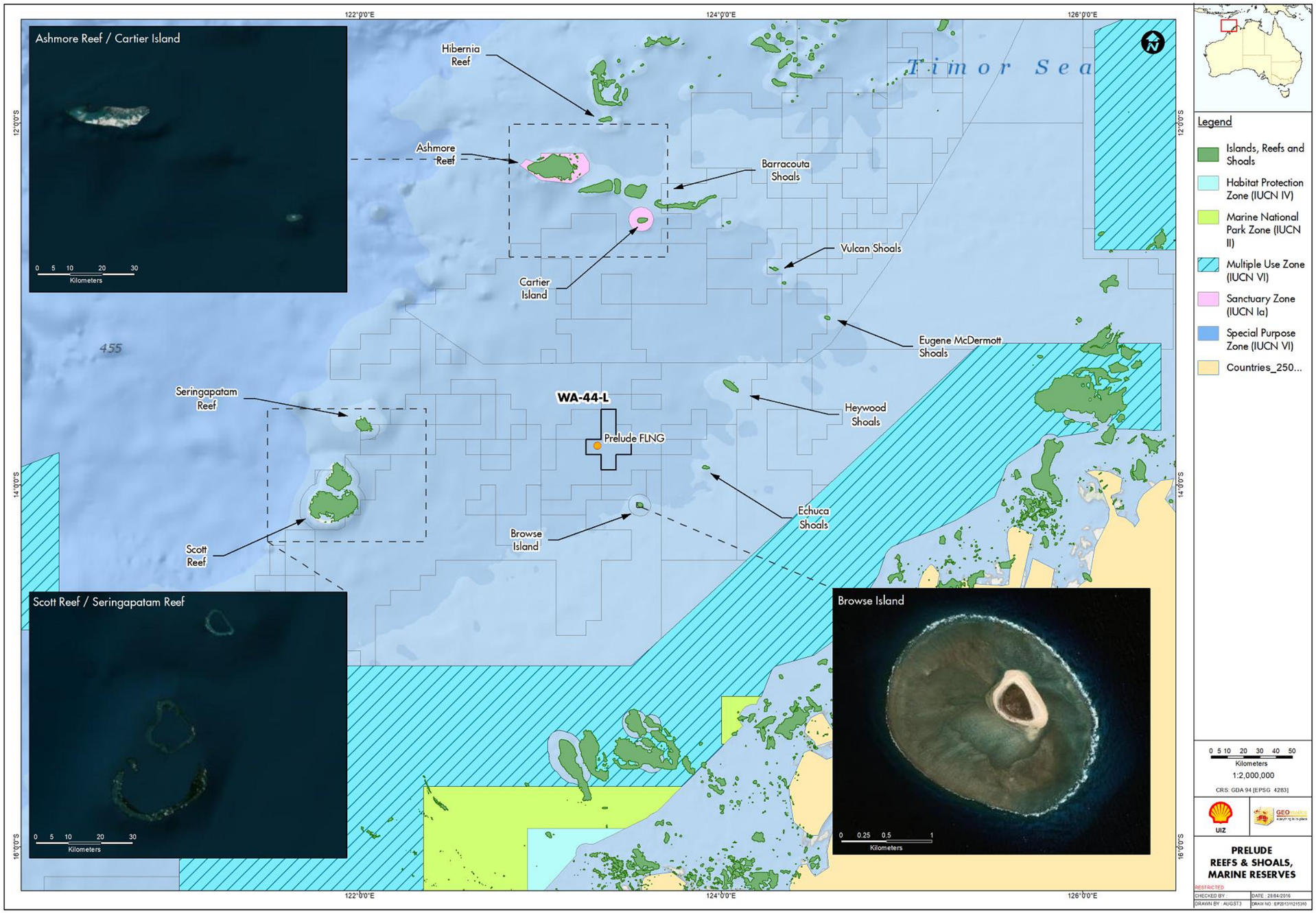
The objectives of this OPEP are to:

- Provide guidance to Shell such that, in the event of a spill, a rapid and effective initial (first strike) response and transition to an extended response can be implemented (if required);
- Meet regulations under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations);
- Integrate with the National Plan for Maritime Environment Emergencies (AMSA, 2019) requirements for preparedness and response for vessel and offshore petroleum facility spills;
- Meet Shell's requirements under the HSSE & SP Control Framework: Spill Preparedness and Response Manual and Specification; and
- Integrate with Shell Emergency Management Procedure HSE_GEN_010996 and supporting ER Arrangements.

1.2. Field Details

The Prelude FLNG Project is in WA-44-L, in Commonwealth marine waters, 200 km offshore northwest Australia and 460 km north-north east of Broome, in 237 m from Mean Sea Level (MSL) water depth (Figure 1-1).

Figure 1-1: Locations of Prelude and Permit Area WA-44-L in relation to regional sensitivities and marine protected areas.



1.3. Interface with Other Plans

Shell has developed the Prelude Emergency Response Plan (ERP) (HSE_PRE_005612) to provide procedural guidance on the roles, responsibilities, actions, reporting requirements, emergency management processes and facilities that are in place to manage all Prelude emergencies, including oil spills. This OPEP builds upon the arrangements presented in the ERP (HSE_PRE_005612), providing the specific information required to plan and respond to a spill event. This OPEP, in conjunction with the ERP (HSE_PRE_005612), are focused on implementation of an effective oil spill response. These are available on the Shell intranet as controlled documents. In addition, the following internal documents are relevant to an oil spill response:

- **Prelude FLNG Environmental Plan 2000-010-S001-SS01-U01000-UA-5880-00002:** This plan describes the activity and the location, the environment, the risks to the environment as a result of the activity and the associated management controls. Of particular relevance to this plan, it identifies the credible spill scenarios, zones of potential influence and protection priorities. It also provides details of the training, exercises, drills and audits that will be undertaken to provide preparedness and capability for delivery of this OPEP in the event of a spill.
- **Shell Oil Spill Monitoring Implementation Plan:** This plan describes the how the Joint Industry Operational and Scientific Monitoring Plan Framework will be applied to Shell's activities to conduct monitoring in the event of either Level 2 or 3 spills.
- **Shell Incident Management Team (West) (IMT(W)) Emergency Response Plan HSE_GEN_011209:** Describes roles and responsibilities of the Level 2 IMT(W) in response to an all hazards emergency.
- **Weekly Contact List Work Instruction HSE_GEN_011648:** This work instruction contains all relevant contact and communications information to enable effective communication amongst the response personnel and also external stakeholders. It is updated and kept live at all times.
- **Shell Crisis Management Manual and Instruction**; Relating to this OPEP, the Crisis Management Team will provide for expanded external and media communications ability during a spill event. Crisis management Team activation criteria is contained within this document.
- **Shell Emergency Management Procedure HSE_GEN_010996:** This plan describes the criteria for notification of an emergency incident to a crisis.
- **Browse Island Incident Management Guide (**

- Appendix F: Browse Island Incident Management Guide**);** This Plan aims to specifically outline detailed tactics planning to allow an effective/pre-planned response at Browse Island in the event it is impacted from a spill.
- **Prelude Well Control Contingency Plan TEC_PRE_000412:** This plan describes the pre-planned relief well location, access to sufficient drilling strings and appropriate relief well drill rig for the Prelude location; and
- **SWCS and SFRT Mobilisation Plan IMT_GEN_001595:** This plan describes how to access and utilise global well capping systems specifically for Australia.

Shell interfaces with the following key external plans:

- **Vessels' Shipboard Oil Pollution Emergency Plan (SOPEP) Plans:** These plans contain details about the ship, roles and responsibilities in the event of a spill and spill response equipment on board. MARPOL 73/78 requires that every oil tanker of 150 tonnes gross tonnage and above, and every ship of 400 gross tonnes and above carry a shipboard oil pollution emergency plan (SOPEP) approved by the Administration. It is the same Shipboard Marine Pollution Plan that is required under the OPRC Convention. Shipboard Marine Pollution Plans also include noxious liquid substances and should more correctly be called "Shipboard Marine Pollution Emergency Plan". The plans must be prepared in accordance with vessel class and flag state requirements and guidelines as laid down by the International Maritime Organisation (IMO).
- **National Plan:** The National Plan for Maritime Environmental Emergencies (National Plan) (AMSA, 2019): This plan has been developed by the Commonwealth and State governments, and is administered by the Australian Maritime Safety Authority (AMSA). It defines the efforts and resources of the Commonwealth and State Governments and the oil and shipping industry to combat oil spills in the marine environment.
- **State Hazard Plan** – Marine Environmental Emergencies (SHP-MEE)**:** State Hazard Plan – Marine Environmental Emergencies (SHP-MEE) (DoT, 2018) supports the National Plan for Western Australia waters, and is administered by the Department of Transport (DoT) Western Australian Hazard Management Agency, as detailed in the Emergency Management Regulations 2006. The plan details the arrangements between state government agencies and industry to combat marine oil pollution within WA. It prescribes responsibilities and procedures, and provides a basis for coordination of resources for responding to spills. Under this plan DoT have published the Dispersant Use Consent Framework which identifies requested notification of dispersant use where chemically dispersed oil is likely to enter state waters (this includes notification of DMIRS also). Further details of detail of DOT expectation relating to Shell's role in a state water response is outlined within the DOT Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018) (IGN).
- **Western Australian Oiled Wildlife Response Plan** (DPAW & AMOSC, 2014): Owned and administered by the Western Australia Department of Biodiversity, Conservation and Attractions (DBCA), this Plan sets out the minimum standard required for an oiled wildlife response (OWR) in Western Australia in both Commonwealth (upon request by Shell) and State waters.
- **AMOSPlan:** This plan is managed by the Australian Marine Oil Spill Centre (AMOSC), and will be activated by Shell when the response to an oil spill incident is regarded by Shell to be requiring resources beyond those of Shell. The plan coordinates the participation of the oil industry in the National Plan. AMOSC's role includes the:
    - provision of oil spill response personnel and equipment;
    - provision of oil spill training services at the training centre; and
    - administration of the oil industry mutual aid arrangements where industry oil spill response resources are available to other operators and to the National Plan.

2. Spill Management Arrangements

2.1. Control Agencies and Jurisdictional Authorities

The responsibility for an oil spill is dependent on location and spill origin. The National Plan for Maritime Environmental Emergencies (National Plan) (AMSA, 2019) sets out the divisions of responsibility for an oil spill response. Definitions of Jurisdictional Authority and Control Agency are as follows:

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

Table 2-1 provides guidance on the designated Control Agency and Jurisdictional Authority for Commonwealth and State waters and for vessel and facility spills, which is explained in additional detail below.

Vessel spills

The Australian Maritime Safety Authority (AMSA) is the designated Control Agency for oil spills from vessels within Commonwealth jurisdiction. AMSA manages the National Plan for Maritime Environmental Emergencies (National Plan), Australia's key maritime emergency contingency and response plan. National Plan resources may be made available to Titleholders through request to AMSA.

Upon notification of an incident involving a ship, AMSA or another nominated National Plan agency (under National Plan arrangements) may assume control of the incident. Shell has arrangements in place to conduct the first strike response (e.g. SOPEP and/or aerial surveillance operations) until AMSA or a nominated National Plan agency assumes Incident Command (as the Control Agency). Shell will continue to implement response activities outlined in this OPEP and operational and scientific monitoring activities as outlined in the OSMP, as deemed necessary by the Control Agency.

Facility spills – Commonwealth waters

Shell holds the Control Agency role for its facility related spills within Commonwealth waters. Facility spills include those from fixed platforms, Floating Production Storage and Offloading (FPSO)/Floating Storage and Offloading (FSO) systems, Mobile Offshore Drilling Units (MODU) and subsea infrastructure. It also includes vessels undertaking construction, decommissioning and pipelaying activities in Shell's operational area. This definition of a 'facility' is defined by Schedule 3, Part 1, Clause 4 of the *Offshore Petroleum and Greenhouse Gas Storage Act 2006*.

For instances where Shell, as the Control Agency, requests assistance of AMSA, Shell will request an AMSA liaison officer be mobilised to the IMT as soon as possible. In the interim period until AMSA have assembled their IMT, Shell (IMT Leader) will liaise closely with the AMSA liaison officer and or the AMSA Incident Controller to inform them of first strike/initial actions being taken. Where a first strike involves dispersant application; specific written approval from the AMSA IC is required before chemical dispersant application.

Facility spills – Western Australian waters

For WA State waters, the DoT Marine Safety General Manager (or proxy) 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 Facility spills in State waters, whose responsibility is to ensure there is an adequate response to marine pollution in State Waters.

If a Level 2/3 spill has potential to enter WA waters, Shell would contact the DoT Maritime Environmental Emergency Response (MEER) unit, as per the reporting requirements in Table 4-1. Upon notification, the DoT will activate their Maritime Environmental Emergency Coordination Centre (MEECC), DoT Incident Management Team (IMT) and appoint the State Maritime Environmental Coordinator (SMEEC). Relevant State Response Team members would also be activated by DoT.

Shell will be 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 (September 2018) (available online: https://www.transport.wa.gov.au/imarine/oil-spill-contingency-plans.asp).

For Level 2/3 spills that cross from Commonwealth waters to WA waters, both DoT and Shell will be Control Agencies. For a cross-jurisdictional response, there will be a Lead IMT (DoT or Shell) for each spill response activity, with DoT's control resting primarily in State waters activities.

Annex 1 within Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (September 2018) provides guidance on the allocation of a Lead IMT to response activities for a cross jurisdictional spill.

At the request of the SMEEC, Shell will be required to provide all necessary resources, including personnel and equipment, to assist the DoT's IMT in performing duties as the Control Agency for State waters response. This includes providing initial 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 personnel to serve in DoT's Forward Operating Base no later than 24 hours following formal request by the SMEEC. DoT will in turn, provide Shell with Liaison Officer/s from DoT's command structure to sit within Shell's IMT.

Provision of personnel to support the WA DoT IMT and FOB may be through a combination of Shell, AMOSC and/or AMOSC Core Group personnel.

Figure 2-1 shows the cross jurisdictional arrangements and Control Agency structure for a Facility spill entering WA waters. The roles and responsibilities of Shell personnel working within DoT's command structure are subject to negotiation with DoT.

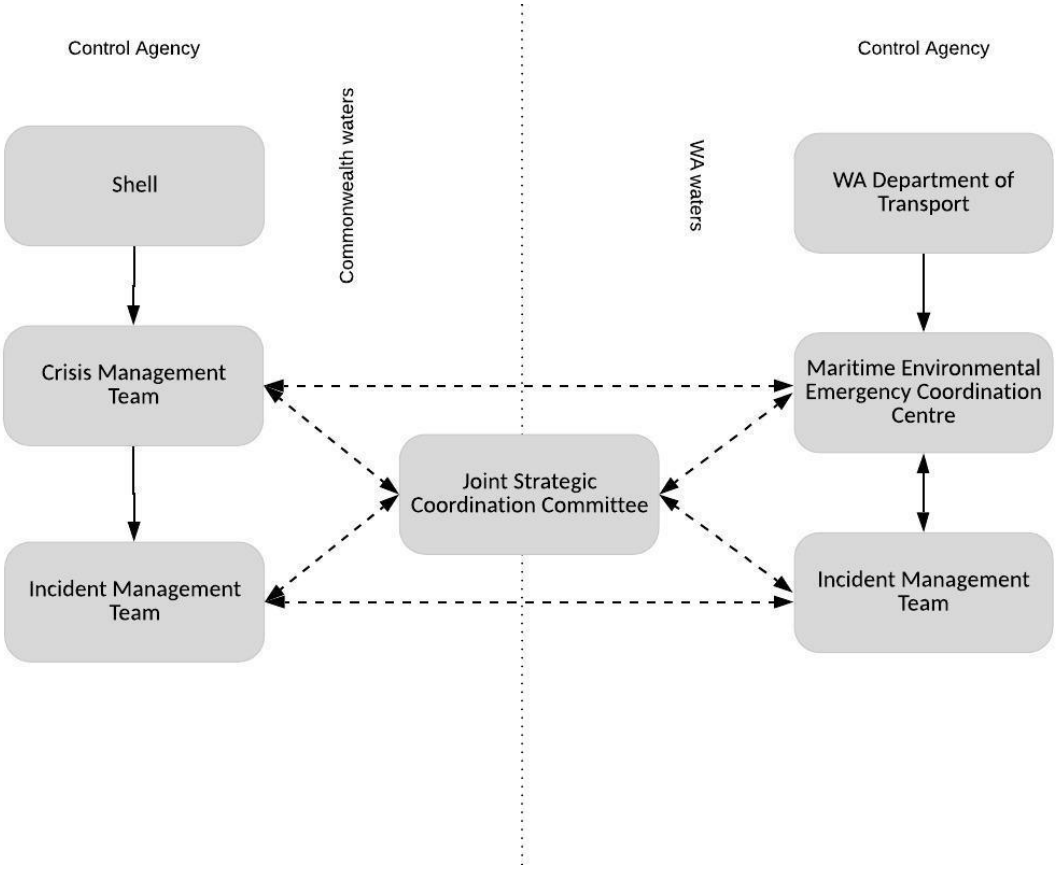


Figure 2-1: Cross Jurisdictional Control Agency Arrangements (WA waters)

Facility spills – Northern Territory waters

The NT Department of Environment and Natural Resources (DENR) is the Jurisdictional Authority for marine oil pollution incidents from vessels and petroleum facilities into NT coastal waters (from the coastline seaward of 3 nm from the territorial sea baseline). If a Level 2/3 spill occurs within Commonwealth waters and trajectory modelling predicts entry of the hydrocarbon into NT waters, Shell shall notify the NT Regional Harbourmaster and NT Pollution Hotline as per Table 4-1 who will then contact the Territory Marine Pollution Controller (TMPC). The TMPC will then establish an NT Incident Controller (IC) and NT IMT, if required.

For Level 2/3 spills that cross from Commonwealth waters into NT waters, Shell will remain Control Agency but will ensure all operational tasking has been reviewed by the NT IC. The NT IC and the TMPC will be consulted prior to the finalisation of each Incident Action Plan (IAP) that relates to activities in NT waters.

For Level 2/3 spills that contact NT shorelines, the NT IMT will assume the role of Control Agency. An NT IMT will be established in Darwin, comprising staff from across NT Government. The NT IMT will be supported by existing Northern Territory emergency response arrangements and Shell will provide support via resourcing and personnel. Additional support, if required, will be provided under the provisions of the NT *Emergency Management Act* 2013, through the Territory Emergency Management Council and the NT Government Functional Groups. Shell will provide Liaison Officer/s to sit within the NT IMT to ensure uniformity between the NT IMT and Shell in the incident response.

Figure 2-2 illustrates the Control Agency and coordination structure for spills entering NT waters and contacting NT shorelines.

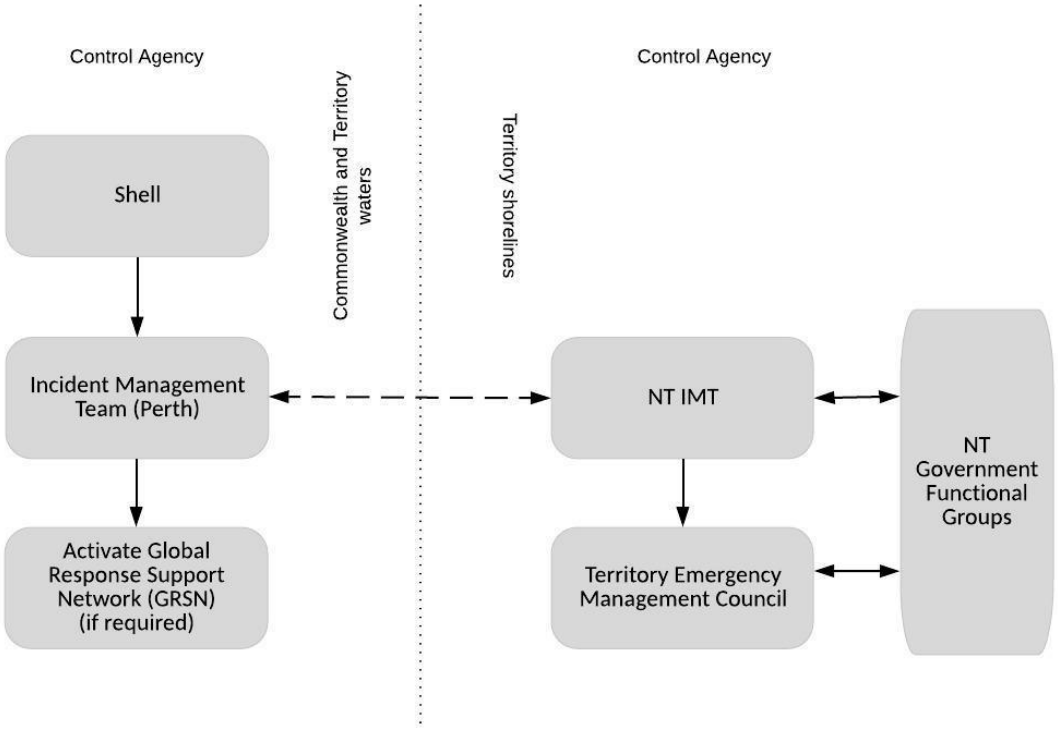


Figure 2-2: Cross Jurisdictional Control Agency Arrangements (NT waters)

General

Other key general interface issues between Shell and AMSA/DoT include external communications and information sharing, as discussed below.

External communications; A joint communications team between Shell and AMSA/DoT (as relevant) will sought to be established to align external communications.

Information sharing; Information sharing in the early stages of a response between Shell and DoT/AMSA (as relevant) will be through the most efficient means possible which will likely be either telephone conversations, emails or face to face. Documentation of such communications will be held in incident logs wherever possible. This includes sharing of key information such as initial SIMA's.

Oiled wildlife response

In Western Australia, the Department of Biodiversity, Conservation and Attractions (DBCA) is the Jurisdictional Authority for oiled wildlife response (OWR). If a spill from Shell's activities enters WA waters and impacted, or had the potential to impact wildlife, then DBCA will lead the oiled wildlife response under the control of the appointed Control Agency.

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

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

The Commonwealth Department of the Environment and Energy is the Jurisdictional Authority for oiled wildlife in Commonwealth waters, although for vessel-based spills, the Control Agency function remains with AMSA. The framework for developing the Commonwealth Oiled Wildlife Response Plan (OWRP) is provided in AMSA's National

Guidelines for the Development of Oiled Wildlife Response Contingency Plans and guidance may also be sought from State and Territory OWRPs.

Table 2-1: Jurisdictional and Control Agencies for Hydrocarbon Spills

Jurisdictional boundary	Spill source	Jurisdictional authority	Control agency		Relevant documentation
			Level 1	Level 2-3	
Commonwealth waters (three to 200 nautical miles from territorial/state sea baseline)	Vessel [2]	AMSA	AMSA		• Vessel SOPEP • National Plan
	Facility[3]	NOPSEMA	Shell		• Activity OPEP
Western Australian waters (State waters to three nautical miles and some areas around offshore atolls and islands)	Vessel	WA Department of Transport (DoT)	WA DoT	WA DoT	• State Hazard Plan: Maritime Environmental Emergencies • Oil Spill Contingency Plan (WA DoT 2015)
	Facility	WA DoT	Shell	WA DoT	• Activity OPEP • State Hazard Plan: Maritime Environmental Emergencies
NT waters (territorial sea baseline to three nautical miles and some areas around offshore atolls and islands)	Vessel	Department of Environment and Natural Resources (DENR)	Vessel owner	Northern Territory (NT) IMT[4]	• Vessel SOPEP • NT Oil Spill Contingency Plan (Department of Lands and Planning 2012)
	Facility	DENR	Shell[5]		• Activity OPEP

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

[3] '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.

[4] NT IMT will be the Control Agency but will be supported by the Titleholder (additional support from AMOSC if required)

[5] Shell will be the Control Agency but will request approval of IAPs from the NT IC.

Jurisdictional boundary	Spill source	Jurisdictional authority	Control agency		Relevant documentation
			Level 1	Level 2-3	
					• NT Oil Spill Contingency Plan (Department of Lands and Planning 2012)
NT shorelines	Vessel	DENR	Vessel owner	NT IMT[6]	• NT Oil Spill Contingency Plan (Department of Lands and Planning 2012)
	Facility	DENR	Shell	NT IMT[6]	• NT Oil Spill Contingency Plan (Department of Lands and Planning 2012)

[6] NT IMT will be the Control Agency but will be supported by the Titleholder (additional support from AMOSC if required)

2.2. Spill Level Classification

The incident level will determine where the resources will be drawn from to respond to the spill and the level of incident management that is required to manage the response effort. In the event of a spill occurring where effective response is considered beyond the capabilities within a level the response will be escalated immediately to the next level.

The decision to escalate a response to a higher level (as defined in Table 2-2) will be made by the responsible Control Agency. If the response level is undetermined, then a worst-case scenario should be assumed when activating resources, as it is always possible to scale down the response effort.

Table 2-2 provides guidance on the initial 'Level' classification of a spill.

Table 2-2: Spill Level Classification Guide

Characteristic	Level 1	Level 2	Level 3
Management			
Jurisdiction	Single jurisdiction (Commonwealth Waters)	Multiple jurisdictions (State/ Cwth Waters)	Multiple jurisdictions, including international
Resources	Resourced from within one area	Requires intra-state resources	Requires national or international resources
Incident Action Plan	Simple/Outline	Outline	Detailed
Type of Incident			
Type of response	First-strike	Escalated	Campaign
Duration of response	Single shift	Multiple shifts Days to weeks	Extended response Weeks to months
Resources at Risk			
Human	Potential for serious injuries	Potential for loss of life	Potential for multiple loss of life
Environment	Isolated impacts or with natural recovery expected within weeks.	Significant impacts and recovery may take months. Monitoring and remediation may be required.	Significant area and recovery may take months or years. Monitoring and remediation will be required.
Wildlife	Individuals of a small number of fauna species affected	Groups of fauna species or multiple numbers of individuals affected	Large numbers of fauna (individuals and species) affected

Characteristic	Level 1	Level 2	Level 3
Economy	Business level disruption	Business failure	Disruption to a sector
Social	Reduced services	Ongoing reduced services	Reduced quality of life
Infrastructure	Short term failure Non-safety/operational critical failure	Medium term failure Potentially safety/operational critical failure	Severe impairment Safety/operational critical system failure
Public affairs	Local and regional media coverage	National media coverage	International media coverage

2.3. Shell IMT Key Roles and Responsibilities

Shell's IMT personnel are trained in emergency management in line with the Shell Incident Command System (ICS). The roles and responsibilities of the IMT are listed in detail in the Shell Incident Management Team (West) Emergency Response Plan (HSE_GEN_011209). The function of each team and key individual roles are summarised in the EP.

3. Incident Management

Shell utilise the Incident Command System (ICS) framework for managing incidents. This enables Shell to conduct a more effective response through use of a broad range of personnel resources by using globally consistent terminology.

As part of this framework, Shell uses the 'Planning Process', commonly referred to as the 'Planning P'. The leg of the 'P' describes the initial response period which is commonly characterised by the first operational period of the response (Initial or Reactive Phase). During this period, the IMT will conduct initial notifications, assess the incident, prepare initial ICS Forms and consider resourcing and tactics to respond to the incident. For a short-duration response, an initial response may be all that is required, and an ICS 201, the initial response IAP may be sufficient.

3.1. Incident Action Plans

For spills extending beyond the initial (first strike) actions outlined in Tables A and B (Initial Response Actions), an Incident Action Plan (IAP) for each operational period will be developed at the time of a spill, appropriate to the nature, size and scale of the activity and utilising the response strategies outlined in Sections 7 to 15. The pre-spill planning assessment of the applicability of each response strategy, including the Spill Impact Mitigation Assessment (SIMA), will be revisited and updated if required based on the actual characteristics of the spill at hand.

If the incident is likely to require additional operational periods, shift changes of personnel or third parties involved in the response, an IAP should be developed. The development of the IAP is facilitated by the IMT Planning Section Chief. This involves using IAP software and/or status boards to facilitate development of the IAP and recording of critical information and actions to enable effective management of the response.

The IMT should ensure that as IAPs are implemented, their performance is monitored through communication with the ERT (e.g. surveillance personnel, Vessel Masters, team leaders) who can report on the effectiveness of the tactics being implemented. This information can then be used in the development of the IAP for the next operational period.

3.2. Activation of External Oil Spill Response Organisations and Support Organisations

Shell has numerous agreements in place with Oil Spill Response Organisations (OSROs) and support organisations involved in the storage, maintenance and mobilisation of Level 2 and 3 spill response resources.

OSROs and support organisations which Shell can call on in the event of a Level 2 or 3 spill are outlined below. Additional Information on OSROs and support organisations equipment capability is outlined in Appendix B: Oil Spill Resource Directory. The IMT is responsible for activating OSROs and support organisations as outlined in the initial response Tables A and B, with more detailed activation instructions provided in Table 3-1.

Table 3-1: Activation Instructions for External Support Organisations

Support agency/role	Timing	Resources	Activation instructions	Shell person responsible for activating
AMOSC, AMOSC Duty Manager	As soon as possible	Shell is a Participating Company Member in AMOSC and can call upon AMOSC personnel and equipment (including oiled wildlife). Under the AMOSPlan, Shell 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 (Refer to Appendix B: Oil Spill Resource Directory for additional detail)	**Step 1.** 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 2.** E-mail confirmation and a telephone call to AMOSC will be required for mobilisation of response personnel and equipment, and call out 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	If support if required, the General Manager HSE, IMT Leader or Shell Emergency Manager will notify AMOSC
Oil Spill Response Limited (OSRL), OSRL Duty Manager	If spill requires additional resources or technical expertise	Shell is a Participating Member of OSRL, which can provide advice, equipment and personnel to meet a wide range of scenarios **Technical Advice** Shell can contact ORSL via the Shell Oil Spill Expertise Centre and receive free technical support for the first 48hrs. However, mobilisation of OSRL	**Technical advice only** **Step 1.** Contact OSRL Duty Manager in Singapore and request advice from OSRL **Step 2.** Advise STASCo that OSRL have been contacted for advice only. Consider the need for additional resources with STASCo.	If support if required, the General Manager HSE, IMT Leader or Shell Emergency Manager will notify OSRL

Support agency/role	Timing	Resources	Activation instructions	Shell person responsible for activating
		personnel or equipment must be pre-approved by the Shell Oil Spill Expertise Centre **<u>Personnel and equipment</u>** **Personnel** Personnel are on standby and available 24 hours a day, 365 days a year with equipment and logistics support to initiate, mobilise, and sustain a response comprising: 1 Senior Oil Spill Response Manager 1 Oil Spill Response Manager 18 Oil Spill Response Specialists / Oil Spill Responders 1 Logistics Service Branch Coordinator Technical advisors and additional response personnel may also be provided OSRL can obtain access to a Wildlife Response Officer through the Sea Alarm Foundation **Equipment and services** Equipment includes subsea well intervention equipment, dispersant, dispersant application systems, containment, recovery, cleaning,	**<u>Personnel and equipment mobilisation</u>** Step 1. Contact STASCo to obtain approval to contact OSRL **Step 2.** Contact OSRL Duty Manager in Singapore and request personnel and equipment assistance from OSRL **Step 3.** Send written notification to OSRL in conjunction with STASCo 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. Mobilisation of resources will take place once OSRL has received mobilisation authorisation from STASCo	

Support agency/role	Timing	Resources	Activation instructions	Shell person responsible for activating
		absorbent, waste storage, oiled wildlife kits, vehicles, vessel and communications equipment, plus logistics support (Access to 50% of equipment by type)		
AMSA	As soon as practicable	AMSA will coordinate the resources of the National Plan for Maritime Environmental Emergencies on the formal request of the appointed IMT Leader. Where Shell is the control agency, requests for AMSA assistance (through the MOU) will include an AMSA liaison officer be mobilised to the IMT ASAP. Where AMSA is the control agency, during the interim period until AMSA have assembled their IMT, Shell (IMT Leader) will liaise closely with the AMSA liaison officer and or the AMSA incident controller to inform them of first strike actions being taken. Where a first strike involves dispersant application; specific written approval from the AMSA IC is required before chemical dispersant application.	Contact Rescue Coordination Centre	If support if required, the General Manager HSE, IMT Leader or Shell Emergency Manager will notify AMSA
Department of Biodiversity, Conservation and Attractions (DBCA)	If spill has the potential to impact wildlife	DBCA has 1 oiled wildlife container positioned at Kensington and 2 x trailer kits (one at Kensington and one at Karratha)	Contact Oiled Wildlife Duty Officer	Environment Unit Lead

Support agency/role	Timing	Resources	Activation instructions	Shell person responsible for activating
RPS Group	As soon as practicable	Shell has an agreement in place with RPS Group to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, for Level 2-3 spills. AMOSC can also run modelling on behalf of Shell, if required, as part of contracting arrangements with RPS Group	Contact RPS Group Duty Officer	Situation Unit Lead
OSMP Provider	If OSMP initiation criteria are triggered (Refer to OSMP Implementation Plan for criteria)	OSMP Provider supplies Shell with operational and scientific monitoring personnel and equipment in the event of a Level 2 or 3 oil spill	Contact OSMP Provider's Duty Officer	Environment Unit Lead

3.1. Activation of Shell Global Response Support Network

If Shell requires additional support to respond to a spill, it can activate its Global Response Support Network (GRSN) (Level 3 response network) through the Shell Tanker and Shipping Company (STASCo)/ Shell Oil Spill Expertise Centre (OSEC) (Table 3-2).

The GRSN can supply necessary trained personnel from Australia and throughout the world to provide incident management, field command and supervision of response teams. When these resources arrive, they are integrated into Shell's existing IMT structure. The nearest response team is the Asia, Russia, Australasia Team (ARAT).

Table 3-2: Shell Global Resources Activation Instructions

Activation Instructions	Shell IMT member Responsible for Activating
Step 1. Contact on-call STASCo/OSEC representative and provide them with an activation brief, detailing as much information about the incident as possible. **Step 2.** Continue to liaise with on-call STASCo/OSEC representative (or delegate) to determine support available and required.	IMT Leader

3.2. Emergency Response Centre Locations

Emergency response centres will be located in the following areas;

- Prelude Emergency Response Team (ERT): Emergency Response Centre (ERC) within the affected Facility (if feasible). Details are outlined in the Prelude Emergency response Plan.
- Incident Management Team (IMT);
- Primary; Shell House, Level 4
- Secondary Shell House Level 11
- IMT: Alternate; Regency Hyatt or Pan Pacific Hotel, Perth. Further details in Weekly Contact List HES_GEN_011648.
- Forward Operating Base (FOB) or Staging Area; Broome; Details are outlined in the IMT (W) ERP HSE_GEN_011209. Note; if a response at Browse Island is required, a FOB may be established from a vessel at Browse Island.

3.3. Customs Clearance Processes and Approvals

The following list is an example of arrangements that Shell would have to make in the event of an international mobilisation;

- Customs clearance for equipment
- Emergency visa and immigration clearance for personnel

In the event any delays or issues are encountered with customs clearance or visa requirements, this can be escalated through the Offshore Petroleum Incident Coordination Committee (OPICC) as outlined under the Offshore Incident Coordination Framework.

Personnel will require visas, personnel lists and names will be required. This should be fastracked (if required) through the 'trusted trader agreement' with Australian Boarder Force. Use of emergency visas are a possible avenue to use during a response. However, all of these visa application processes are likely to take greater than 24 hours.

Equipment importation can be expedited and facilitated through the 'trusted trader agreement' with Australian Boarder Force. This can be done very quickly. Best case scenario would be equipment could be cleared by customs on route to Australia and delivered intermediately to the carrier after arrival. This assumes that the equipment (units) are 'clean' and can pass biosecurity inspection. Key international response organisations such as OSRL are aware of customs clearance processes and approvals required for Australia.

3.4. Communications

The Weekly Contact List Work Instruction HES_GEN_011_648 includes all contact phone numbers for all key relevant response roles which can be passed onto relevant organisations such as AMSA during a response.

Field communications during a spill response will initially be handled via the existing Facility communications network (radios/phones). This network will utilise existing radios, telephones/mobiles, and computers and will be maintained by Facility personnel. In the event of a Level 2-3 incident, field communications will be enhanced with other Shell and contract resources as the situation demands.

4. External Notifications and Reporting

The IMT is responsible for making most external notification and reporting except where outlined in initial (first strike) actions (Tables A & B). Table 4-1 outlines external notification and reporting requirements required for Level 2-3 incidents. Reporting for Level 1 incidents can be found within the Prelude FLNG EP. Further details on external notifications and reporting is found within the IMT (W) ERP (HSE_GEN_011_209).

The Shell IMT Weekly Contact List Work Instruction (HSE_GEN_011648) contains the contact numbers for all agencies listed. The IMT Weekly Contact List is periodically reviewed and updated.

Table 4-1: External Notifications and Reporting

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
AMSA (Rescue Coordination Centre)	**Immediate** verbal notification to include: • name of ship/s involved • time, type and location of incident • quantity and type of harmful substance • assistance and salvage measures • any other relevant information Written POLREP form, within **24 hours** of request from AMSA	National Plan for Maritime Environmental Emergencies	All slicks trailing from a vessel All spills to the marine environment (notwithstanding the size or amount of oil or sheen) All spills where National Plan equipment is used in a response	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/
NOPSEMA (Incident Notification Office)	1. Verbal notification within **2 hours** 2. 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 activity that has caused, or has the potential to cause, moderate to significant environmental damage: • Prelude loss of well control • Prelude loss of containment (Condensate)	Notification by OIM	Incident reporting requirements: https://www.nopsema.gov.au/assets/Guidance-notes/A198752.pdf

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
			• Vessel loss of containment (MDO or HFO)		
National Offshore Petroleum Titles Administrator (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 - https://www.nopsema.gov.au/assets/Guidance-notes/A198752.pdf	Spill in Commonwealth waters that is reportable to NOPSEMA	Notification by IMT Public Information Officer (or delegate)	Provide same written report as provided to NOPSEMA
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 Matters of National Environmental Significance (MNES) are considered at risk from a spill or response strategy, or where there is death or injury to a protected species	Notification by IMT Public Information Officer (or delegate)	Not applicable
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	Notification by IMT Public Information Officer (or delegate)	No forms, but the following information should be provided: • Titleholder's details

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
			an Australian marine park		• 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 (AFMA)	Verbal phone call notification **as soon as practicable** (within 4 hours)		Fisheries within the environment that may be affected (ZPI) Consider a courtesy call if not in exposure zone	Notification by IMT Public Information Officer (or delegate)	Not applicable
If spill is heading towards WA waters					
WA DoT (WA Maritime Environmental Emergency Response (MEER) unit)	**Immediate notification** to the Maritime Environmental Emergency Response (MEER) Duty Officer Follow up with written POLREP, **as soon as practicable** Written Situation Report (SITREP) submitted within **24 hours** of being directed by DoT	State Hazard Plan – Maritime Environmental Emergencies	All actual or impending spills in WA waters, regardless of source or quantity	Immediate notification by IMT Leader POLREP to be submitted by IMT Public Information Officer (or delegate)	DoT POLREP: http://www.transport.wa.gov.au/mediaFiles/marine/MAC-F-PollutionReport.pdf SITREP: http://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 to be submitted by IMT Public Information Officer (or delegate)	
Department of Mines, Industry Regulation and Safety (DMIRS) (Petroleum Environment Duty Officer)	Verbal notification within **24 hours** Notification report within **10 days**	Agreed consultation	All actual or impending spills in WA waters	Notification by IMT Public Information Officer (or delegate)	Not applicable
Department of Water and Environment Regulation (DWER)	Verbal notification **as soon as practicable (within 4 hours)**	Environment Protection Act	All actual or impending spills in WA waters	Notification by IMT Public Information Officer (or delegate)	Not applicable
Department of Biodiversity Conservation and Attractions (State Duty Officer)	Verbal notification **as soon as practicable**	WA Oiled Wildlife Response Plan	Notify if spill has the potential to impact or has impacted wildlife in State waters (to activate the Oiled Wildlife Advisor)	Notification by Environment Unit Lead	Not applicable

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
Department of Primary Industries and Resource Development (DPIRD)	Verbal notification **as soon as practicable** (within 4 hours)	Agreed consultation	Notify if spill has the potential to impact or has impacted fisheries in State waters	Notification by IMT Public Information Officer (or delegate)	Not applicable
If spill is heading towards NT waters					
NT Regional Harbourmaster	Verbal notification Follow up with POLREP as soon as practicable after verbal notification	Northern Territory Oil Spill Contingency Plan. As per State legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in NT waters, regardless of source or quantity Notify if spill has the potential to impact wildlife in Territory waters (to activate the Oiled Wildlife Coordinator)	Notification by IMT Public Information Officer (or delegate)	Marine Pollution Reports (POLREPs) are to be emailed to rhm@nt.gov.au (Regional Harbourmaster) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government webpage https://nt.gov.au/marine/marine-safety/report-marine-pollution
NT Department of Environment and Natural Resources (DENR) (Pollution Response Hotline;	Verbal notification as soon as practicable Written report to be provided as soon as practicable after the incident, unless otherwise specified by the Minister	Northern Territory Oil Spill Contingency Plan. As per State legislation (i.e. *Marine Pollution Act 1999*)	All actual or impending spills in NT waters	Notification by IMT Public Information Officer (or delegate)	Marine Pollution Reports (POLREPs) are to be emailed to pollution@nt.gov.au (Environmental Operations) Instructions for submitting POLREPs (including a POLREP Template) are provided on the NT Government webpage

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
Environmental Operations)					https://nt.gov.au/marine/marine-safety/report-marine-pollution
NT Department of Primary Industry and Fisheries (DPIF)	Verbal notification, timing not specified	Not applicable	Fisheries within the ZPI Consider a courtesy call if not in exposure zone	Notification by IMT Public Information Officer (or delegate)	Not applicable
If spill is heading towards international waters					
Department of Foreign Affairs and Trade (DFAT) (24-hour consular emergency centre)	Verbal phone call notification within **8 hours**, if the spill is likely to extend into international waters	Not applicable	Notify DFAT that a spill has occurred and is likely to extend into international waters Inform DFAT of the measures being undertaken to manage the spill, e.g. implementation of any operational and scientific monitoring plans that have been triggered, e.g. modelling studies, aerial surveillance to predict and monitor the spill extent and	Notification by IMT Public Information Officer (or delegate)	Not applicable

Agency or Authority	Type of Notification /Timing	Legislation/ Guidance	Reporting Requirements	Responsible Person/Group	Forms
			potential impact to fishing activities		

5. Selection of Response Strategies

The implementation of response strategies will be subject to their ability to be executed safely and effectively. Constraints on the execution of response strategies applicable on the day may include but not be limited to; time of day, weather conditions and seasons, actual properties of the oil, safety and compliance with SOLAS 1974. Where timeframes are given for the implementation of response strategies, this is always subject to suitable conditions to safely implement the strategy.

5.1. Response Objectives

For spills where Shell is the Control Agency, the response objectives are to develop and implement appropriate and effective response strategies that are commensurate to the scale, nature and risk of the spill. Incident objectives will be set in an Objectives Meeting, to be held within the IMT's first operational period. Guidance on how to draft and test these objectives is provided in Shell IMT (West) Emergency Response Plan (HSE_GEN_011_209).

5.2. Spill Scenarios

There are four maximum credible spill scenarios associated with Prelude FLNG, which could occur in the ZPI as outlined in the Prelude FLNG Environment Plan (2000-010-S001-SS01-U01000-UA-5880-00002).

Additional detail on hydrocarbon characteristics and weathering data are included in Appendix A - Types/characteristics of oils.

Table 5-1: Worst-case credible spill scenarios associated with Prelude FLNG Facility

Spill Scenario		
Event	**Hydrocarbon Type**	**Approximate Maximum Volume and Duration**
Subsea well blow out	Prelude Condensate	1,611 m^3/day (128,944 m^3 over 80 days)
Vessel collision with Prelude FLNG rupturing Prelude Condensate tank	Prelude Condensate	42,000 m^3 over 2 hours
Cargo Vessel collision with Prelude FLNG rupturing Cargo Vessel storage tank	Heavy Fuel Oil	1,000 m^3 over 1 hour
Complete rupture of Support Vessel Diesel Tank	Marine Diesel Oil	750 m^3 over 1 hour

5.3. Spill Modelling Results

The worst-case credible spill scenarios shown in Table 5-1 were used as the basis for modelling, which was performed using a three-dimensional spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program). This model is designed to simulate the transport, spreading and weathering of specific oil types under the influence of changing meteorological and oceanographic forces.

A stochastic modelling scheme was followed for each of the scenarios. The stochastic scheme involves the repeated application of SIMAP to simulate the defined spill scenarios using different samples of current and wind data. The model results were then combined to provide a summary of each season.

The modelling outputs do not represent the potential behaviour of a single spill (which would have a much smaller area of influence) but provides an indication of the probability of any given area of the sea surface being contacted by hydrocarbons above impact thresholds.

For the purpose of spill response preparedness, outputs relating to floating oil and oil accumulated on the shoreline are most relevant (i.e. oil that can be diverted, contained, collected or dispersed through the use of spill response strategies) for the allocation and mobilisation of spill response resources. Therefore, the modelling results presented in Table 5-2 relate to floating concentrations and shoreline accumulation volumes.

Results for the worst-case credible scenarios have only been included if there was a floating hydrocarbon concentration greater than 10 g/m^2 at >0.25% probability.

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.

Table 5-2: Prelude FLNG Summary of Spill Modelling Results

Spill Scenario			Modelling Results			
Event	**Hydrocarbon Type**	**Maximum volume/duration**	**Location**	**Annualised probability (%) of films arriving at receptors >10g/m^2**	**Minimum time to receptor (days) for films >10g/m^2**	**Maximum accumulated volume along shoreline (m^3) in the worst replicate spill**
Subsea well blow out	Prelude Condensate	~1,611 m^3/day (128,944 m^3 over 80 days)[7]	Browse Island	<0.5	NC	NC
			Cartier Island	<0.5	NC	NC
			Echuca Shoal*	<0.5	NC	NC
			Heywood Shoal*	<0.5	NC	NC
			Seringapatam Reef*	<0.5	NC	NC
			Scott Reef*	<0.5	NC	NC
			Ashmore Reef	<0.5	NC	NC
			Buccaneer Archipelago	<0.5	NC	1.1
			Indonesian Boundary	<0.5	NC	50.8
Vessel collision (vessel	Prelude Condensate	42,000 m^3 over 2 hours	Browse Island	2.75	1.9	N/A
			Cartier Island	2.0	4.8	N/A

[7] The modelling results presented here are for the original estimated spill volume of ~3,180 m³/day. This volume was revised down to ~1,611m³/day following commencement of operations and further analysis of the wells. Therefore, the modelling results presented for this scenario are significantly conservative.

Spill Scenario			Modelling Results			
Event	**Hydrocarbon Type**	**Maximum volume/duration**	**Location**	**Annualised probability (%) of films arriving at receptors >10g/m^2**	**Minimum time to receptor (days) for films >10g/m^2**	**Maximum accumulated volume along shoreline (m^3) in the worst replicate spill**
storage tank at Prelude FLNG)			Echuca Shoal*	3.5	3.5	NC
			Heywood Shoal*	5.5	3.3	NC
			Seringapatam Reef*	1	8.1	NC
			Scott Reef*	0.25	8.5	NC
			Ashmore Reef	3.25	6.9	NC
			Indonesian Boundary	0.5	15.5	1,393
Vessel collision (vessel storage tank at Prelude FLNG)	Heavy Fuel Oil	1,000 m^3 over 1 hour	Browse Island	0.75	2.0	N/A
			Cartier Island	0.75	4.8	N/A
			Echuca Shoal*	1.0	3.3	NC
			Heywood Shoal*	4.75	2.5	NC
			Seringapatam Reef*	1.0	5.7	NC
			Scott Reef*	0.75	6.7	NC
			Ashmore Reef	1.0	7.0	NC
			Buccaneer Archipelago	0.25	10.0	475

Spill Scenario			**Modelling Results**			
Event	**Hydrocarbon Type**	**Maximum volume/duration**	**Location**	**Annualised probability (%) of films arriving at receptors >10g/m^2**	**Minimum time to receptor (days) for films >10g/m^2**	**Maximum accumulated volume along shoreline (m^3) in the worst replicate spill**
Complete rupture of FLNG storage tank	Marine Diesel Oil	750 m^3 over 1 hour	Browse Island	0.5	1.8	61.1
			Cartier Island	<0.5	NC	NC
			Echuca Shoal*	0.5	3.6	NC
			Heywood Shoal*	<0.5	NC	NC
			Seringapatam Reef*	<0.5	NC	NC
			Scott Reef*	<0.5	NC	NC
			Ashmore Reef	<0.5	NC	6.7
			Buccaneer Archipelago	<0.5	NC	71

NC – No contact to receptor predicted for specified threshold (e.g. 10g/m^2) and/or no contact predicted at any threshold

N/A - Due to the order of magnitude difference in the size of Browse Island and Cartier Island (< 500 m) compared to the size of the individual grid cells used in modelling (1 km), Browse Island and Cartier Island have not been represented with a shoreline in the model. The proportion of shoreline accumulation forecast by the model would be greatly over-predicted if these islands were represented by a shoreline grid cell.

* Floating oil will not accumulate on submerged features at open ocean locations, but these receptors have been shown to indicate potential impacts at these locations from entrained hydrocarbons.

5.4. Protection Priorities

When dealing with oil spills in remote environments, it is not always realistic or feasible to protect all receptors. Therefore, prioritising receptors helps identify where available resources should be directed for the best effect. It enables the Control Agency to make informed decisions, and ultimately in the development and execution of an effective response strategy.

For the purposes of this OPEP, protection priorities refer to the most significant receptors and values (hereafter referred to as receptors) that require protection from the impacts of a spill. The protection priority rankings listed in Table 5-3 to Table 5-6 are consistent with those drafted by DoT for the Kimberley Region (Advisian, 2018).

Results from hydrocarbon spill modelling (Table 5-2) were compared against the location of key sensitive receptors with high conservation valued habitat or species or important socio-economic/heritage value within the ZPI. Sensitive receptors within the ZPI with shortest potential timeframes to contact above the floating moderate impact threshold of 10 g/m^2 were identified.

More information on the development of the moderate impact thresholds is provided in the EP.

Table 5-3 to Table 5-6 outline the locations with highest protection priority in the event of a spill associated with Prelude FLNG activities. Depending on the spill scenario (i.e. volume and location), the priority protection areas could be impacted by hydrocarbons at or above moderate threshold concentrations. Figure 5-1 to Figure 5-5 show the coastal sensitivities for some of the protection priority locations.

Table 5-3 : Priority Protection Areas in the ZPI for Subsea Well Blow Out (Condensate) Scenario

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Browse Island	40 km SE	Marine turtles (Green turtle nesting and foraging)	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	NC	NC	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
Cartier Island	134 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	NC	NC	Medium (if contact above thresholds may occur)
		Seabird breeding site	Breeding possibly limited to Crested Terns[8]	2	1			
		Foraging habitat for whale sharks	Oct-Dec	1	2			
		Marine turtles (internesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Marine Park (IUCN Ia)	Always present	4	3			

[8] Limited surveys have been undertaken at this site (Clarke, 2010)

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Echuca Shoal	61 km ESE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	NC	NC	Low
Heywood Shoal	81 km NE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	NC	NC	Low
Seringapatam Reef, Scott Reef and Sandy Islet	131 km W	Staging post for migratory shorebirds and a foraging area for seabirds including roseate terns, lesser frigatebirds and brown boobies	Various	2	1	NC	NC	Medium (if contact above thresholds may occur)
		Marine turtles (Green turtle nesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but always present	4	4			
		Key Ecological Feature and Commonwealth Heritage Place	Always present	3	3			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Ashmore Reef	162 km NNE	Marine turtles (Green turtle nesting and foraging; Loggerhead and Hawksbill foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	NC	NC	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Fish	Always present	1	2			
		Seabird rookery and migratory staging/feeding area for migratory birds (Red knot, Curlew sandpiper, Eastern curlew)	Various, although majority from April - Oct	3	2			
		Dugong (small population <50 individuals)	Always present	3	2			
		Ramsar wetland; Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts); and	Always present	5	5			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Commonwealth Heritage Place						
Buccaneer Archipelago	250 km S	Mangroves	Always present	4	4	NC	1.1	Medium (if contact above thresholds may occur)
		Saltwater Crocodile	Nesting Dec to Apr	2	1			
		Marine turtles (Green turtle nesting and foraging	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Fish (including Vulnerable Green Sawfish, Freshwater Sawfish)	Breeding Nov-Mar	2	3			
		Cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature)	Always present	4	4			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
Indonesian Boundary	300 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	NC	50.8	Medium (if contact

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Mangroves	Always present	4	4			above thresholds may occur)

NC – No contact to receptor predicted for specified threshold (e.g. 10 g/m^2) and/or no contact predicted at any threshold

N/A - Due to the order of magnitude difference in the size of Browse Island and Cartier Island (< 500 m) compared to the size of the individual grid cells used in modelling (1 km), Browse Island and Cartier Island have not been represented with a shoreline in the model. The proportion of shoreline accumulation forecast by the model would be greatly over-predicted if these islands were represented by a shoreline grid cell.

Table 5-4 : Priority Protection Areas in the ZPI for Vessel Collision (Condensate) Scenario

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Browse Island	40 km S/E	Marine turtles (Green turtle nesting and foraging)	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	1.9	N/A	High
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
Cartier Island	134 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	4.8	N/A	High
		Seabird breeding site	Breeding possibly limited to Crested Terns[9]	2	1			
		Foraging habitat for whale sharks	Oct-Dec	1	2			
		Marine turtles (internesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Marine Park (IUCN Ia)	Always present	4	3			

[9] Limited surveys have been undertaken at this site (Clarke, 2010)

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Echuca Shoal	61 km ESE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	3.5	NC	Low
Heywood Shoal	81 km NE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	3.3	NC	Low
Seringapatam Reef, Scott Reef and Sandy Islet	131 km W	Staging post for migratory shorebirds and a foraging area for seabirds including roseate terns, lesser frigatebirds and brown boobies	Various	2	1	8.1	NC	Medium (if contact above thresholds may occur)
		Marine turtles (Green turtle nesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but always present	4	4			
		Key Ecological Feature and Commonwealth Heritage Place	Always present	3	3			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Ashmore Reef	162 km NNE	Marine turtles (Green turtle nesting and foraging; Loggerhead and Hawksbill foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	6.9	NC	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Fish	Always present	1	2			
		Seabird rookery and migratory staging/feeding area for migratory birds (Red knot, Curlew sandpiper, Eastern curlew)	Various, although majority from April - Oct	3	2			
		Dugong (small population <50 individuals)	Always present	3	2			
		Ramsar wetland; Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts); and	Always present	5	5			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Commonwealth Heritage Place						
Indonesian Boundary	300 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	15.5	1,393	Medium
		Mangroves	Always present	4	4			

Table 5-5 : Priority Protection Areas in the ZPI for Vessel Collision (Heavy Fuel Oil) Scenario

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Browse Island	40 km S/E	Marine turtles (Green turtle nesting and foraging)	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	2.0	N/A	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
Cartier Island	134 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	4.8	N/A	Medium (if contact above thresholds may occur)
		Seabird breeding site	Breeding possibly limited to Crested Terns[10]	2	1			
		Foraging habitat for whale sharks	Oct-Dec	1	2			
		Marine turtles (internesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Marine Park (IUCN Ia)	Always present	4	3			

[10] Limited surveys have been undertaken at this site (Clarke, 2010)

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Echuca Shoal	61 km ESE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	3.3	NC	Low
Heywood Shoal	81 km NE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	2.5	NC	Low
Seringapatam Reef, Scott Reef and Sandy Islet	131 km W	Staging post for migratory shorebirds and a foraging area for seabirds including roseate terns, lesser frigatebirds and brown boobies	Various	2	1	5.7	NC	Medium (if contact above thresholds may occur)
		Marine turtles (Green turtle nesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but always present	4	4			
		Key Ecological Feature and Commonwealth Heritage Place	Always present	3	3			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Ashmore Reef	162 km NNE	Marine turtles (Green turtle nesting and foraging; Loggerhead and Hawksbill foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	7.0	NC	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Fish	Always present	1	2			
		Seabird rookery and migratory staging/feeding area for migratory birds (Red knot, Curlew sandpiper, Eastern curlew)	Various, although majority from April - Oct	3	2			
		Dugong (small population <50 individuals)	Always present	3	2			
		Ramsar wetland; Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts); and	Always present	5	5			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Commonwealth Heritage Place						
Buccaneer Archipelago	250 km S	Mangroves	Always present	4	4	10	475	Medium
		Saltwater Crocodile	Nesting Dec to Apr	2	1			
		Marine turtles (Green turtle nesting and foraging	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Fish (including Vulnerable Green Sawfish, Freshwater Sawfish)	Breeding Nov-Mar	2	3			
		Cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature)	Always present	4	4			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
Indonesian Boundary	300 km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	NC	50.8	Medium

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Mangroves	Always present	4	4			

Table 5-6: Priority Protection Areas in the ZPI for Complete Rupture of FLNG Storage Tank Scenario (Marine Diesel Oil)

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
Browse Island	40km S/E	Marine turtles (Green turtle nesting and foraging)	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	1.8	61.1	High
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Ramsar wetland, Key Ecological Feature and Marine Park (IUCN Ia)	Always present	5	5			
Cartier Island	134km N	Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4	NC	NC	Medium (if contact above thresholds may occur)
		Seabird breeding site	Breeding possibly limited to Crested Terns[11]	2	1			
		Foraging habitat for whale sharks	Oct-Dec	1	2			
		Marine turtles (internesting and	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			

[11] Limited surveys have been undertaken at this site (Clarke, 2010)

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		foraging); and sea snakes						
		Marine Park (IUCN Ia)	Always present	4	3			
Echuca Shoal	61km ESE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	3.6	NC	Low
Heywood Shoal	81km NE	Coral Reefs (subtidal)	Spawning – Sept – Nov and Mar – May; but corals always present	3	4	NC	NC	Low
Seringapatam Reef, Scott Reef and Sandy Islet	131km W	Staging post for migratory shorebirds and a foraging area for seabirds including roseate terns, lesser frigatebirds and brown boobies	Various	2	1	NC	NC	Medium (if contact above thresholds may occur)
		Marine turtles (Green turtle nesting and foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but always present	4	4			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Key Ecological Feature and Commonwealth Heritage Place	Always present	3	3			
Ashmore Reef	162km NNE	Marine turtles (Green turtle nesting and foraging; Loggerhead and Hawksbill foraging); and sea snakes	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2	NC	6.7	Medium (if contact above thresholds may occur)
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Fish	Always present	1	2			
		Seabird rookery and migratory staging/feeding area for migratory birds (Red knot, Curlew sandpiper, Eastern curlew)	Various, although majority from April - Oct	3	2			
		Dugong (small population <50 individuals)	Always present	3	2			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Ramsar wetland; Marine Park (IUCN Ia) – including cultural heritage (Indonesian artefacts); and Commonwealth Heritage Place	Always present	5	5			
Buccaneer Archipelago	250 km S	Mangroves	Always present	4	4	NC	71	Medium (if contact above thresholds may occur)
		Saltwater Crocodile	Nesting Dec to Apr	2	1			
		Marine turtles (Green turtle nesting and foraging	Year round, with peak season from Dec to Jan. Hatchling emergence is thought to be highest in May	3	2			
		Fish (including Vulnerable Green Sawfish, Freshwater Sawfish)	Breeding Nov-Mar	2	3			
		Cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature)	Always present	4	4			

Priority protection area	Location (in proximity to Prelude FLNG)	High value receptors	Seasonality of receptor	Ranking (floating oil)	Ranking (dissolved oil)	Minimum time to receptor (days) for films >10g/m^2	Maximum accumulated volume along shoreline (m^3) in the worst replicate spill	Protection and response priority
		Coral Reefs	Spawning – Sept – Nov and Mar – May; but corals always present	4	4			
		Mangroves	Always present	4	4			

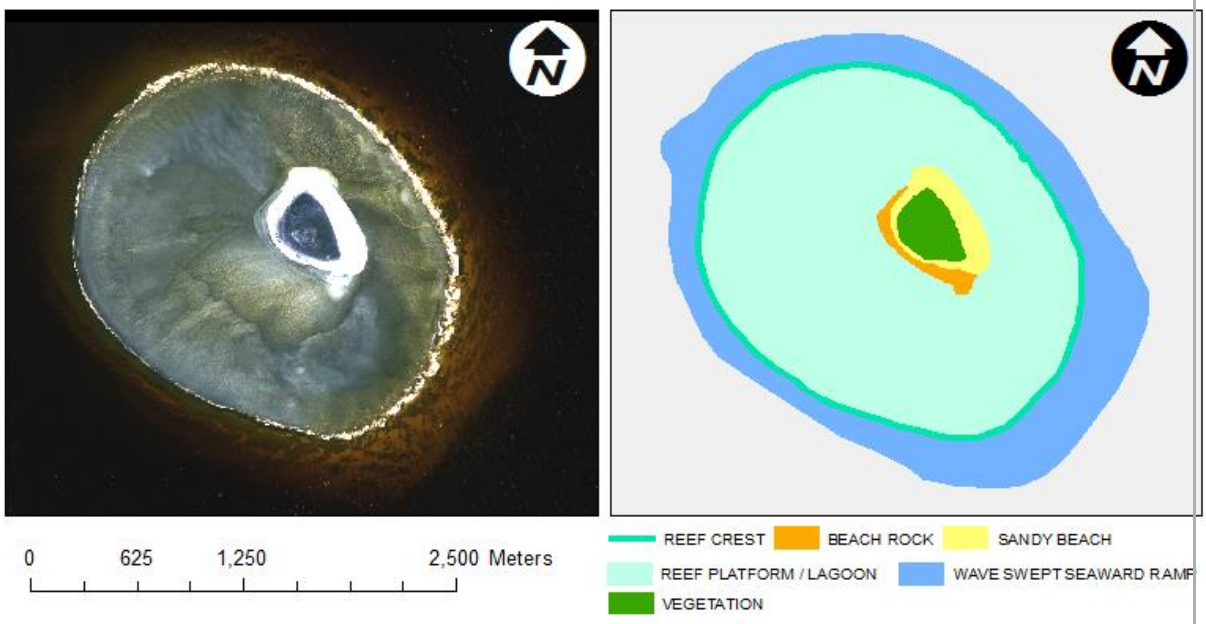


Figure 5-1: Coastal Sensitivity Map Browse Island

Figure 5-2 Coastal Sensitivities at Hibernia reef

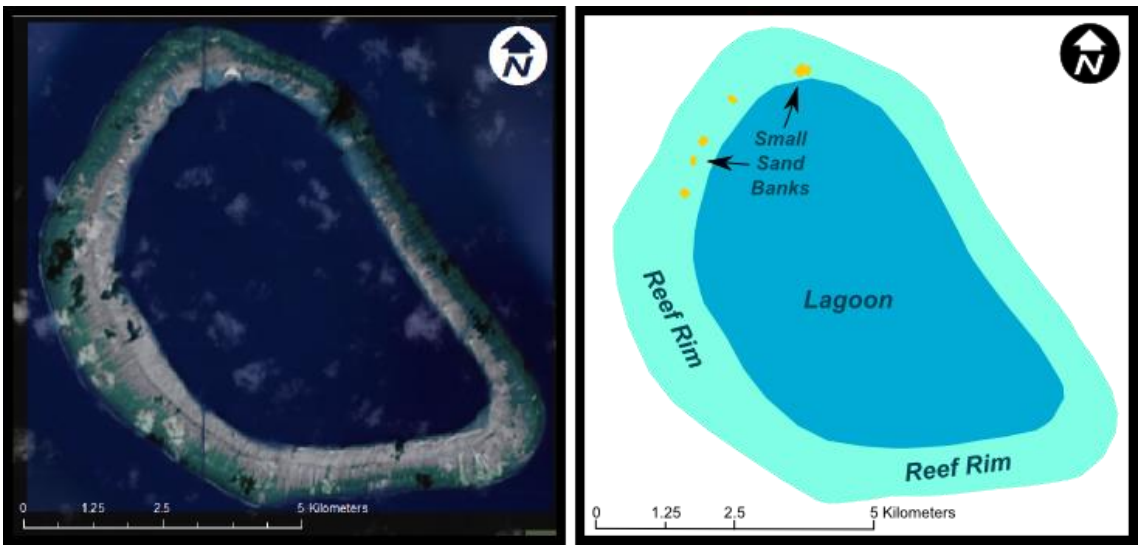
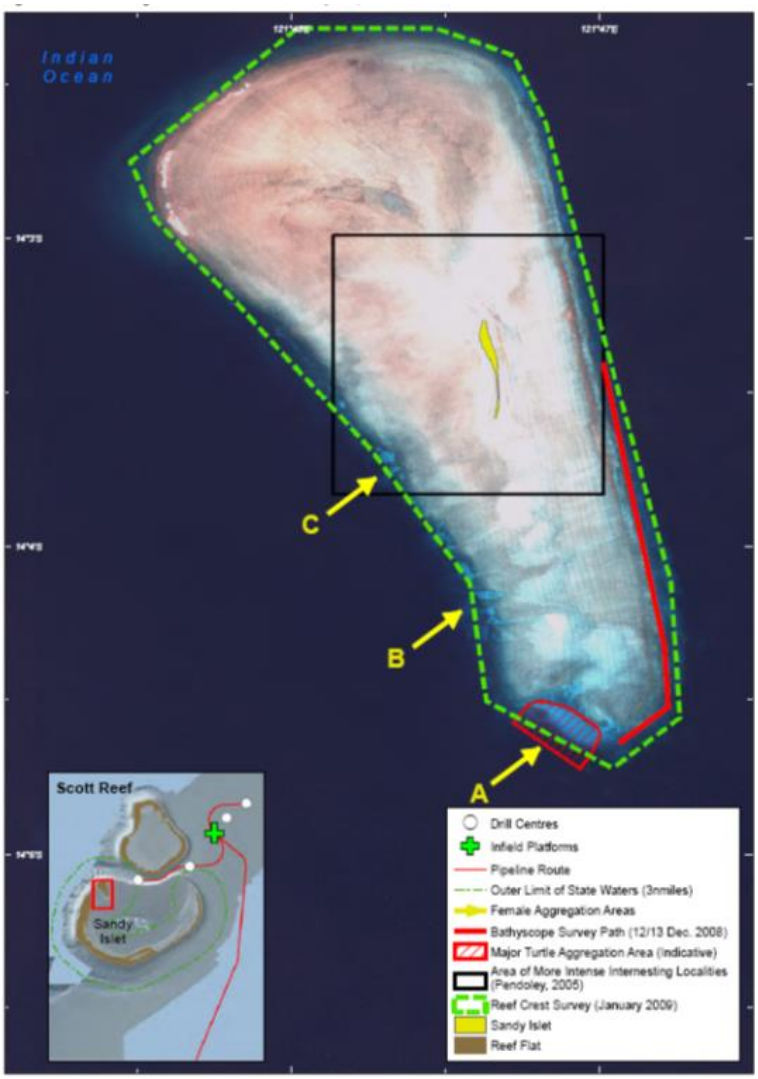
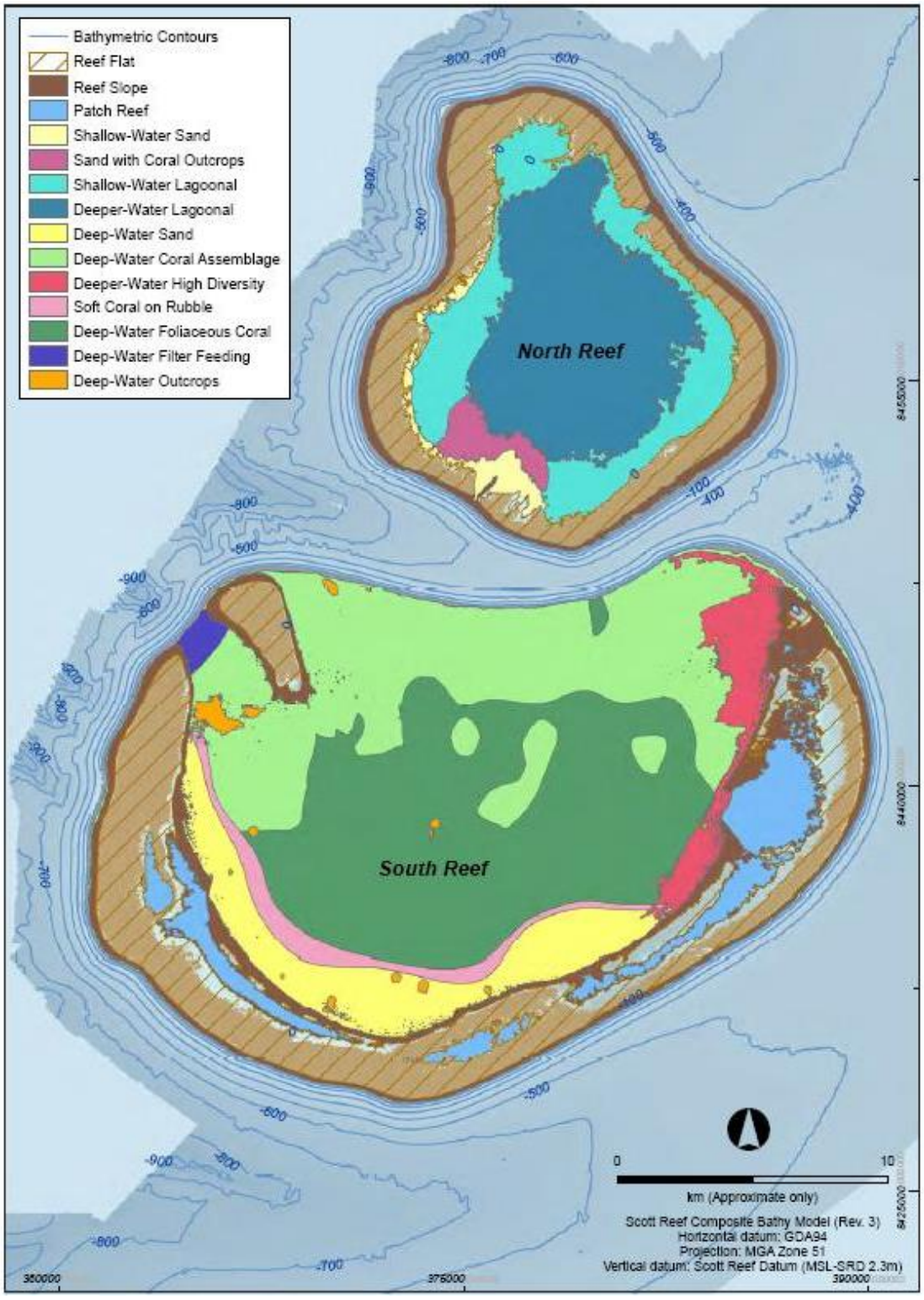


Figure 5-3: Coastal Sensitivities at Seringapatam Reef


Indian Ocean
C
B
A
Scott Reef
Sandy Islet
Drill Centres
Infield Platforms
Pipeline Route
Outer Limit of State Waters (3nmiles)
Female Aggregation Areas
Bathyscope Survey Path (12/13 Dec. 2008)
Major Turtle Aggregation Area (Indicative)
Area of More Intense Interesting Localities (Pendoley, 2005)
Reef Crest Survey (January 2009)
Sandy Islet
Reef Flat



Source: Figure 6.21 and Figure 6.30 Woodside Energy Limited (2011).

Figure 5-4: Coastal Sensitivity Map Scott Reef with insert of Sandy Islet

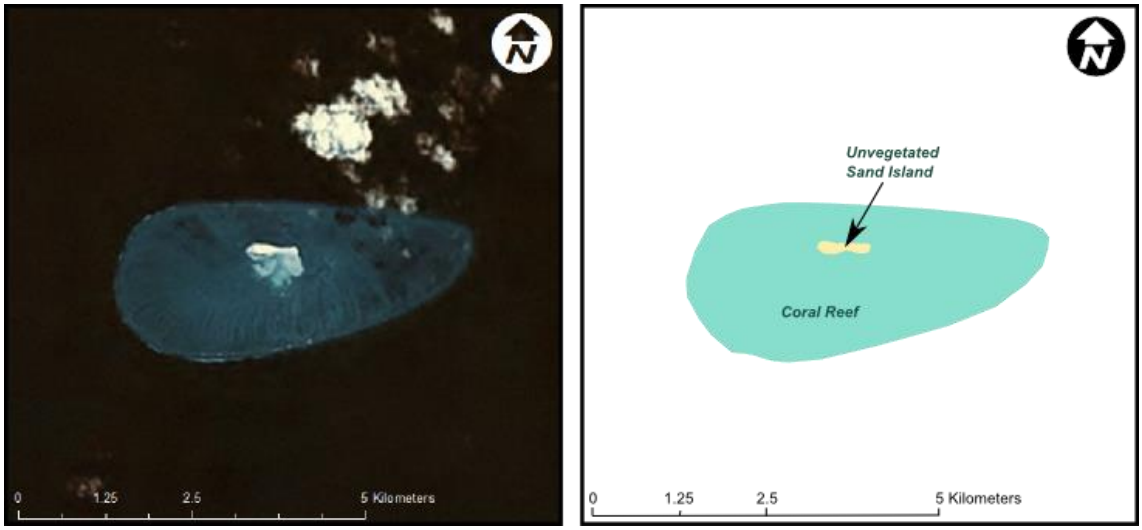


Figure 5-5: Coastal Sensitivities at Cartier Island

5.5. Response Planning Thresholds

In addition to the moderate impact assessment threshold described in Section 5.4, response thresholds have been developed for response planning to determine the conditions that response strategies would be effective. These thresholds are provided as a guide for response planning based on case studies that have demonstrated some response strategies (e.g. chemical dispersant application) require certain oil spill thicknesses and conditions to be effective.

In the event of a spill, initiation of response strategies will be based on the initiation criteria provided for each response strategy. This typically includes that the Operational SIMA (Section 5.6.2) has confirmed that the response strategy would result in a net environmental benefit. The Operational SIMA assessment will take into account effectiveness of response strategies as part of the assessment process.

Section 9.1 describes the conditions and oil thicknesses at which chemical dispersants are most effective and Section 10.1 describes the optimal conditions for effective containment and recovery operations. Response planning thresholds are provided in Table 5-7.

Table 5-7: Surface Hydrocarbon Thresholds for Response Planning

Hydrocarbon (g/m^2)	Description
10	Estimated threshold for oiled wildlife impacts
50	Estimated minimum floating hydrocarbon threshold for containment and recovery and surface dispersant application
100	Estimated floating hydrocarbon threshold for effective containment and recovery and surface dispersant application Estimated minimum shoreline accumulation threshold for shoreline clean-up

5.6. Spill Impact Mitigation Analysis

Spill Impact Mitigation Analysis (SIMA) is a decision support tool that enables planners and responders to consider available information which helps them select the most suitable response strategy or combination of strategies that would minimise impacts to the environment and people. Different response strategies provide varying levels of effectiveness and protection under different environmental conditions, depending on the individual spill (Coelho et al. 2014).

Conducting a SIMA is an important step in the oil spill planning and preparedness process, and is often called a Strategic SIMA. An overview of this assessment is provided in Figure 5-6. To complete a Strategic SIMA, all available information on a potential spill is considered (e.g. oil type, volume, duration of release), together with any spill trajectory modelling to consider potential impacts to sensitive receptors (Sections 5.1 to 5.5). Following this, a detailed assessment of the benefits and drawbacks of all response strategies are evaluated to help determine the combination of response strategies that would be most suited to each maximum credible spill scenario (Table 5-8). This includes 'primary response strategies' and 'secondary response strategies', with the former typically being more reliable and effective in reducing impacts from an individual spill. Table 5-8 also identifies any strategies not recommended for a particular spill and hydrocarbon type.

An Operational SIMA is an iterative process that should be used to help guide an IMT during a response. The initiation criteria for some of the response strategies in the following sections are also reliant upon an Operational SIMA. Real-time data from monitor and evaluate and operational monitoring activities should be incorporated into the Operational SIMA, so that the IMT can adjust the response according to the effectiveness of tactics during each operational period.

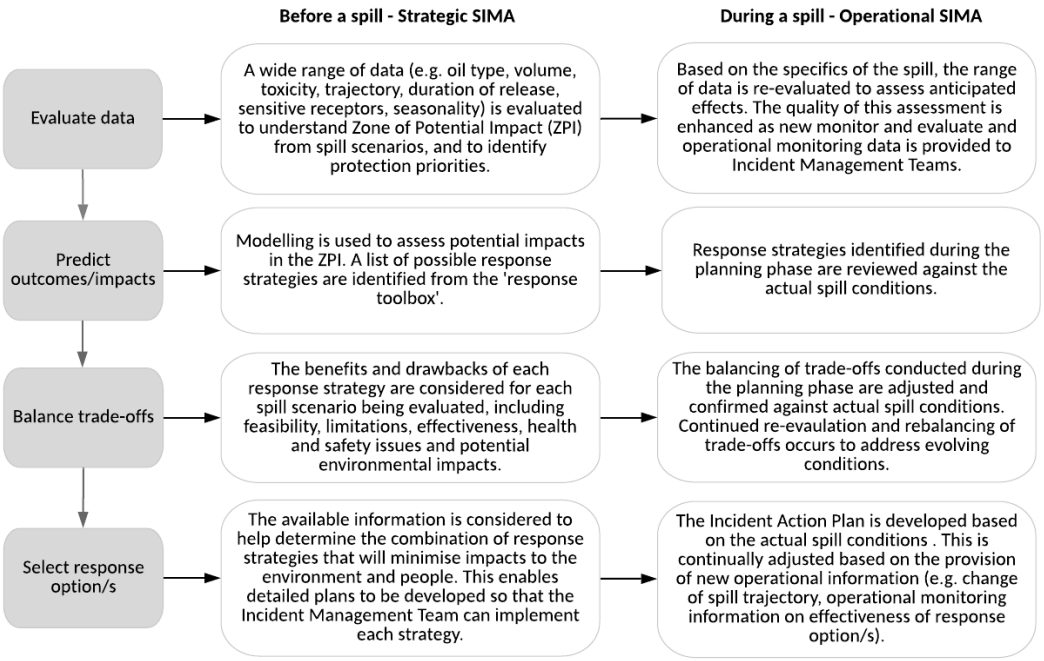


Figure 5-6: SIMA application during planning and responses phases (adapted from IPIECA-IOPG, 2015b)

5.6.1. Strategic SIMA

Selecting which response strategies to use often involves making trade-offs (e.g. health and safety, feasibility, flexibility, effectiveness), based on which environmental receptors should receive priority protection. For example, it may be more beneficial to apply subsea dispersants on a well blow out, as dispersant efficacy is highest on fresh condensate, even though this may result in minor impacts to certain fish populations in the immediate vicinity of the spill location. However, this application of dispersant would then make the spill location much safer for responders to undertake source control and reduce the overall area that would be affected by higher hydrocarbon concentrations. In turn, this would potentially reduce impacts to other fish populations and sensitive shoreline receptors, such as nesting turtles or birds.

A Strategic SIMA is presented in Table 5-8 and indicates the applicability of each response strategy for each spill scenario.

5.6.2. Operational SIMA

Following implementation of the initial (first strike) response, the Strategic SIMA (Table 5-8) will form the basis for the initial Operational SIMA. Table 5-8 includes considerations to help complete the Operational SIMA.

It should be noted that the initial Operational SIMA may be based on limited information, however, the overall response effort should not be delayed due to a lack of some information. The Operational SIMA can always be revised when more information is provided to the Environment Unit Lead.

The Environment Unit Lead is responsible for completing the Operational SIMA and to determine if outputs from the Strategic SIMA are still appropriate. The Operational SIMA should incorporate post-spill trajectory modelling data, surveillance data, operational monitoring data and should be incorporated into the IAP.

Additional guidance on the Operational SIMA process is provided in the IMT (W) ERP (HSE_GEN_011209) – Environment Unit Lead Duty Card. The Operational SIMA will also be used to inform decision making around the initiation and termination of response strategies.

Table 5-8: Strategic SIMA: Strategy applicability to maximum credible spill scenarios

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
Source Control	Primary response strategy	Not recommended	Not recommended	Not recommended	*FLNG* An FLNG spill would be instantaneous, so source control activities would be unfeasible and potentially unsafe due to the Volatile Organic Compound (VOC) levels at the sea surface. *Vessel collision* In the event of a vessel spill, the Vessel Master would revert to the Ship Oil Pollution Emergency Plan (SOPEP), which is a MARPOL requirement for applicable vessels. *Well blow out* Source control is the primary method of stopping the flow of condensate. Source control activities will occur in a staged approach, commencing with SFRT (debris clearance), subsea dispersant injection (SSDI), capping stack and relief well drilling. Chemical dispersant testing was carried out on Prelude condensate and testing showed dispersants to be relatively effective on this product. SSDI is known to reduce VOC levels at the sea surface, making conditions safer for responders and source control personnel. In addition, SSDI is shown to reduce surface concentrations of hydrocarbons, thereby reducing the exposure of seabirds and surfacing marine fauna to hydrocarbons. It also disperses hydrocarbons into a larger volume of water, reducing concentrations and enhances biodegradation (French McCay et al. 2018). A potential drawback of this response tactic is that it will result in smaller droplet sizes and entrainment of hydrocarbons into the water

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					column, which may affect some oceanic and benthic organisms (e.g. fish, plankton). However, this is likely to be temporary and restricted to the top ~3m of the water column whilst SSDI is being used (RPS, 2019). This increase in entrainment is partially offset by significant increases in biodegradation rates. SSDI is likely to be an important response tactic for a well blow out to ensure safer and more reliable delivery of other source control tactics.
					Operational SIMA considerations: • What is the optimum Dispersant-to-Oil Ratio (DOR) to achieve maximum efficacy? • Have the relevant operational monitoring components been initiated to help monitor SSDI effectiveness?
Monitor and Evaluate	Primary response strategy	Primary response strategy	Primary response strategy	Primary response strategy	Monitor and Evaluate is applicable and helpful in all spill events. This strategy has several tactics (e.g. tracking buoys, aerial surveillance) and is scalable according to the nature and scale of a spill. SIMA will always support the implementation of 'Monitor and Evaluate' given the clear benefits in maintaining situational awareness throughout the duration of a spill event and little or no environmental impact associated with its implementation. This strategy intentionally duplicates some tools outlined in the Oil Spill Monitoring Plan.
					Operational SIMA considerations: • Is the actual spill trajectory tracking as expected and what sensitive receptors are in the current or anticipated trajectory? • What is the assessed volume and size of the spill?

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					• Is the product weathering as anticipated? • How do the response strategies seem to be influencing the spill?
Natural Recovery	Secondary response strategy	Primary response strategy	Not recommended	Primary response strategy	*Diesel and Prelude condensate* Natural recovery is often the most effective response for light oils (Group 1-3). These oils typically lose a large percentage of their volume via natural weathering and fate processes in the first 24 hours following a spill. Due to the remote location of the activity, it is unlikely that significant response resources would be able to be deployed within this time period, so much of the spill volume will weather and evaporate prior to the arrival of additional response resources. *HFO* Natural recovery is not recommended for heavier hydrocarbon products, such as HFO as it has low weathering potential, especially in calm metocean conditions.
					Operational SIMA considerations: • Is the monitor and evaluate strategy showing this strategy to be effective? • Are the relevant operational monitoring components indicating that the product is naturally weathering as expected?
Surface Chemical Dispersant	Not recommended	Not recommended	Secondary response strategy	Not recommended	*Diesel and Prelude condensate* Diesel has high natural spreading, dispersion and evaporation rates in the marine environment and would be too thin to enable effective use

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					of chemical dispersants. Adding chemical dispersants would introduce more chemicals into the marine environment, for little to no benefit. Chemical dispersant testing was carried out on Prelude condensate, and testing showed some dispersants to be effective on the fresh, unweathered product. However, efficacy rapidly declined after two hours which was due to the rapid weathering of the condensate. Weathering of condensates increases the viscosity and pour point of condensates, thereby reducing the effectiveness of dispersants (Refer to Appendix A1.4 Prelude Condensate Dispersant Efficacy). Due to the remote location of this activity, it is not feasible to store significant volumes of dispersant at the facility to enable rapid dispersant application for the instantaneous FLNG spill. In addition, the VOCs expected from the FLNG spill would make the immediate vicinity unsafe for responders during the narrow window for which dispersants would be effective (<2 hours). *HFO* AMSA approval required. Some dispersants will be effective on different HFO/IFO's, although effectiveness decreases as the product weathers. Testing conducted by the New Zealand Maritime Safety Authority indicated that Corexit 9500 and Slickgone EW were most effective on a range of IFOs and heavy fuel oils (Stevens and Roberts, 2003). Due to the persistent and viscous nature of this product, it is expected that repeated application or increased dispersant dosage ratios will be required to achieve the recommended treatment rate of dispersant.

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					Consideration should be given to any impacts this may cause on sub-surface receptors and the location of spraying. This strategy is a secondary option for the HFO spill scenario. If successful, dispersant application would reduce the volume of persistent hydrocarbons contacting sensitive receptors.
					Operational SIMA considerations: • Will the spill thickness be favourable for dispersant application? • Is the product too weathered for dispersants to be effective? • What Dispersant-to-Oil Ratio (DOR) is required for this strategy to be effective on this product? • What are the metocean conditions and how would this affect the DOR? • What dispersant types are most effective on the particular product spilt? • Will spraying adversely affect any sub-surface receptors?
Contain and Recover	Not recommended	Not recommended	Primary response strategy	Not recommended	*Diesel and Prelude condensate* Diesel spreads quickly and rapidly degrades, resulting in a slick too thin to corral and recover. There is no net environmental benefit from employing this response strategy. Condensate is a volatile, rapidly spreading hydrocarbon and by the time it is safe to approach the slick, it is likely to be too thin to be amenable to the contain and recover strategy. Any attempts to corral the hydrocarbon would also reduce the rate of natural evaporation. If

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					the concentration of vapour becomes too high, then the condensate may ignite, causing safety concerns for responders. *HFO* Recommended for HFO, as it is a more persistent hydrocarbon and is likely to have a sufficient thickness on the water for some time after release due to its relatively low rates of weathering. The drawbacks of this strategy include production of significant volumes of waste due to the collection of water with floating oil, however this can be mitigated to some extent if decanting is permitted. If metocean conditions are favourable, this strategy would result in the removal of floating hydrocarbons from the environment.
					Operational SIMA considerations: • Are metocean conditions favourable for the available equipment? • Will the spill thickness be adequate for recovery? • Is decanting permitted? If not, how will waste volumes be managed?
In-situ Burning	Not recommended	Not recommended	Not recommended	Not recommended	*Diesel and Prelude condensate* Diesel spreads too quickly and it will be too thin to corral to enable in-situ burning. Condensate is a volatile, rapidly spreading oil and, by the time it is safe to approach the slick, it is likely to be too thin to be amenable to

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					in-situ burning. Given the waxy nature of the persistent fractions, it is unlikely that burning will be able to be initiated. *HFO* In-situ Burning is typically most effective on heavy crudes. It would have limited effectiveness on HFO, and only then when fresh. There are no trained personnel or fire-proof booms to facilitate In-situ Burning in Australia for it to be considered it as a feasible response strategy. Use of this response would only be through the use of trained international resources.
Protect and Deflect	Secondary response strategy	Secondary response strategy	Secondary response strategy	Secondary response strategy	Shoreline protect and deflect activities for these spill scenarios would involve mobilising personnel and equipment to remote coastal locations, which may result in physical disturbance to intertidal and shoreline habitats. It would also require small inshore vessels and calm weather to be effective and temporary staging areas for waste that would be generated from the recovery of floating oil. Protect and deflect activities are only planned to be carried out if priority receptors (Refer to Section 5.4) are contacted or at risk of being contacted and Operational SIMA demonstrates there would be an overall benefit to receptors. Particular consideration should be given to seasonal receptors during the Operational SIMA. Guidance is provided in Section 5.4. Preparations for this strategy should be made as soon as predictions indicate a possible shoreline impact. DoT IC (as Control Agency)

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					approval is required before commencing protect and deflect activities in State waters.
					Operational SIMA considerations: • Are conditions (e.g. tides, current, sea state) favourable for this strategy to be effective in open ocean environments immediately surrounding the emergent sensitivities (reefs)? • Will access to the shallow intertidal areas on top of emergent sensitivities be safe and feasible? • Can the IMT access suitable shallow draft vessels to safely establish booming arrangements (e.g. does vessel have ability to transfer anchors and booms; does it have adequate tie-points?). • Is there potential that reefs could be damaged from potential anchor drag?
Shoreline clean-up	Secondary response strategy	Secondary response strategy	Primary response strategy	Secondary response strategy	Shoreline clean-up activities for these spill scenarios would involve mobilising personnel and equipment to remote coastal environments, which may result in physical disturbance to intertidal and shoreline habitats. Shoreline clean-up is only planned to be carried out if priority receptors (Refer to Section 5.4) are contacted or at risk of being contacted and Operational SIMA demonstrates there would be an overall benefit to receptors. Preparations for shoreline response should be made as soon as predictions indicate a possible shoreline impact. DoT IC (as control agency) approval is required before commencing shoreline clean-up in State waters.

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
					Operational SIMA considerations: • What volumes and/or concentrations of hydrocarbons are present or expected on the shoreline and what would be the impact to leave the product to weather naturally? • Will access to remote shorelines be safe and feasible? • Will responders disturb sensitive nesting species? • Would it reduce overall impacts to send small teams of clean-up personnel?
Oiled Wildlife	Secondary response strategy	Secondary response strategy	Secondary response strategy	Secondary response strategy	This strategy would only be triggered if the monitor and evaluate option and/or operational monitoring showed wildlife were at risk of being impacted or had already been impacted by the spill, and it is safe and practicable to implement wildlife response tactics.
					Operational SIMA considerations: • Would response activities cause more stress or mortality to individuals than the hydrocarbon itself (e.g. How long would individuals need to be kept. How far would they need to be transported.)? • Are known species breeding or nesting? • What is their known vulnerability and/or recoverability to this hydrocarbon type?

Strategy	Well Blow-out – Prelude condensate (~up to 128,944 m^3)	Prelude condensate spill - FLNG (up to 42,000 m^3)	Vessel collision - HFO spill (up to 1,000 m^3)	Vessel collision – diesel (~up to 750 m^3)	Considerations
Oil Spill Monitoring Plan	Primary response strategy	Primary response strategy	Primary response strategy	Primary response strategy	In the event of a Level 2 or 3 spill, monitoring will be enacted according to the initiation criteria in the Oil Spill Monitoring Implementation Plan.

Table 5-9: Environmental Performance – SIMA

Performance Standard	Measurement Criteria
Protection priorities confirmed with relevant Control Agency (if applicable)	Incident Log
IMT to undertake Operational SIMA to support initiation of surface dispersants, contain and recover and shoreline protect/ deflect and clean-up response strategies	Records demonstrate Operational SIMA undertaken during OPEP implementation
IMT to undertake an Operational SIMA during the preparation and review of IAPs	Records demonstrate IMT completed an Operational SIMA during the preparation and review of IAPs

6. Source Control Strategy

Table 6-1: Source Control - Objective, Initiation Criteria and Termination Criteria

Objective	To minimise the total volume of spilled oil into the marine environment
Initiation criteria	Level 2-3 spill from a well blow out incident
Termination criteria	When flow from the well has been fully controlled via a relief well or other control measures

6.1. Overview

Source control involves stopping the discharge of hydrocarbons from the source of the spill. The source of the spill may be a vessel or subsea well. If the source of the spill is a vessel, then the vessel owner is responsible for undertaking source control, as per its Ship Oil Pollution Emergency Plan (SOPEP).

If the source of the spill is a loss of well control (LOWC) or well blowout, then source control typically involves subsea well intervention, which includes the methods outlined below.

6.2. Source Control Methods

Subsea First Response Toolkit (SFRT)

If a loss of well control incident was to occur, the seabed around a well would require an assessment to determine the most suitable subsea well intervention methods to employ. The Subsea First Response Toolkit (SFRT) includes debris clearance equipment, blowout preventer intervention equipment and ancillary tools (it also includes subsea dispersant equipment addressed below). This Toolkit provides the capability to assess the well site and prepare the well and surrounding area for installation of the capping stack or relief well drilling. It does this via remotely operated vehicles (ROVs), which Shell is required to provide independently of the SFRT.

In the event of a well control incident, Shell will mobilise the AMOSC SFRT from Fremantle to Broome for transhipment to a suitable vessel for transport and deployment at the incident location. The SFRT is located at Oceaneering's facilities at Jandakot and the dispersants are held at Fremantle. If required, the equipment would be mobilised via road from Fremantle and Jandakot to either Broome or Darwin. It is estimated this would take 24 hours to arrange and about 120 hours (5 days) to transport. A suitable vessel would be acquired by Shell during this timeframe and arrive in Broome or Darwin by Day 8 for onloading of equipment.

In addition, as a member of OSRL, Shell can request a Subsea Incident Response Toolkit (SIRT) as an alternative. If required, the SIRT would need to be mobilised from Norway or Brazil.

Subsea Dispersant Injection

Subsea dispersant injection (SSDI) aims to disperse hydrocarbons close to the release point and minimise the amount of hydrocarbons reaching the sea surface. This technique helps to break up the oil droplets so that they are dispersed, diluted and biodegraded more rapidly in the water column, reducing the amount of surface hydrocarbons drifting towards sensitive receptors. An additional benefit of this technique is that it can

successfully reduce volatile organic compounds from reaching the surface close to the release site, which is beneficial to the health and safety of personnel involved in any source control operations.

As described above, Shell can mobilise the AMOSC SFRT through its membership, which also includes a dedicated dispersant stockpile (500m^3 of Dasic Slickgone NS) plus ancillary equipment (e.g. pumps, flying leads, coiled tubing head, dispersant wands). Shell would still be required to obtain a suitable vessel for transportation of the subsea dispersant injection system and ancillary equipment including ROVs and coiled tubing. It is estimated that SSDI would commence by Day 10-12.

It is assumed the dispersant to oil ratio (DOR) would commence at 1:100 and would be modified based on the results of the effectiveness monitoring, conducted as part of operational monitoring (Section 15). Research conducted by Brandvik et al., 2014 indicated that DORs of 1:50, 1:100 may be sufficient to cause substantial additional dispersion, particularly if the dispersant is injected close to the nozzle. To achieve a DOR of 1:100, IPIECA-IOGP (2015a) recommend for a flow rate of 20,000 bbl./day, a dispersant pump rate of 22 L/min is required. The maximum credible flow rate for a loss of well control for Prelude is estimated to be ~10,138 bbl/day (~1,611 m^3/day), therefore a dispersant pump rate of 11L/min (15.84 m^3/day) is expected to be required, however this volume will reduce over time as the reservoir depletes.

The SFRT stockpile in Fremantle is sufficient to sustain SSDI for a well blowout for approximately 31 days. By this stage, additional quantities of dispersant would be sought from additional AMOSC and AMSA stockpiles within Australia and/or international OSRL stockpiles. Shell will prioritise the use of chemical dispersants listed on the OSCA register. If a chemical dispersant is available and is not listed on the OSCA register, Shell will assess its acceptability for use via its Chemical Management Process (HSE_GEN_007879) prior to application.

Subsea dispersant effectiveness monitoring is required as part of SSDI, which will be addressed by the relevant operational monitoring component (Section 15). Prior to any application of subsea dispersants, initial monitoring should be conducted at the release point to determine the nature of the release, characterise the properties and behaviour of the oil and estimate the oil and gas flow rates. This information will inform the initial choice of dispersant injection methods (e.g. number of nozzles, nozzle sizes) and application rates. Results from the monitoring will feed into the operational SIMA assessment used for decision-making regarding the continuation or termination of subsea dispersant use.

Capping Stack

A capping stack is designed to be installed on a subsea well and provides a temporary means of sealing the well until a permanent well kill can be performed through either a relief well or well re-entry. The well may be capped by using a dedicated capping stack or a subsea blowout preventer stack run on a riser connected to the wellhead (after the damaged Blowout Preventer (BOP) has been removed) or to the existing BOP stack (after disconnecting the existing Lower Marine Riser Package).

Capping stack compatibility varies from well to well and can also depend on the extent of blow out and damage to an individual well, which would only be known at the time of the spill and assessed via the SFRT and accompanying ROVs. If there is a partial blowout, it is possible that the Singapore-based capping stack would be able to access the well vertically and would reduce the transit time to Darwin Port. In the event of the worst credible well blow out, it is likely that the OSRL capping stack located in Stavanger, Norway would be more compatible and would also require supplementary equipment,

specifically to facilitate the safe deployment of the capping stack onto a high flow gas well in shallow water.

This supplementary equipment, known as the Offset Installation Equipment (OIE) is owned and operated by Saipem and is located in Trieste, Italy. Shell has access to this equipment via the same global agreement with OSRL.

As the capping stack and OIE are located in separate locations in Europe, this will represent a shipping interval of between 35 – 42 days, with the proposed destination of Darwin. Once in Darwin, all equipment will be consolidated and tested and then deployed to the well site for installation.

Relief Well Drilling

A relief well requires the mobilisation of a suitable MODU to the location adjacent to the failed well. The MODU then drills an interception well into the failed well, so that it can be killed (e.g. stop the flow of hydrocarbons), enabling trained personnel to safely plug and abandon the well.

Shell is a signatory to an Australian Petroleum Production and Exploration Association (APPEA) memorandum of understanding (MoU) between Australian offshore operators to provide mutual aid to facilitate and expedite mobilising a MODU and drilling a relief well in the event of a loss of well control incident. The MoU commits the signatories to share rigs, equipment, personnel and services to assist another operator in need. When selecting a suitable rig, the MODU's Safety Case should be considered (Section 6.4.2).

It is estimated a suitable MODU could reach the well location and kill the well within 80 days.

6.3. Implementation

Shell has access to a global network of subsea response equipment. This equipment is kept in a state of readiness by industry participants through specialist response agencies. Shell has a Global Agreement with Oil Spill Response Ltd (OSRL) enabling access to capping systems in Norway, Singapore, Brazil and South Africa. Shell has in place localised global contracts with well control specialist response agencies, namely Wild Well Control and Boots & Coots (Halliburton). In Australia, Shell is a contributor to an industry owned Subsea First Response Toolkit (SFRT). This toolkit is managed by AMOSC and stored and maintained by Oceaneering. Shell has access to the SFRT via an agreement with AMOSC.

Shell has operations contracts in place that allow for transport, laydown, and port access to facilitate these activities in any event. Shell also has operations contracts in place with specialist freight forwarders with global capabilities that will be engaged to mobilise the capping stack and OIE from their respective locations to Darwin as a primary point of entry to Australia. Shell also has operations contracts in place that will facilitate access to local transport, laydown yards and associated services to manage the transhipment of this equipment onto suitable deployment vessels. Freight Forwarding is managed within the Stakeholder Engagement plan by the relevant contract owner/holder.

6.3.1. Processes and Procedures for Well Control Equipment

The IAP process outlined in Section 0 will be a key process used throughout all aspects of an oil spill response including well control response.

The key documents that support well control equipment and response are outlined below:

- Well Control Contingency Plan: This plan describes the pre-planned relief well location, access to sufficient drilling strings and appropriate relief well drill rig for the location;
- SWCS and SFRT Mobilisation Plan IMT_GEN_001595: This plan describes how to access and utilise global well capping systems specifically for Australia;
- Blowout response QuickStart guide: provides initial step-by-step guidance to Shell personnel to activate source control in Australia;
- Subsea Well Offset Installation System (OIS) Guidelines: this includes a suite of guidelines written to provide the Shell with sufficient knowledge and appropriate references to enable an easier decision making process. Key documents are listed and summarised below:
    - OIS Description and Capabilities (SWR-PR-SA-MAN-40027):This document provides a simplified version of the OIS System Description
    - Guide to Using the Offset Installation System (SWR-PR-SA-MAN-40025): The pictograms provided in Appendix A are designed for quick reference to the overall use of the OIS.
    - OIS Well Owner Supplied Equipment and Spare (SWR-PR-SA-MAN-40028): This guideline identifies those items that form part of the OIS but are well owner supplied and includes a reference to spares; and
- Logistics Planning Guide Offset Installation Equipment (OSRL-SW-PLA-00007)
    - Purpose: This Logistics Planning Guide is an aid to the planning and understanding of the processes for the mobilisation and initial deployment phases of OIE.

6.3.2. Personnel

Shell have a team of technical specalists located internationally which would be utilised to help plan and execute a well control response. In addition, people from companies such as Saipem (for the OIE) and Trendsetter Engineering (for the capping stack) will be required to help execute the infield activities associated with deployment and installation. Further details of these teams are outlined below:

- Shell: Capping Stack Task Force and Offset Installation Task Force (under the Capping and Subsea Intervention Group/Source Control Branch), various subsea engineers, marine/shipping, logistics, geotechnical, flow modelling and Wells Process safety group.
- Contractors: Saipem (owner of the OIE system), Trendsetter Engineering (owner of the Capping Stack), Oceaneering (owner of the SIRT kits), OSRL (custodian of the equipment), WWC/Boots and Coots (Well Control advisors), freight forwarders for logistics help and Clarksons Plateau for vessel identification/brokering.

6.4. Equipment and Vessel Requirements

The OSRL capping stack located in Stavanger Norway, has the capability of being packaged for air transport, and Shell would assess the transport options on the day. Shell has operations contracts with freight forwarders with global projects capabilities that are capable of executing any transport requirements Shell have for this equipment.

In terms of mobilisation it has been identified that a large capacity construction vessel with 400 – 500T heave compensated crane capabilities and >800 m^2 of free deck space will be required. There will also be a requirement for multiple ROV support capabilities, and this requirement will be assessed and engaged according to market availabilities at the time.

6.4.1. Offset Installation Equipment (OIE) and Associated Vessel Requirements

The OIE system is located in Trieste, Italy. Shell has operations contracts with freight forwarders with global projects capabilities that are capable of executing the transport demands for this equipment. There is a large amount of additional supporting equipment that is required to be locally fabricated and/or procured (in Australia). This equipment includes large anchoring systems, various rigging assemblies and consumables. Shell has operations contracts in place that will facilitate the sourcing of this additional equipment.

There is a requirement for a large capacity construction/crane vessel (up to 1000t) with 1200 – 1400 m^2 of free deck space to deploy this equipment. Additionally, there is a requirement for 2 Anchor Handling Tugs to operate the OIE once deployed.

6.4.2. Safety Case Requirements

The MODU required for a relief well will be required to have an approved safety case before it can commence work at the wellsite location. In addition, the operating vessels and heavy lift vessel/s will also require a safety case where installing the capping stack and OIE at the well site. The following presents a prioritised order, which would be carried out post an event, for sourcing relevant MODU/vessels for required relief well, capping stack/OIE activities to enable the most efficient path to an approved safety case:

1. Identify MODU and/or heavy lift vessels with required vessel/facility specifications working in Australia with an approved Safety Case.
2. Identify MODU and/or heavy lift vessels with required vessel/facility specifications working outside Australia with an approved Safety Case.
3. Identify MODU and/or heavy lift vessels with required vessel/facility specifications working outside Australia without an approved Safety Case.

The approved Prelude FLNG Facility safety case revision would form the basis for any required safety case revision required for priorities 1 and 2 listed above which would be a significant saving of time to develop and receive an accepted safety case.

Table 6-2 provides guidance to the ERT and IMT, on tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide to the ERT and IMT. The OIM and/or Incident Commander are 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 are shown in Table 6-3. Environmental Performance Outcomes, Standards and Measurement Criteria are listed in Table 6-4.

Table 6-2: Source Control Implementation Guide

Responsibility		Task	Consideration	Complete
SFRT and SSDI				
Initial Actions	Operations Section Chief	Commence activations as per Shell Blowout QuickStart Guide		❑
	Logistics Section Chief	Notify and mobilise specialist personnel including: • Shell technical specalists (Perth and international) • AMOSC/Oceaneering Australia • Wild Well Control • OSRL and specialist consultants		❑
	Logistics Section Chief	Liaise with AMOSC to activate SFRT by: • Providing proof of insurance and a copy of Shell's Operations, Training and Advice (OTA) Agreement with Oceaneering • Execute SFRT Contract Note between Shell and AMOSC		❑
Ongoing Actions	Logistics Section Chief	Contract suitable vessel capable of deploying SFRT equipment		❑
	Logistics Section Chief	Arrange road transport of SFRT from Jandakot to Broome or Darwin	24 hours to arrange; 120 hours to transport	❑
	Logistics Section Chief	Arrange equipment to be loaded on to vessel once in Broome or Darwin and authorise transit to field		❑

Responsibility		Task	Consideration	Complete
Capping stack				
Initial Actions	Operations Section Chief/Source Control Branch	Commence activations as per Shell Blowout QuickStart Guide and Capping Procedure		❑
	Logistics Section Chief	Notify and mobilise specialist personnel including: • Shell technical specialists (Perth and international) • OSRL and specialist consultants • Wild Well Control • Boots and Coots		❑
Ongoing Actions	Logistics Section Chief	Arrange for transportation of selected capping stack as per Blowout QuickStart Guide and Capping Procedure and OIE as per the Subsea Well Offset Installation System (OIS) Guidelines		❑
Relief well				
Initial Actions	Source Control Branch	Determine well kill/intervention strategy as per Shell Blowout QuickStart Guide and Shell Well Control Contingency Plan		❑
	Logistics Section Chief	Identify and arrange for contracting of a suitable relief well rig		❑

Table 6-3: Source Control Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
SFRT and SSDI	***Processes***					
	Shell SWCS and SFRT Mobilisation Plan	N/A	N/A	SRFT Activation Process	N/A	24 hours
	Equipment					
	N/A	N/A	N/A	Subsea First Response Toolkit (SFRT) managed by AMOSC (Perth, Western Australia), including 500m^3 of Dasic Slickgone NS Shell has operational contracts for transport, freight forwarding, laydown, and port access to facilitate these activities	Fremantle	AMOSC SFRT mobilisation and transport interval of approximately 6 days to Broome
				OSRL Subsea Incident Response Toolkit (SIRT)	Norway or Brazil	Up to 42 days (if by sea), shorter if air freighted.
	Personnel					
	Subsea Intervention Group/Source Control Branch), various subsea engineers, marine/shipping, logistics, geotechnical, flow modelling and Wells Process Safety Group	Perth and international	24-72 hours	AMOSC and Oceaneering Australia personnel for SFRT deployment and usage	Perth and Geelong	24 hours

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Capping stack	***Processes***					
	Shell SWCS and SFRT Mobilisation Plan Subsea Well Offset Installation System (OIS) Guidelines Logistics Planning Guide Offset Installation Equipment	N/A	N/A	OSRL Logistics Planning Guide: Offset Installation Equipment	N/A	N/A
	Equipment					
	N/A	N/A	N/A	OSRL Capping Stack	Stavanger, Norway	Up to 42 days
				Saipem Offset Installation Equipment (OIE)	Trieste, Italy	Up to 42 days
				Shell has operational contracts for transport, freight forwarding, laydown, and port access to facilitate these activities		Up to 42 days
	Personnel					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Capping and Subsea Intervention Group/Source Control Branch), various subsea engineers, marine/shipping, logistics, geotechnical, flow modelling and Wells Process Safety Group	Perth and international	24-72 hours	Specialist personnel from Wild Well Control, Boots and Coots and OSRL	Various	48-72 hours
Relief well	***Processes***					
	Shell Well Control Contingency Plan	N/A	N/A	N/A	N/A	N/A
	Equipment					
	N/A	N/A	N/A	MODU with approved Safety Case	Preference for Australian based MODU	80 days to kill the well
	Personnel					
	Subsea Intervention Group/Source Control Branch), various subsea engineers, marine/shipping, logistics, geotechnical, flow modelling and Wells Process Safety Group	Perth and international	24-72 hours	Specialist personnel from Wild Well Control and Boots and Coots	Various locations internationally	+72 hours

Table 6-4: Environmental Performance – Source Control

Performance Standard	Measurement Criteria
Source control conducted in accordance with relevant plans listed in Section 6.3.1 of this OPEP	Records demonstrate source control activities conducted in accordance with relevant source control plan

7. Monitor and Evaluate Strategy

Table 7-1: Monitor and Evaluate - Objective, Initiation Criteria and Termination Criteria

Objective	To acquire and maintain situational awareness and assess the effectiveness of response options during a spill event to inform IMT decision making.
Initiation criteria	To commence for every spill to water as soon as the spill occurs. This may range from very simplistic visual observation only through to more involved monitor and evaluate tactics.
Termination criteria	• For visible oil observation when the spill is no longer visible to surveillance personnel. Specifically, a 'silvery/grey' sheen, as defined by the Bonn Agreement Oil Appearance Code, is no longer observable; or • For subsurface oil observation, when subsurface plume no longer detected using fluorometry; and • Agreement is reached with Jurisdictional Authorities (i.e. AMSA/DoT) and stakeholders to terminate the incident response.

7.1. Overview

Monitor and evaluate involves the collection and evaluation of information to provide and maintain situational awareness in the event of a spill. Monitor and evaluate activities should be conducted throughout the spill response, as it provides the IMT with ongoing information on sensitive receptors at risk of impact from the spill and the effectiveness of spill response operations. The monitor and evaluate tactics included in this strategy focus on tracking, visual observations and modelling. These tactics are supported by data obtained through the operational monitoring program (Section 15). Together, this compilation of information builds the common operating picture for the response. Data from monitor and evaluate activities and operational monitoring will be used by the IMT when updating response (operational) SIMAs and in the development of IAPs.

As there is an insignificant environmental impact associated with the monitor and evaluate strategy, a SIMA will always support the implementation of the strategy given the clear benefit of maintaining situational awareness throughout the duration of a spill event.

7.2. Tactics

Monitor and evaluate can include one or more of the following tactics:

- Deployment of tracking buoy(s) – requires a buoy to be deployed to the water at the leading edge of the spill to track the movement of the spill
- Fate and weathering modelling – uses computer modelling (e.g. ADIOS2) to estimate the weathering of an oil spill
- Oil spill trajectory modelling – uses computer modelling (e.g. SIMAP) to estimate the movement, fate and weathering of spills

- Satellite imagery – uses satellite technology to identify and track oil spills
- Metocean data acquisition – obtaining data on wind speed, water currents, water temperatures, air temperatures and humidity which can be either used as data inputs into models and/or can aid in building situational awareness
- Vessel surveillance – used to help characterise spills and obtain information on spill trajectory. Can also be used to ground truth oil spill trajectory modelling and monitor the effectiveness of response options, although aerial surveillance is typically provides greater visual coverage
- Aerial surveillance – used to help characterise and quantify spills and obtain visual information on spill trajectory. Can also be used to ground truth oil spill trajectory modelling and monitor the effectiveness of response options.

7.3. Implementation Guide

Table 7-2 provides guidance to the ERT and IMT, on tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide to the ERT and IMT. The OIM and/or Incident Commander are 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 7-3. Environmental Performance Standards and Measurement Criteria are listed in Table 7-4.

Table 7-2: Monitor and Evaluate Implementation Guide

Responsibility		Task	Consideration	Complete
Tracking buoy (if selected) *Most suitable for Level 2-3 spills*				
Initial Actions	OIM	Direct personnel to deploy buoy from the facility or vessel as close as possible to the leading edge of the spill (personnel and vessel safety is priority)	Deployment should be co-ordinated through the SA IMT (W) Geomatics team (see SDA.GM.WI.OSS002 and SDA.GM.WI.GIM.003)	❑
	OIM	Inform IMT that buoy has been deployed and provide IMT with current weather conditions	Note deployment details in incident log. Tracking bouys are located on Prelude FLNG A-Deck.	❑
	Situation Unit Leader	Verify deployment of tracking buoy using tracking buoy deployment guideline		❑
Ongoing Actions	Situation Unit Leader	Use tracking buoy data to maintain Common Operating Picture	Data tracked online and fed into spill trajectory models and Common Operating Picture	❑
	Situation Unit Leader	Incident Action Plan to provide guidance to the OIM regarding any additional deployments of tracking buoys		❑
Trajectory and fate/weathering modelling (if selected) *Most suitable for Level 2-3 spills*				
Initial Actions	Situation Unit Leader	Contact Shell Geomatics Team to conduct in-house deterministic modelling and to initiate external modelling, using AMOSC and/or RPS Group contracts (as per below)	In-house deterministic modelling is suitable for surface spills only AMOSC has in place a call off contract with APASA to perform independent modelling in the event of a spill, which will be available	❑

Responsibility		Task	Consideration	Complete
			within 2 hours of notification. These services include the use of OilMap, OilMap Deep and plume modelling products Shell also has a contract with RPS Group to provide the remainder of modelling services not provided through AMOSC	
	Situation Unit Leader	Contact AMOSC and/or RPS Group Duty Manager to execute service contract and commence trajectory modelling	Surveillance activities should aim to ground truth trajectory modelling results	❑
	Situation Unit Leader	Complete and submit the hydrocarbon spill modelling request form to RPS Group Duty Manager (if required)	Hydrocarbon spill trajectory modelling request form available in Situation Unit Kit Modelling to be undertaken within 4 hours of the request being sent to RPS Group, then every operational day during the spill response. Note actions in incident log	❑
	Situation Unit Leader	Conduct hydrocarbon distribution, fate and weathering assessment using Automated Data Inquiry for Oil Spills (ADIOS2) using information available on oil type (See Appendix A - Types/characteristics of oils)	Compare fate curves from OilMap (trajectory modelling) and ADIOS2	❑
Ongoing Actions	Situation Unit Leader	Request trajectory modelling be provided daily throughout the duration of the response and integrate data into Common Operating Picture	Use Oil Spill Trajectory Modelling Update form.	❑
	Situation Unit Leader	Use results from monitor and evaluate activities, and/or data derived from hydrocarbon assays of the source hydrocarbon or from other reservoirs in the region (that may be available) as input		❑

Responsibility		Task	Consideration	Complete
		data (if or when available) to improve model accuracy		
Satellite imagery (if selected) *Most suitable for Level 2-3 spills*				
Initial Actions	Situation Unit Leader	Notify AMOSC Duty Officer to request initiation of satellite services. Alternatively, the following satellite imagery can also be accessed: • Rapid Response Satellite Imagery (LANCE / MODIS via NASA): • Priority Tasking of RADAR Imagery (Radarsat, COSMO-SkyMed, TerraSARX, Sentinel) • High resolution Optical Satellite Imagery Baseline; and • Other "non-emergency" acquisitions of various other sensor platforms. Access to these services will be co-ordinated by the Shell Geomatics team (see SDA.GM.WI.RS.001 and 2).	Refer to ER Weekly Contact List (request for AMOSC support must be approved by IMT (West) Leader)	❑
	Situation Unit Leader	Combine satellite data with optical imagery (aerial surveillance, vessel-based observations) to mitigate issues of angle of insolation, thick cloud cover and night	Satellite derived data can be used to broaden aerial survey data in terms of both spatial and temporal scale and provide images	❑

Responsibility		Task	Consideration	Complete
Ongoing Actions	Situation Unit Leader	Request satellite imagery be provided daily throughout the duration of the response and integrate data into Common Operating Picture		❑
Metocean data acquisition				
Initial Actions	Situation Unit Leader	Contact Shell Geomatics Team to obtain metocean data for integration into the Common Operating Picture	Numerous data sets of metocean data are accessible from the Bureau of Meteorology and APASA (Environmental Data Service, ECOP and Coastmap) via Shell Geomatics Team. The Prelude FLNG also has a weather station which measures wave, current and wind in real-time	❑
Ongoing Actions	Situation Unit Leader	Request metocean data be provided daily throughout the duration of the response and integrate data into Common Operating Picture		❑
Vessel surveillance (if selected) *Most suitable for Level 1-3 spills*				
Initial Actions **Ongoing Actions**	OIM	Determine if there are any vessels available to follow spills and aid surveillance activities	FLNG support vessels may be able to provide assistance, however maintaining the FLNG or undertaking other duties in a response are likely to be prioritised	❑
	OIM or Vessel Master	Provide IMT initial report on estimated spill volumes and movement based on visual observation (if possible)	Preliminary observations are intended to provide initial projections of spill trajectory and scale prior to more detailed modelling and surveillance. These observations should be immediately verified by more detailed surveillance	❑

Responsibility		Task	Consideration	Complete
Ongoing Actions		If vessel surveillance is feasible, ensure surveillance data is regularly incorporated into the Common Operating Picture		❑
Aerial surveillance (if selected) *Most suitable for Level 1-3 spills*				
Initial Actions	IMT Logistics Leader	Contact Broome International Airport to establish Shell Air Support Base	The primary Shell Air Support Base is Broome International Airport with Djarindjin Airport being used as a refuelling point for aerial ops supporting OPEP operations, if required	❑
	IMT Logistics Leader	Confirm availability of aerial surveillance platform to conduct initial surveillance flight	If aviation asset available near spill location, utilise where possible to gather as much information about the spill. If aviation asset not available at spill location IMT is to seek available resources through existing contractual arrangements. It is possible that the initial surveillance flight will not include a trained aerial surveillance observer. Initial flights can be conducted using a standard crew and initial surveillance should not be delayed waiting for trained personnel. Ensure all safety requirements are met prior to deployment. There should be an attempt to obtain the following data during initial surveillance: • name of observer, date, time, aircraft type, speed and altitude of aircraft • location of slick or plume (GPS	❑

Responsibility	Task	Consideration	Complete
		positions, if possible) • spill source • size of the spill, including approximate length and width of the slick or plume • visual appearance of the slick (e.g. colour) • edge description (clear or blurred) • general description (windrows, patches etc.) • wildlife, habitat or other sensitive receptors observed • basic metocean conditions (e.g. sea state, wind, current) • photographic/video images	
Operations Section Chief	Obtain approval from OIM to commence surveillance flights in the vicinity of the facility	Operations Section is to assume primary coordination for all flights	❑
Operations Section Chief	Once initial flight is complete, IMT to determine if additional flights are required		❑
Operations Section Chief	In addition to arranging initial flight, mobilise aircraft and trained observers to the spill location to undertake surveillance activities (these can be cancelled if initial flight determines no additional surveillance is required)	Aerial platform should be capable of providing the following: • immediate accessibility from a Darwin based airport • capability to fly at 150 feet • provision of aircraft crew for 1 x aircraft and space for at least one trained aerial observer	❑

Responsibility		Task	Consideration	Complete
			Trained observers should be familiar with the Bonn Agreement Aerial Operations Handbook (Part III) (Bonn Agreement, 2016). An Aerial Surveillance Observation Log is provided in Appendix C: Aerial Surveillance Observation Log. Trained aerial observers are available from AMOSC (24 hours mobilisation time), AMSA National Response Team (via the National Plan), through mutual aid arrangements from operators with trained staff (e.g. Chevron) and also through OSRL (international deployment required).	
	Operations Section Chief	All records to be relayed to IMT when aircraft returns from observation flight	Visual observations from aircraft have inherent subjectivity due to the effect of the angle of insolation on the surface of the ocean. Optical techniques are also dependent on cloud cover and daylight. 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	❑
Ongoing Actions	Operations Section Chief	Develop a flight schedule for ongoing aerial surveillance	Frequency of flights should consider information needs of IMT to help maintain the Common Operating Picture and determine ongoing response operations	❑

Table 7-3: Monitor and Evaluate Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Tracking buoy	***Processes***					
	N/A	N/A	N/A	N/A	N/A	N/A
	Equipment					
	Prelude Tracking buoy	Prelude FLNG Deck A: fire team room cabinet	Immediately, as support vessel location allows Deployment of tracker buoys is better prior to last light as this allows better tracking of spill during dark without wasting the buoys. Only other use should be to confirm hydrodynamic models Deployment of buoys should be under advice from	AMOSC, AMSA and OSRL	Various locations Australia-wide and internationally	48 hours
	Tracking buoys on support vessels	Support vessels, ISVs/MPSV				
	Shell shared stockpile	Broome				

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
			Geomatics / Metocean			
	Personnel					
	Personnel on board ISV's trained in deployment	ISVs at Prelude location	Immediately, as support vessel location allows	AMOSC, AMSA and OSRL	Various locations Australia-wide and internationally	48 hours
Trajectory modelling and fate/weathering modelling	***Processes***					
	N/A	N/A	N/A	AMOSC Call off procedure: oil spill trajectory modelling services	N/A	N/A
	Equipment					
	In-house deterministic modelling	Incident Management Room	Within 2 hours of IMT being notified of spill	AMOSC (call off contract with RPS Group) RPS Group	N/A	Within 2 hours of notification
	Situation Unit Kit	Internal computers				
	ADIOS2 on IMT computers	Incident Management Room				
	Personnel					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Geomatics team trained in use of deterministic modelling and ADIOS2 software	Perth based	Within 2 hours of IMT being notified of spill	Trained personnel available through contracts	N/A	Within 2 hours of notification
Satellite imagery	***Processes***					
	N/A	N/A	N/A	N/A	N/A	N/A
	Equipment					
	N/A	N/A	N/A	Satellite data from supplier sourced through AMOSC subscription (OSRL subscription available as a secondary option)	N/A	Data available within 24 hours, then every 6 to 24 hours thereafter depending on satellite positions
	Personnel					
	N/A	N/A	N/A	N/A	N/A	N/A
Metocean data	***Equipment***					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Weather station	Prelude FLNG	Real time data	Bureau of Meteorology and RPS Group (Environmental Data Service, ECOP and Coastmap)	N/A	12 hours
	Personnel					
	Geomatics team trained on how to incorporate metocean data into Common Operating Picture	Perth based	Within 2 hours of IMT being notified of spill	Bureau of Meteorology and RPS Group (Environmental Data Service, ECOP and Coastmap)	N/A	12 hours
Vessel surveillance	***Processes***					
	N/A	N/A	N/A	N/A	N/A	N/A
	Equipment					
	FLNG support vessels	Prelude FLNG	As soon as support vessel location allows	Contract with marine vessel contractors to provide additional	Various	4-8 days

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
				vessels for oil spill response activities		
	Personnel					
	FLNG support vessel crew	Prelude FLNG	As soon as support vessel location allows	Vessel crews and AMOSC personnel	Various locations across Australia	4-8 days
Aerial Surveillance	***Processes***					
	Third-party call off contract	N/A	N/A	N/A	N/A	N/A
	Aerial Surveillance Observation Log	N/A	N/A			
	Equipment					
	N/A	N/A	N/A	Third-party call off contracts for helicopters and fixed wing aircraft	Broome, Karratha and Perth	4-8 hours for aircraft to be ready for mobilisation
	Personnel					
	N/A	N/A	N/A	AMOSC personnel and	Perth and Geelong	24 hours for national pool

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
				mutual aid (e.g. other Titleholder personnel who may be accessed through AMOSPlan), AMSA (National Response Teams), and OSRL have personnel trained and experienced in aerial surveillance		trained/experienced aerial observers

Table 7-4: Environmental Performance – Monitor and Evaluate

Performance Standard	Measurement Criteria
IMT to select and initiate suitable monitor and evaluate tactics to gain situational awareness	Records demonstrate that IMT employed monitor and evaluate tactics and incorporated results into situational awareness boards
Data from monitor and evaluate activities and operational monitoring will be used by the IMT when updating response (operational) SIMAs and in the development of IAPs	Records demonstrate IMT used monitor and evaluate data and operational monitoring information during the preparation and review of Operational SIMAs and IAPs

8. Natural Recovery

8.1. Overview

Natural recovery is a no impact response. There are no commencement and termination criteria, nor capability required to implement it apart from supporting strategies such as monitor and evaluate and oil spill monitoring.

Natural recovery is the process of letting hydrocarbons degrade naturally in the environment, either offshore or onshore. This section addresses offshore natural recovery, including degradation on or in the water column.

Oil on the ocean disperses and breaks up via a number of processes. Natural processes acting on the oil such as evaporation, dissolution, dispersion into the water column, biodegradation and photo oxidisation reduce the volume of oil over time. Evaporation can be the most important mechanism to reduce the volume of oil; especially in the short term. Approximately 40% of a surface condensate spill by mass is predicted to evaporate over the first two days, depending upon the prevailing conditions, with further evaporation slowing over time (APASA, 2014).

Whilst offshore natural recovery involves no direct response activities to mitigate the spill, it may be an appropriate response strategy to complement other intervention-based response strategies; or as a primary response strategy if other strategies are likely to cause a greater impact than leaving the oil to degrade naturally. It may also be the only viable response option during inclement weather (e.g. tropical cyclones), as responding could place personnel at risk.

Table 8-1 provides guidance on when natural recovery may be a suitable response option.

Table 8-1: Natural Recovery Application Criteria

Recommended	Not Recommended
• For light, non-persistent hydrocarbons, such as ITOPF Group 1-2 hydrocarbons (e.g. MDO, condensate, hydraulic oil) • Product is weathering rapidly due to environmental conditions (e.g. high energy coastline, wave action) • Product is too thin for effective use of dispersants or containment and recovery • If responding during inclement weather conditions would place response personnel at risk	• For persistent hydrocarbons, such as ITOPF Group 3-4 hydrocarbons (Crude oil, Intermediate Fuel Oil, Heavy Fuel Oil) • Environmental conditions are not favourable for rapid degradation (e.g. calm seas) • Slick is continuous enough and thick enough to treat with dispersants or via containment and recovery methods

There is no implementation guide provided for this response option, as no direct tasks are required. However, if natural recovery is selected as a suitable response strategy, the Operational SIMA would need to confirm that natural recovery remains a suitable response strategy throughout the spill response.

9. Surface Chemical Dispersants Strategy

Table 9-1: Surface Chemical Dispersants - Objective, Initiation Criteria and Termination Criteria

Objective	To enhance the breakdown of oil into smaller droplets and enhance dispersion into the water column so that impacts of floating hydrocarbons may be reduced
Initiation criteria	Dispersant application has the following commencement criteria; • Spill Impact Mitigation Assessment (SIMA) and field testing demonstrate beneficial use of dispersant prior to application that is likely to result in a net environmental benefit • Since surface dispersant application would only be recommended for use during a vessel HFO/IFO spill the AMSA IC (as Control Agency) must provide approval to apply dispersants before any dispersant is applied to oil • If chemically dispersed oil is likely to impact state waters, DoT and DMIRS should be informed before applying dispersant
Termination criteria	Terminate dispersant application through consultation with relevant Jurisdictional Authorities (e.g. DoT/AMSA) and in line with the Shell Dispersant Application Guide (Figure 9-1)

9.1. Overview

Surface dispersants are applied to floating hydrocarbon spills to enhance the breakdown of hydrocarbon droplets and enhance dispersion into the water column, so the smaller droplets can biodegrade more rapidly. Dispersant application has a limited window of opportunity, as the ability for the dispersants to break up the hydrocarbons typically decreases as the product weathers. As such, Table 5-8 outlines why surface dispersant application is a secondary response option only for the HFO spill scenario.

AMSA administers an Oil Spill Control Agent (OSCA) Register (AMSA, 2018), which provides evidence on the dispersant's efficacy, toxicology and biodegradation potential. Shell will prioritise the use of chemical dispersants listed on the OSCA register. If a chemical dispersant is available and is not listed on the OSCA register, Shell will assess its acceptability for use via its Chemical Management Process (HSE_GEN_007879) prior to application.

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

Table 9-2).

Table 9-2: Bonn Agreement Oil Agreement Appearance Codes (BAOAC)

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

Spraying thin sheens can result in an overdose of dispersant. It should be noted that the thickness of hydrocarbons can vary greatly over the entire slick, therefore an Operational SIMA should take into account quantified aerial surveillance reports conducted by personnel trained in the Bonn Agreement Oil Appearance Code (BAOAC) during monitor and evaluate tactics. Shell does not plan on applying surface chemical dispersants on slicks determined as BAOAC 1-3.

Spraying areas of hydrocarbon designated as BAOAC Code 4 (Discontinuous true oil colour) with dispersant will, on average, deliver approximately the recommended treatment rate of dispersant. Spraying areas of oil designated as BAOAC Code 5 with dispersant (Continuous true oil colour and more than 0.2 mm thick) will, on average, deliver approximately half the recommended treatment rate of dispersant. Repeated application of these areas of thicker oil, or increased dosage ratios, will be required to achieve the recommended treatment rate of dispersant (EMSA 2012).

9.2. Tactics

Activities involved in the application of dispersants include:

- Efficacy testing - Surface dispersant application needs to be preceded by suitable efficacy testing to ensure the product is amenable to the specific dispersant type being used. Once the dispersant is determined to be effective, application should be accompanied with on ongoing efficacy monitoring throughout the response. This ongoing monitoring shall be conducted by the OSMP Team and/or Air Attack Supervisors (who will be monitoring aerial dispersant efficacy). The OSMP Team is responsible for coordinating and implementing efficacy testing, which is addressed in detail in the OSMP (Section 15). The IMT is required liaise directly with the Operational and Scientific Monitoring (OSMP) Team regarding efficacy testing results to ensure they are incorporated into each relevant IAP (where dispersant application is being considered or is continuously being applied).
- Vessel application – due to the proximity offshore, Shell has 4-5 vessels in-field or on route (ISVs and supply vessels) that have the capability to apply chemical dispersants. These vessels have Dasic Slickgone NS and an AFEDO Spray Set on board which can be used to apply chemical dispersants.
- Aerial application – as part of Shell's AMOSC membership, it has access to its Fixed Wing Aerial Dispersant Capability (FWADC). If this capability is required, AMOSC will activate its contract with AMSA, which shall provide Shell with

aircraft and dispersants. If additional aerial dispersant capability is required, Shell can activate OSRL, who can supply its Hercules aircraft from Senai, Malaysia. For any aerial dispersant operations, Shell will be required to develop an 'Air Operations Plan' prior to aircraft being deployed.

9.3. Implementation Guide

Table 9-3 and

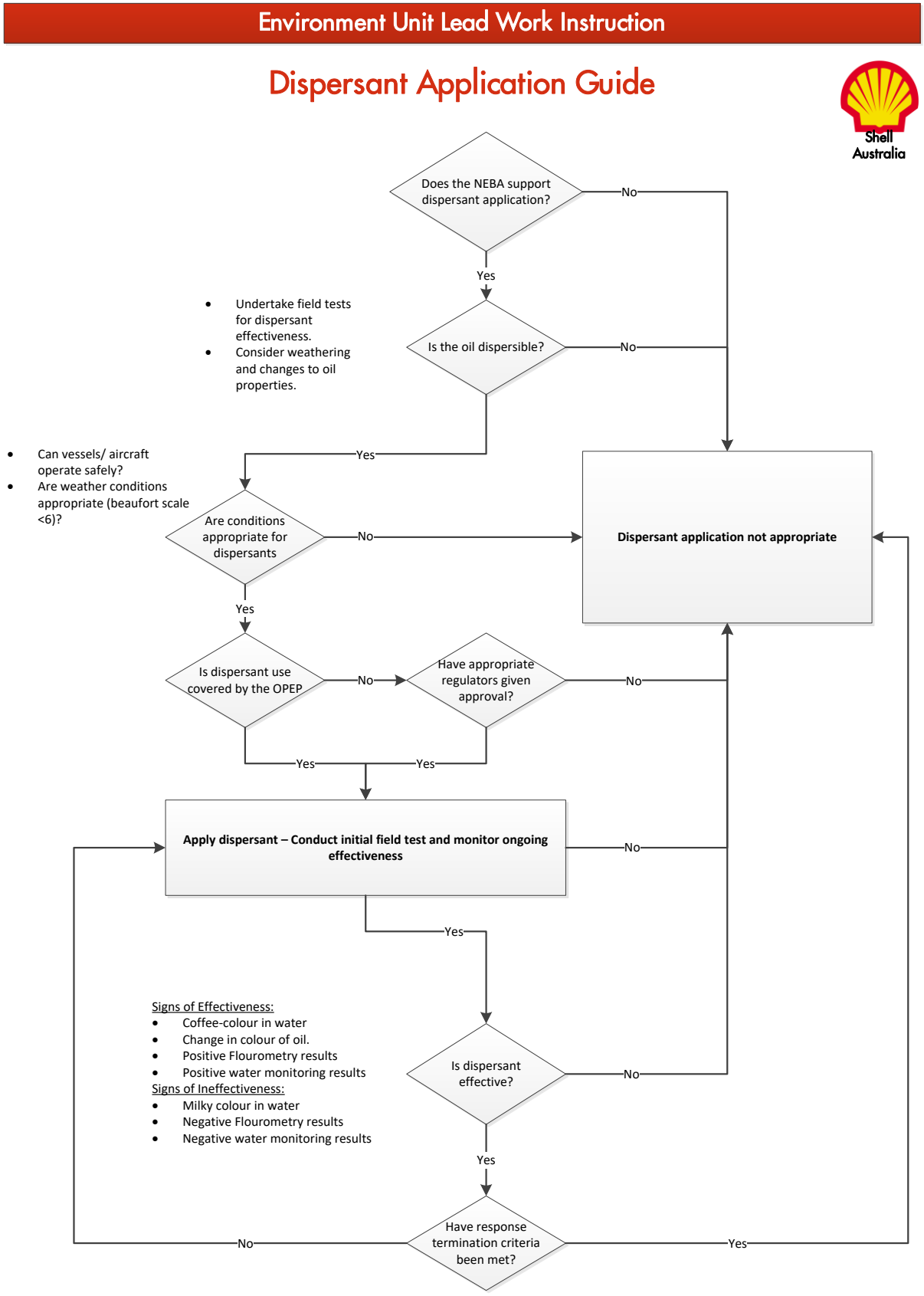


Figure 9-1 provides guidance to the ERT and IMT, on considerations, tasks and

responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide to the ERT and IMT. The OIM and/or Incident Commander are 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 9-4.
Environmental Performance Standards and Measurement Criteria are listed in Table 9-5.

Dispersant Application Guide

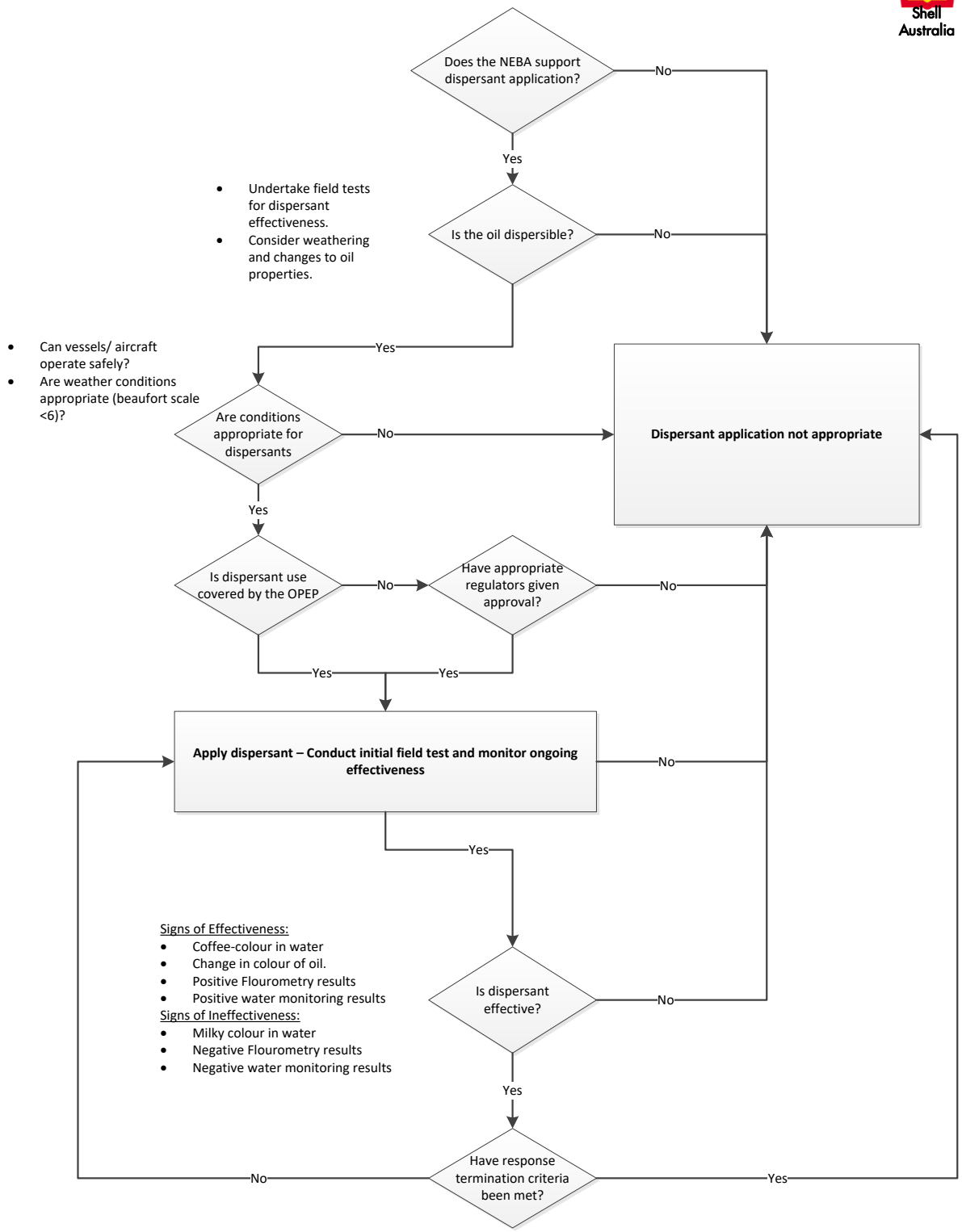


Figure 9-1: Shell Surface Dispersant Application Guide

Table 9-3: Surface Chemical Dispersants Implementation Guide

Responsibility		Task	Consideration	Complete
Vessel application				
Initial Actions	Environment Unit Lead	Confirm Operational SIMA supports surface chemical dispersant application	Confirm oil spill thickness supports use of dispersants (e.g. BAOAC Codes 4-5). Liaise with third party providers (e.g. AMOSC) as part of Operational SIMA. Obtain estimates on transit times to spill location to help determine if window of opportunity is viable given transit times to the spill location	❑
	OIM	Contact ISV or support vessels and confirm location and ability to deploy surface chemical dispersants to slick	Vessel based dispersant operations require one AFEDO spray system per vessel. Spray arms need to be secured to vessel by welding or chains as determined by the vessel master.	❑
	OIM	Using real-time or most recent visual surveillance observation data, develop operational zones for vessel dispersant operations	Focus on applying dispersant to areas of slick that threaten priority receptors and are of a sufficient thickness whereby chemical dispersants will be effective	❑
	OIM	Aerial surveillance operations (if available) to provide Vessel Master with GPS coordinates for dispersant application within operational zones		❑
Ongoing Actions	Environment Unit Lead	Conduct Operational SIMA during each operational period to reassess effectiveness of application rates and dispersant efficacy		❑

Responsibility		Task	Consideration	Complete
	Logistics Section Chief	Source additional vessels (if required) via marine contracts and arrange for deployments from Broome		❑
	Logistics Section Chief	Arrange for additional vessels to be resourced with equipment, personnel and dispersant stocks prior to deployment from Broome		❑
	Operations Section Chief	Maintain operational zones and provide updates to Vessel Masters on most suitable locations for application		❑
Aerial application				
Initial Actions	Environment Unit Lead	Confirm Operational SIMA supports surface chemical dispersant application	Confirm oil spill thickness supports use of dispersants (e.g. BAOAC Codes 4-5). Liaise with third party providers (e.g. AMOSC) as part of Operational SIMA. Obtain estimates on transit times to spill location to help determine if window of opportunity is viable given transit times to the spill location	❑
	Logistics Section Chief Operations Section Chief	Mobilise initial resources for aerial application: After initial AMOSC notifications are complete, contact AMOSC Duty Officer and confirm requirements for the following resources: • Access to and mobilisation of required AMOSC dispersant stocks and associated equipment into Broome (AMOSC may	Ensure all equipment mobilisation is coordinated noting need for AMOSC/AMSA equipment in support of other response strategies	❑

Responsibility	Task	Consideration	Complete
	arrange through their contracted transport provider) • Activation of the Fixed Wing Aerial Dispersant Capability (FWADC) from AMSA (AMOSC will activate this on behalf of Shell); and • Provision of trained spill responders to support operations (AMOSC Staff and Core Group)		
Logistics Section Chief	Request AMSA assistance to mobilise Air Attack Supervisors into Broome	Shell may be required to provide logistical assistance	❑
Logistics Section Chief	Coordinate the arrival of dispersant stockpiles and equipment into Broome through AMOSC		❑
Operations Section Chief	Finalise Air Operations Plan in consultation with AMSA	Ensure flight schedule in Air Operations Plan considers requirements for other activities such as aerial surveillance sorties	❑
Operations Section Chief	Using real-time or most recent visual surveillance observation data, develop operational zones for aerial dispersant operations	Focus on applying dispersant to areas of slick that threaten priority receptors and are of a sufficient thickness whereby chemical dispersants will be effective	❑
Operations Section Chief	Aerial surveillance operations to provide pilots with GPS coordinates for dispersant application within operational zones (if available)		❑

Responsibility		Task	Consideration	Complete
Ongoing Actions	Environment Unit Lead	Conduct Operational SIMA during each operational period to reassess effectiveness of application rates and dispersant efficacy	Dispersant effectiveness on HFO declines as the product weathers	❑
	Logistics Section Chief	Coordinate additional dispersant stocks and equipment through OSRL and arrange: • Permit for low level flying • Accommodation and transport for personnel • immigration clearance for personnel		❑
	Operations Section Chief	Maintain operational zones and provide updates to pilots on most suitable locations for aerial application		❑

Table 9-4: Surface Chemical Dispersant Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Vessel application	***Processes***					
	Shell Surface Dispersant Application Guide (Figure 9-1)	N/A	N/A	N/A	N/A	N/A

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Equipment					
	5m^3 Dasic Slickgone and AFEDO spray set on each ISV (4-5 vessels in field or en-route – 3 x ISV's (with dispersant onboard) and 2 x supply vessels (no dispersant but can obtain from Broome stockpile))	Prelude FLNG or in transit from/to Broome	ASAP following receiving AMSA (IC) approval (where relevant – vessel spills)	15 m^3 of Ardrox 6120 dispersant, an AFEDO Spray set and spay arms Contract with marine vessel contractors to provide additional vessels for oil spill response activities	Broome	2-4 days
	Personnel					
	ISV personnel trained in vessel application techniques	Prelude FLNG or in transit from/to Broome	ASAP following receiving AMSA (IC) approval (where relevant – vessel spills)	AMOSC, AMSA (National Response Teams), mutual aid (e.g. other Titleholders) and OSRL have personnel trained and experienced in vessel application of chemical dispersants	Perth, Geelong and various locations around Australia	24 hours for national pool of trained personnel
	Processes					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Aerial application	Shell Surface Dispersant Application Guide	N/A	N/A	N/A	N/A	N/A
	Equipment					
	N/A	N/A	N/A	AMOSC/AMSA Fixed Wing Aerial Dispersant Capability	Various locations around Australia (two aircraft in the NT)	AMSA fixed wing aircraft wheel up in 4 hours and first implementation within 36 hours with supporting monitoring aircraft Closest dispersant aircraft in Batchelor, NT
				AMOSC and AMSA dispersant stockpiles	Various locations around Australia	
	Personnel					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	N/A	N/A	N/A	AMOSC/AMSA Fixed Wing Aerial Dispersant Capability, including pilots and Air Attack Supervisors	Various locations around Australia	AMSA fixed wing aircraft wheels up in 4 hours and first implementation within 36 hours with supporting monitoring aircraft and supporting aerial attack supervisor

Table 9-5: Environmental Performance – Surface Chemical Dispersants

Performance Standard	Measurement Criteria
IMT have confirmed that Operational SIMA supports the use of surface chemical dispersants to reduce adverse impacts to protection priorities	Records confirm that Operational SIMA supports the use of surface chemical dispersants to reduce adverse impacts to protection priorities
IMT prioritised use of chemical dispersants listed on the OSCA register. For chemical dispersants not listed on the OSCA register, the IMT have assessed its acceptability for use via the Chemical Management Process (HSE_GEN_007879) prior to application	Records confirm OSCA listed chemical dispersants were prioritised for use, otherwise IMT assessed other dispersants against Chemical Management Process (HSE_GEN_007879) prior to application
IMT have obtained approval from AMSA to apply dispersants	Incident log and copy of approval
IMT and Operational and Scientific Monitoring (OSMP) Team have discussed dispersant efficacy testing results to ensure they are incorporated into each relevant IAP	Records confirm dispersant efficacy testing results incorporated into each relevant IAP

10. Contain and Recover Strategy

Table 10-1: Contain and Recover - Objective, Initiation Criteria and Termination Criteria

Objective	To reduce the volume of floating hydrocarbons to reduce contact with protection priorities
Initiation criteria	• Level 2 or Level 3 HFO/IFO spills; or • SIMA demonstrates that the response strategy is likely to result in a net environmental benefit
Termination criteria	Terminate Contain and Recover through consultation with relevant Jurisdictional Authorities (e.g. DoT/AMSA) and in line with the Shell Contain and Recover Guide (Figure 10-1).

10.1. Overview

Contain and recover aims to contain and recover hydrocarbons from the sea surface to limit spread and reduce adverse impacts. For contain and recover to be an effective option the operating environment must be suitable (Refer to Table 10-2) so that the equipment can perform efficiently, and response personnel can safely operate the equipment. Contain and recover is more effective when a sufficient oil thickness can be achieved by the containment booms (minimum of 50g/m^2), which is often limited to Group 3 and 4 (ITOPF) hydrocarbons.

Table 10-2 provides applicability criteria on when containment and recovery may be a suitable response option. Figure 10-1 outlines the Shell guidance on Contain and Recover.

Table 10-2: Containment and Recovery Application Criteria

Criteria	Recommended	Not Recommended
Spill characteristics	• Patchy slick • Fresh or emulsified • Extended operations • Surface concentrations >50g/m2	• Situation dependent
Hydrocarbon type	• Group 3 hydrocarbons and above • Persistent components of Group 1 and 2 hydrocarbons may be suitable	• Minor to moderate spills of Group 1 and 2 hydrocarbons are likely to weather rapidly. High volatiles of these hydrocarbons may be a safety risk to personnel

Criteria	Recommended	Not Recommended
Operating environment	• Waves <1m for nearshore containment and recovery systems • Waves <1.8m for offshore systems • Winds <25 knots	• Wave heights exceed 1.8m • Current >0.75 knots

10.2. Tactics

The following tactics can be used in isolation or in combination to contain and recover hydrocarbons:

- Containment booming – involves the use of a variety of booming techniques to concentrate and contain hydrocarbons to enable recovery
- Oil recovery – uses a variety of techniques to remove corralled hydrocarbons from the environment, such as skimmers and pumps; and sorbent materials (passive recovery)
- Transfer and storage of oily liquids – uses a variety of techniques to transfer hydrocarbons to primary and secondary storage. Insufficient oily waste storage can lead to a suspension in operations
- Decanting - Decanting involves discharging wastewater back into a boomed area adjacent to the vessel, where it can pass through a skimmer again to maximise the recoverability of oil content. Decanting is an important tool needed to make efficient use of waste management resources which are often a limiting factor in contain and recover. The reduction of overall waste in some circumstances can create an environmental benefit which outweighs the minimal impact caused by the release of water with very low concentrations of oil. An oil spill waste management plan template can be used for waste planning purposes.

The POWBONS Act; s. 8 allows for decanting for combating specific pollution incidents. Additionally, Annex 1 of MARPOL (Regulation 9) allows for decanting for combating specific pollution events to minimise the damage from pollution. Under both MARPOL and POWBONS decanting must be approved by the relevant Jurisdictional Authority. In WA State waters this is DoT (as the Hazard Management Agency under the Emergency Management Act 2005) and in Commonwealth waters this is the Australian Maritime Safety Authority (AMSA).

Figure 10-2 outlines the Shell guidance on Decanting.

10.3. Implementation Guide

Table 10-3 provides guidance to the ERT and IMT, on tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide to the ERT and IMT. The OIM and/or Incident Commander are 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 10-4. Environmental Performance Standards and Measurement Criteria are listed in Table 10-5.

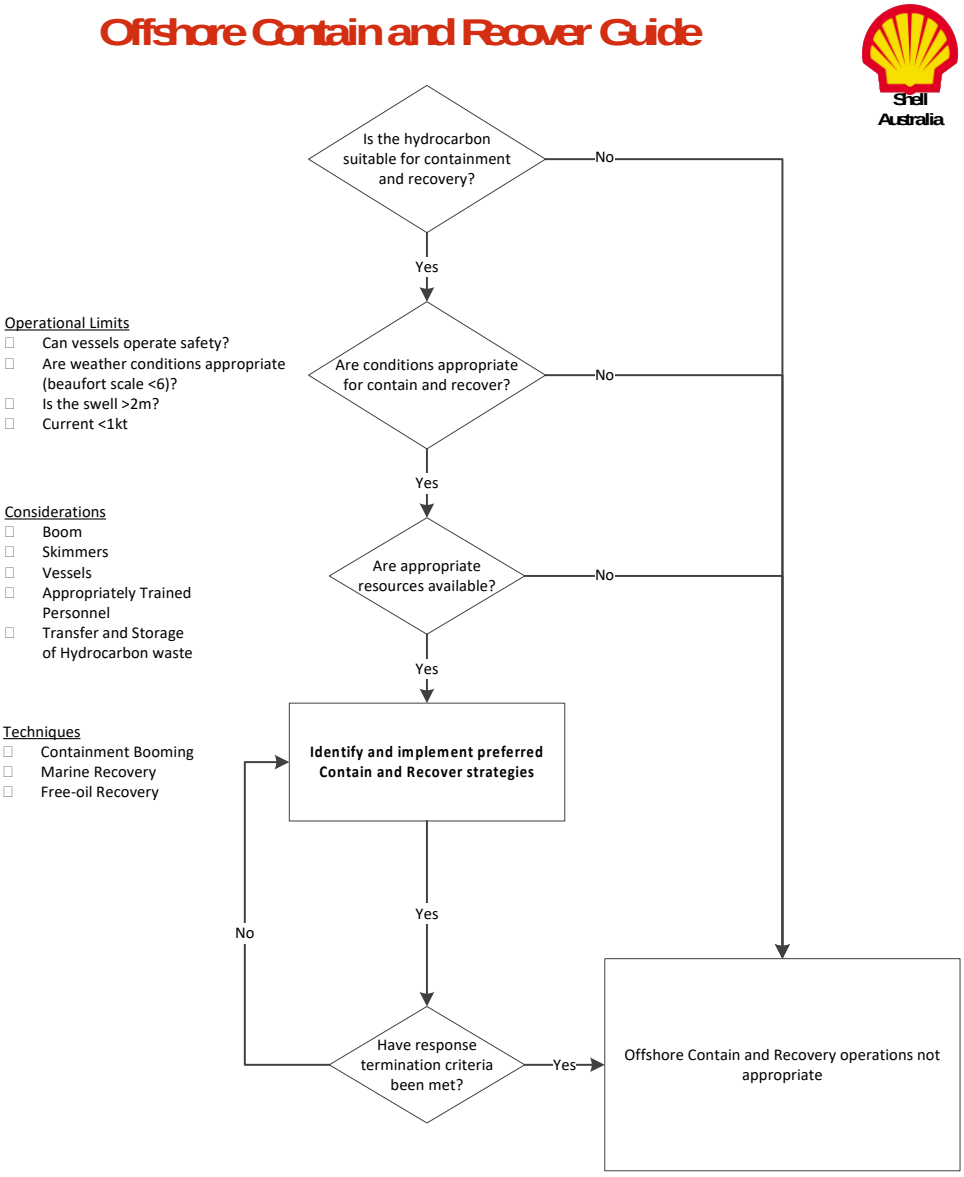


Figure 10-1: Shell Offshore Contain and Recover Guide

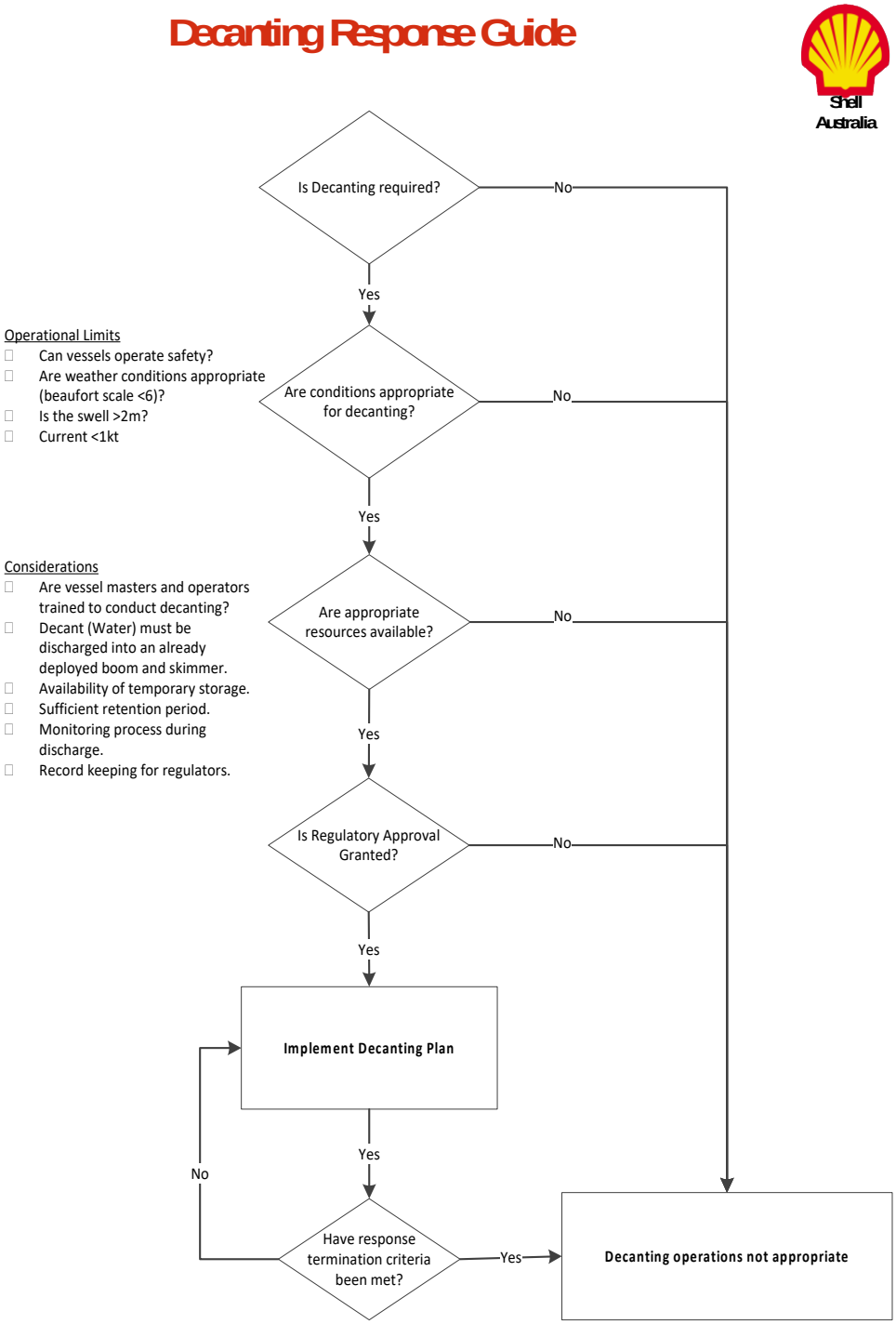


Figure 10-2: Shell Decanting Response Guide

Table 10-3: Contain and Recover Implementation Guide

Responsibility		Task	Consideration	Complete
Booming and Recovery (if selected)				
Initial Actions	Operations Section Chief	Confirm conditions are suitable for contain and recover activities	Refer to Figure 10-1 for guidance	❑
	Logistics Section Chief	Contact AMOSC and AMSA to commence mobilisation of trained personnel and equipment (if required)	Utilise Broome contain and recover stockpiles in first instance and liaise with AMSOC/AMSA to determine if additional equipment may be required Ensure all equipment mobilisation is coordinated noting need for AMOSC/AMSA equipment in support of other response strategies	❑
	Logistics Section Chief	Arrange for suitable vessels to travel to Broome Port for onloading of trained personnel and equipment		❑
	Logistics Section Chief	Activate Waste Management Contractor and/or vessel providers to supply adequate waste storage		❑
	Operations Section Chief	Coordinate aerial surveillance (or initial visual) support to vessels to ensure vessels are being directed to priority locations for contain and recover activities within operational zones	Focus on contain and recover activities to areas of slick that threaten priority receptors and are of a sufficient thickness whereby contain and recover activities will be effective	❑
	OIM	Liaise with Vessel Masters of infield vessels and commence initial contain and recover operations		❑

Responsibility		Task	Consideration	Complete
Ongoing Actions	Operations Section Chief	Coordinate the dispatch of operationally ready (all equipment and personnel on board) vessel via the IAP		❑
	Operations Section Chief	Maintain operational zones and provide updates to Vessel Masters on most suitable locations for contain and recover activities	Continue to utilise aerial surveillance data to inform the location of operational zones	❑
Decanting (if selected)				
Initial Actions	Operations Section Chief	Confirm conditions are suitable for decanting	Refer to Figure 10-2 Determine optimum retention/settling time for hydrocarbon being recovered. Refer to IPIECA-IOGP (2013) for additional guidance	❑
	Environment Unit Lead	Obtain decanting approval from AMSA (Commonwealth waters) or DoT (WA waters)	Under both MARPOL and POWBONS, decanting must be approved by the relevant jurisdictional authority where the discharge will occur	❑
	Operations Section Chief	Ensure personnel onboard the vessels are trained in decanting procedures		❑
	Operations Section Chief	Ensure there is sufficient temporary storage for oily waste water onboard vessel		❑
	Vessel Master/s	Commence decanting operations, ensuring that any discharged water is directed into the apex of the already deployed containment boom system (with operational skimmer)		❑

Responsibility		Task	Consideration	Complete
Ongoing Actions	Vessel Master/s	Record volumes of all water decanted	This information must be supplied to the relevant jurisdictional authority	❑
	Vessel Master/s	Manage any solid waste generated		❑

Table 10-4: Contain and Recover Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Booming, Recovery and Decanting	***Processes***					
	Shell Offshore Contain and Recover Guide (Figure 10-1)	N/A	N/A	N/A	N/A	N/A
	Equipment					
	5 vessels infield or on route (ISV's) and supply vessels (to obtain equipment from Broome and return to site)	Prelude FLNG	Within 48 hours	AMOSC equipment stored in Broome (400m of Lamor offshore boom and skimmer system – 12T/hr)	Broome	72 hours
				AMOSC and AMSA have additional stockpiles	Perth, Geelong and other various locations around Australia	72-96 hours
	Personnel					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	N/A	N/A	N/A	AMOSC, AMSA (National Response Teams), mutual aid (e.g. other Titleholders) and OSRL have personnel trained and experienced in contain and recover	Perth, Geelong and various locations around Australia	24 hours for national pool of trained personnel

Table 10-5: Environmental Performance – Contain and Recover

Performance Standard	Measurement Criteria
Prepare Operational SIMA to determine if containment and recovery is likely to result in a net environmental benefit	Records demonstrate that an Operational SIMA was completed and indicated containment and recovery was likely to result in a net environmental benefit
Obtain approvals from relevant Jurisdictional Authority prior to commencing decanting operations	Incident Log/ Copy of Approval
Decanting shall only be undertaken under the supervision of trained personnel	Incident Log

11. Shoreline Protect and Deflect

Table 11-1: Shoreline Protect and Deflect - Objective, Initiation Criteria and Termination Criteria

Objective	To reduce hydrocarbon contact with shoreline protection priorities
Initiation criteria	• Level 2 or Level 3 spills where shorelines with protection priorities will potentially be impacted; or • SIMA demonstrates that the response strategy is likely to result in a net environmental benefit; and • Approval has been obtained from the Control Agency.
Termination criteria	• SIMA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s; and • Terminate shoreline protect and deflect through consultation with relevant Jurisdictional Authorities

11.1. Overview

Protect and deflect is used to protect sensitive shoreline receptors, typically pre-emptivley before a spill reaches high priority areas. The effectiveness of these tactics will be dependent upon hydrocarbon type, metocean conditions, spill trajectory and feasibility of deploying response personnel and equipment.

The DoT is the Control Agency for shoreline protect and deflect activities in WA State waters and DENR is the Control Agency for spills that contact NT shorelines (Table 2-1). Shell would support the Control Agency through the provision of resources to conduct this strategy. For WA State waters, this has been developed in consultation with DoT, as outlined in the Browse Island Oil Spill Management Guide (Appendix F).

Note: Ashmore and Cartier Islands are in Commonwealth waters, therefore Shell would be the Control Agency for protect and deflect activities in these locations.

11.2. Tactics

Tactics may be used alone or in combination to protect shorelines including:

- Nearshore booming, which can involve different booming arrangements including:
  - Exclusion booming: boom acts as a barrier to exclude the spill from areas requiring protection
  - Diversion booming: booms divert the spill to a specific location where it may be removed (e.g. sandy beach)
  - Deflection booming: booms deflect the spill away from an area requiring protection
- Berms, dams and dikes – uses sandbags or embankments to exclude oil from sensitive areas

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

11.3. Implementation Guide

Details on shoreline response and other support response arrangements at Browse Island can be found within the Browse Island Incident Management Guide (Appendix F). This document can be used to provide guidance for similar nearby offshore islands.

The information obtained from Operational Monitoring Teams (Section 15), will be used by the IMT in the development of the Operational SIMA to inform the most effective protection tactics (if any) to apply to individual sites.

Table 11-2 provides guidance to the relevant ERT and IMT, on considerations, tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide only. The Control Agency's Incident Commander is ultimately responsible for the implementation of this strategy 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 11-3.
Environmental Performance Standards and Measurement Criteria are listed in Table 11-4.

Table 11-2: Shoreline Protect and Deflect Implementation Guide

Responsibility		Task	Consideration	Complete
Initial Actions	Environment Unit Lead	Collect and provide spill trajectory modelling, other operational monitoring data and existing sensitivity information/mapping to Control Agency (if relevant) for confirmation of priority protection areas and Operational SIMA		❑
Actions below are indicative only and are at the final determination of the Control Agency (if not Shell)				
Initial Actions	Environment Unit Lead	Conduct Operational SIMA to determine if protection and deflection is likely to result in a net environmental benefit using information from shoreline assessments and any tactical response plans for the area	Shoreline Clean-up Assessment Teams are responsible for preparing field maps and forms detailing the area surveyed and making specific clean-up recommendations The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision making Engage a Heritage Advisor if spill response activities overlap with potential areas of cultural significance	❑
Initial Actions	Environment Unit Lead	If Operational SIMA indicates that there is an overall environmental benefit, develop a Shoreline Protection Plan (IAP Sub-Plan) for each deployment area	Refer to Browse Island Incident Management Guide (Appendix F) for guidance on tasking. 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)	❑

Responsibility	Task	Consideration	Complete
		• Locations to deploy protection and deflection equipment • Permits required (if applicable) • Protection and deflection tactics to be employed for each location • List of resources (personnel and equipment) required • Logistical arrangements (e.g. staging areas, accommodation, transport of personnel) • Timeframes to undertake deployment • Access locations from land or sea • Frequency of equipment inspections and maintenance (noting tidal cycles) • Waste management information, including logistical information on temporary storage areas, segregation, decontamination zones and disposal routes • No access and demarcation zones for vehicle and personnel movement considering sensitive vegetation, bird nesting/roosting areas and turtle nesting habitat (utilise existing roads and tracks first)	
Operations Team Leader Logistics Section Chief	Deploy shoreline protection response teams to each shoreline location selected and implement response	Refer to Browse Island Incident Management Guide (Appendix F) for further details.	❑

Responsibility		Task	Consideration	Complete
Ongoing Actions	Environment Unit Lead	Conduct regular Operational SIMA to confirm effectiveness of tactics and demonstrate benefit of continuing to implement shoreline protect and deflect activities		❑

Table 11-3: Shoreline Protect and Deflect Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Booming, recovery, non-oiled shoreline debris removal	***Processes***					
	N/A	N/A	N/A	N/A	N/A	N/A
	Equipment					
	N/A	N/A	N/A	Contract with AMOSC and OSRL to provide specialised equipment	Perth, Geelong and various locations throughout Australia and internationally	Given the logistical and safety limitations with shoreline response in the Browse Basin, implementation of the response will take approximately 1 week to occur from decision being made to commence
	Personnel					
	N/A	N/A	N/A	Contract with AMOSC and OSRL to provide trained response personnel (including	Perth, Geelong and various locations throughout	Given the logistical and safety limitations with shoreline response in the Browse Basin, implementation of the response will take approximately 1 week to

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
				mutual aid – via AMOSC)	Australia and internationally	occur from decision being made to commence

Table 11-4: Environmental Performance – Shoreline Protect and Deflect

Performance Standard	Measurement Criteria
Prepare Operational SIMA to determine if shoreline protection is likely to result in a net environmental benefit	Records demonstrate that an Operational SIMA was completed and indicated shoreline protection was likely to result in a net environmental benefit
Control Agency has provided approval to initiate this strategy in State and/or Territory waters (if relevant)	Incident log and copy of approval
Shoreline Protection Plan (IAP Sub-plan) developed to provide oversight and management of protect and deflect operations	Records indicate Shoreline Protection Plan (IAP sub-plan) prepared prior to protect and deflect operations commencing

12. Shoreline Clean-up Strategy

Table 12-1: Shoreline Clean-up - Objective, Initiation Criteria and Termination Criteria

Objective	To assess the extent and severity of shoreline oiling and apply clean-up tactics to remove as much oil as possible so that impacts on protection priorities are minimised
Initiation criteria	• Level 2 or Level 3 spills where shorelines with protection priorities will potentially be impacted; or • SIMA demonstrates that the response strategy is likely to result in a net environmental benefit; and • Approval has been obtained from DoT IC or delegate (as the Control Agency).
Termination criteria	• SIMA has determined that this strategy is unlikely to result in an overall benefit to the affected shoreline/s; and • Shoreline clean-up end-points have been reached; and • Terminate Shoreline Clean-up through consultation with relevant Jurisdictional Authorities and in line with the Shell Shoreline Response Guide (Figure 12-1).

12.1. Overview

The most probable shoreline to be contacted from a spill from the Prelude FLNG is the nearest shoreline, Browse Island. Refer to Browse Island Incident Management Guide (Appendix F) for details of pre-planned shoreline response activities at Browse Island (or similar offshore islands) which has been already reviewed by WA DoT. If shoreline clean-up is required in the NT, the DENR is the Control Agency and Shell will work in close consultation with them to provide the required resources to conduct shoreline clean-up.

Note: Ashmore and Cartier Islands are in Commonwealth waters, therefore Shell would be the Control Agency for clean-up activities in these locations.

Shoreline clean-up occurs after impact but aims to reduce the overall adverse impacts from a spill through the removal of oil from contaminated shorelines to prevent its remobilisation and/or cross-contamination (e.g. foraging fauna).

Shoreline clean-up and treatment is an iterative process, requiring systematic surveying of impacted areas before, during, and after clean-up. Shoreline surveys must be conducted systematically because they are a crucial component of effective decision-making. Repeated surveys are needed to monitor the effectiveness and effects of ongoing treatment methods (i.e. changes in shoreline oiling conditions, as well as natural recovery), so that the need for changes in methodology, additional treatment, or constraints can be evaluated.

12.2. Tactics

Tactics may be used alone or in combination to clean up oiled shorelines, including:

- Shoreline Assessment – uses the Shoreline Clean-up Assessment Technique (SCAT), also known as, Oiled Shoreline Assessment (OSA) process (refer to OSMP) to evaluate shoreline segments, establish clean-up priorities, and identify suitable tactics. Typically, this should be the first step in any shoreline clean-up response.
- Natural Recovery – oiled shorelines are left untreated and the oil naturally degrades over time
- Manual and Mechanical Removal – removes oil and contaminated materials using machinery, hand tools, or a combination of both
- Washing, Flooding, and Flushing – uses water, steam, or sand to flush oil from impacted shoreline areas
- Sediment reworking and Surf washing – uses various methods to accelerate natural degradation of oil by manipulating the sediment.

12.3. Implementation Guide

Considerations for selecting and applying shoreline clean-up tactics are included in Figure 12-1.

Further details on shoreline response and other support response arrangements at Browse Island can be found within the Browse Island Incident Management Guide (Appendix F). This document can be used to provide guidance for similar nearby offshore islands.

The information obtained from Operational Monitoring Teams (Section 15), will be used by the IMT in the development of the Operational SIMA to inform the most effective clean-up tactics (if any) to apply to individual sites. Shell generally uses a minimum threshold of 100g/m^2 (concentration of accumulated hydrocarbons on shorelines) to determine the lower limit for commencing clean-up operations.

Considerations for selecting and applying clean-up tactics, based on shoreline types, are shown in Table 12-2. Clean-up endpoints should be established in consultation with key stakeholders early in the clean-up process.

Table 12-3 provides guidance to the relevant ERT and IMT, on considerations, tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide only. The Control Agency's Incident Commander is ultimately responsible for the implementation of this strategy 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 12-4. Environmental Performance Standards and Measurement Criteria are listed in Table 12-5.

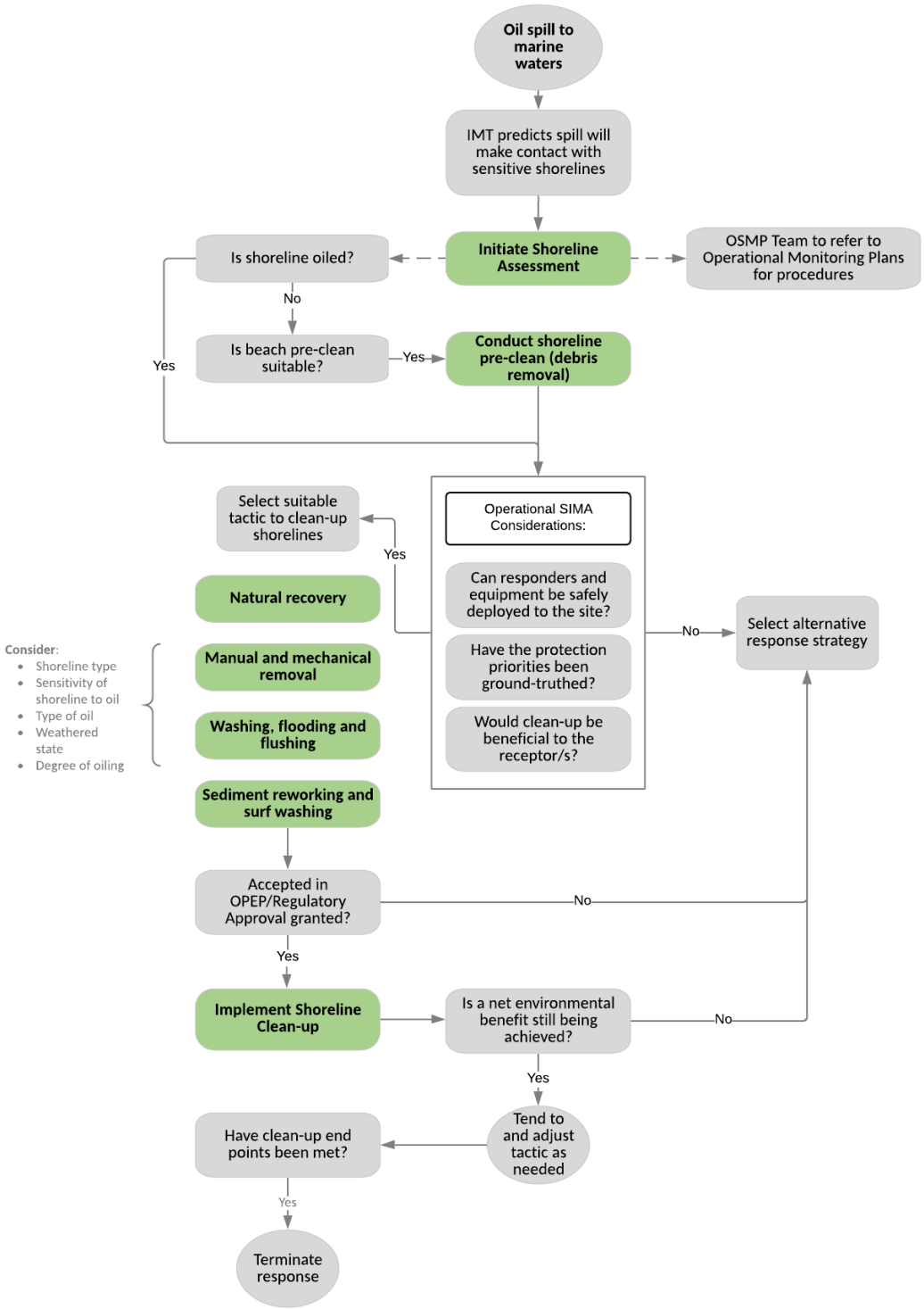


Figure 12-1: Shell Shoreline Response Guide

Table 12-2: Shoreline Clean-up Selection Factors by Shoreline Type, Oil Type and Degree of Oiling

Shoreline Type	Type of Oil	Degree of Oiling*	Shoreline Clean-up Tactic			
			Natural Recovery	Manual and Mechanical	Sediment Reworking	Flooding and Flushing
Exposed Rocky Shores	1	Light	☑	☑	☑	☑
		Moderate	☑	☑		☑
		Heavy	☑			☑
	2	Light	☑	☑	☑	☑
		Moderate	☑	☑		☑
		Heavy	☑	☑		☑
	3	Light		☑		☑
		Moderate		☑		☑
		Heavy				☑
Sandy Shores and Beaches	1	Light	☑	☑	☑	☑
		Moderate	☑			☑
		Heavy				☑
	2	Light	☑	☑	☑	☑
		Moderate	☑	☑		☑
		Heavy		☑		☑
	3	Light		☑		
		Moderate		☑		
		Heavy		☑		
Artificial Structures	1	Light	☑	☑		☑
		Moderate	☑	☑		☑
		Heavy		☑		☑
	2	Light	☑	☑		☑
		Moderate	☑	☑		☑
		Heavy		☑		☑
	3	Light		☑		☑
		Moderate		☑		☑
		Heavy		☑		☑
	1	Light	☑	☑	☑	☑

Shoreline Type	Type of Oil	Degree of Oiling*	Shoreline Clean-up Tactic			
			Natural Recovery	Manual and Mechanical	Sediment Reworking	Flooding and Flushing
Sheltered Rocky Shores		Moderate	☑	☑	☑	☑
		Heavy				☑
	2	Light	☑	☑	☑	☑
		Moderate	☑	☑	☑	☑
		Heavy		☑		☑
	3	Light	☑	☑	☑	☑
		Moderate	☑	☑	☑	☑
		Heavy		☑		☑
Mud and Tidal Flats	1	Light	☑	☑		☑
		Moderate	☑			☑
		Heavy				☑
	2	Light	☑	☑		☑
		Moderate	☑	☑		☑
		Heavy				☑
	3	Light	☑	☑		☑
		Moderate	☑			☑
		Heavy				☑
Mangroves and Wetlands	1	Light	☑	☑		☑
		Moderate	☑			☑
		Heavy				☑
	2	Light	☑	☑		☑
		Moderate	☑	☑		☑
		Heavy				☑
	3	Light	☑	☑		☑
		Moderate		☑		☑
		Heavy				☑

Table 12-3: Shoreline Clean-up Implementation Guide

Responsibility		Task	Consideration	Complete
Shoreline Clean-up Assessment				
Initial Actions	Operations Section Chief	Liaise with Operational Monitoring Team to determine locations to deploy trained personnel, to undertake shoreline assessment, as per OMP: Shoreline Clean-up Assessment		❑
	Environment Unit Lead	Using results of OMP: Shoreline Clean-up Assessment, conduct Operational SIMA to determine if shoreline clean-up is likely to result in a net environmental benefit	The condition of affected shorelines will be constantly changing. Results of shoreline surveys should be reported as quickly as possible to the IMT to help inform real-time decision making	❑
Ongoing Actions	Operations Section Chief	Continue to support Operational Monitoring Team by providing ongoing planning, logistical and operational support		❑
Actions below are indicative only and are at the final determination of the Control Agency (if not Shell)				
Natural recovery (if selected)				
Initial Actions	Planning Section Chief	If Operational SIMA supports natural recovery, use monitor and evaluate data and operational monitoring data to periodically reassess the condition of the shoreline/s and modify tactics, if required		❑

Responsibility		Task	Consideration	Complete
Manual and mechanical removal; washing, flooding and flushing; and/or sediment reworking and surf washing (if selected)				
Initial Actions	Planning Section Chief	If Operational SIMA supports shoreline clean-up, prepare a Shoreline Clean-up Sub-plan for inclusion in the IAP	Shoreline Clean-up Sub-plan may include (but not be limited to): • Clean-up objectives • Clean-up end points • Clean-up priorities • Assessment and location of staging areas and worksites (including health and safety constraints, zoning) • Permits required (if applicable) • Chain of command for onsite personnel • List of resources (personnel, equipment, PPE) • Details of accommodation and transport • 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) Refer to IPEICA-IOGP (2015c) for additional guidance on shoreline clean-up planning and implementation	❑

Responsibility		Task	Consideration	Complete
	Operations Section Chief	Commence implementation of Shoreline Clean-up Sub-plan, in particular mobilisation of personnel and equipment (including vessels) in readiness for deployment and use		❑
Ongoing Actions	Operations Section Chief	Monitor effectiveness of shoreline clean-up operations by continual implementation of OMP: Shoreline Clean-up Assessment	Where possible, maintain same composition of OMP: Shoreline Clean-up Assessment Teams. If the same personnel are able to recommend clean-up techniques and then monitor their implementation, they will be better placed to adapt their recommendations as the clean-up progresses and judge when the agreed end-points have been met	❑

Table 12-4: Shoreline Clean-up Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Shoreline Clean-up Assessment	***Processes***					
	OMP: Shoreline Clean-up Assessment	N/A	N/A	N/A	N/A	N/A
	Equipment					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Staging and accommodation facility	Prelude FLNG or other vessel	5-6 days	Contract with AMOSC and OSRL to provide specialised equipment Helicopter call-off contract in place to mobilise people, equipment and waste to remote shorelines such as Browse Island from staging/accommodation facilities	Perth, Geelong and various locations throughout Australia and internationally	5-6 days
	Personnel					
	N/A	N/A	N/A	Contract with AMOSC and OSRL to provide trained Shoreline Assessment Specialists (including mutual aid – via AMOSC)	Perth, Geelong and various locations throughout Australia and internationally	5-6 days
Manual and mechanical removal; washing, flooding and	***Processes***					
	N/A	N/A	N/A	N/A	N/A	N/A
	Equipment					

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
flushing; sediment reworking and surf washing	N/A	N/A	N/A	Contract with AMOSC and OSRL to provide specialised equipment	Perth, Geelong and various locations throughout Australia and internationally	Given the logistical and safety limitations with shoreline response in the Browse Basin, implementation of the response will take approximately 1 week to occur from decision being made to commence
	Personnel					
	N/A	N/A	N/A	Contract with AMOSC and OSRL to provide trained response personnel (including mutual aid – via AMOSC)	Perth, Geelong and various locations throughout Australia and internationally	Given the logistical and safety limitations with shoreline response in the Browse Basin,

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
						implementation of the response will take approximately 1 week to occur from decision being made to commence

Table 12-5: Environmental Performance – Shoreline Clean-up

Performance Standard	Measurement Criteria
Prepare Operational SIMA to determine if shoreline clean-up is likely to result in a net environmental benefit	Records demonstrate that an Operational SIMA was completed and indicated shoreline clean-up was likely to result in a net environmental benefit
Control Agency has provided approval to initiate this strategy in State and/or Territory waters (if relevant)	Incident log and copy of approval
Shoreline Clean-up Plan (IAP Sub-plan) developed to provide oversight and management of shoreline clean-up operations	Records indicate Shoreline Clean-up Plan (IAP sub-plan) prepared prior to shoreline clean-up commencing

13. Oiled Wildlife Response Plan

Table 13-1: Oiled Wildlife Response - Objective, Initiation Criteria and Termination Criteria

Objective	To reduce damage to fauna threatened by a spill by implementing the Western Australian Oiled Wildlife Response Plan
Initiation criteria	• Oiled wildlife is reported or predicted to be impacted • SIMA demonstrates that the response strategy is likely to result in a net environmental benefit
Termination criteria	• Oiling of wildlife have not been observed over a 48 hour period • Oiled wildlife have been successfully rehabilitated • Agreement is reached with Jurisdictional Authorities and stakeholders to terminate the incident response

13.1. Overview

Oiled Wildlife Response (OWR) includes wildlife hazing, pre-emptive capture and the capture, cleaning, treatment, and rehabilitation of animals that have been oiled. In addition, it includes the collection, post-mortem examination, and disposal of deceased animals that have succumbed to the effects of oiling.

If OWR is required in State waters, the Department of Biodiversity, Conservation and Attractions (DBCA) will support DoT (Control Agency). Shell would provide access to resources to assist DoT through its access to AMOSC oiled wildlife resources. Timely provision of equipment and personnel will be provided by AMOSC to DoT as the Control Agency/Lead IMT through a combination of call-off contracts with suppliers, and the management of industry OWR response personnel through an Industry Oiled Wildlife Advisor (OWA). Where Shell is the Control Agency for OWR in Commonwealth waters, AMOSC will also provide the above-mentioned resources and be supported by DCBA, but would instead work under the direction of the Shell's IMT.

13.2. Potential impacts to wildlife

A lower threshold of floating oil of 1 g/m^2 is likely to be an indicator of where there is a visual presence of an oil slick (rainbow sheen), however there is little potential for impact to surface dwelling fauna at this concentration. Estimates for the minimal thickness of floating oil that might result in harm to seabirds through ingestion from preening of contaminated feathers, has been estimated by different researchers at approximately 10 g/m^2 (French, 2000) to 25 g/m^2 (Koops et al., 2004).

At sea, reptiles including turtles are vulnerable to the effects of hydrocarbon spills at all life stages as they are frequently making contact with the sea surface for resting or feeding. However, reptiles and turtles are unlikely to be feeding out in the deep water in areas where there is likely to be oil at thicknesses greater than 10 g/m^2. A genetically distinct population of Green Turtle nests at Browse Island, the nearest known turtle rookery to Prelude, some 40 km to the south-east.

Worst-case spill modelling indicates floating oil concentrations at 10 g/m^2 may extend up to 460 km west/southwest and north/northwest of the Prelude Facility. Although there is a low density of birds and marine reptiles in the area, conservative estimates for planning purposes predict a worst-case oiled wildlife response could last > 14 days with <200 potentially oil affected birds expected. Therefore, it is estimated that the worst-case oiled wildlife response for this activity is estimated to be an OWR Level 4, as defined in the WA OWRP (2014), shown in Table 13-2.

Table 13-2: Indicative Oiled Wildlife Response Level (adapted from WA OWRP, 2014)

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

13.3. OWR Stages of Response

The WA OWRP includes eight stages to an OWR, which are described in Table 13-3. If an OWR is initiated, implementation will follow these stages, as appropriate to the nature and scale of the incident.

Table 13-3: Oiled Wildlife Response Stages (adapted from WA OWRP)

Stage	Description
Stage 1: Initial wildlife assessment and notifications	Gather situational awareness on whether an OWR impact has occurred or is imminent and complete notifications to Jurisdictional Authorities and external support agencies
Stage 2: Mobilisation of wildlife resources	Mobilise initial preventative measures and/or mobilisation of resources to deal with incident in early stages of development.
Stage 3: Wildlife reconnaissance	Wildlife reconnaissance for the OWR should occur as part of the implementation of surveys for the fauna related Operational Monitoring Plans (OMPs) undertaken to aid planning and decision making for executing spill response or clean-up operations. Wildlife reconnaissance will be required for the duration of the wildlife response operations
Stage 4: IAP Wildlife Response Sub-plan development	The IAP 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.

Stage	Description
	A vessel-based 'on-water' facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping, release and post-release monitoring
Stage 8: Oiled wildlife response termination	Demobilisation of the OWR should be undertaken in accordance with parameters or endpoints established in the IAP and supplementary Wildlife Response Sub-plan. This decision will be made in consultation with the relevant jurisdictional authorities and support agencies

13.4. Implementation Guide

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 typical IMT command structure outlined in the Implementation Strategy of the EP. Specifically, there will be wildlife roles within the planning, finance/admin and logistics sections (as relevant to the nature and scale of the spill). The operations section will contain all the field staff and activities, including oiled wildlife reconnaissance, which is outlined in further detail within the OSMP. The IAP Wildlife Response Sub-plan as outlined in Table 13-3 will form the key management system which will provide control and oversight over the response.

For a Level 4 response, it is expected that up to 77 personnel will be required, with a range of skill levels (

Table 13-4 – OWR 1 = basic training to OWR 4 = OWR Advisor; Information drawn from WA OWRP). 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.

At OWR level 4, Shell expects to initially establish one staging area and oiled wildlife facility and, if required, scale up staging areas in response to the location, number of wildlife and different species encountered. 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 13-4: 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

Skill Level	OWR Response Level and Personnel Numbers					
	Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**	**Level 6**
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**

Table 13-5 provides guidance to the ERT and IMT, on considerations, tasks and responsibilities that should be considered when implementing OWR. These actions are provided as a guide and should be read in conjunction with the WA OWRP. In some cases, the Implementation Guidance (Table 13-5) will provide additional detail to the WA OWRP and has greater linkages to other aspects of the response operation and this OPEP (e.g. operational monitoring and aerial surveillance).

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

Information on resource capability for this strategy is shown in Table 13-6. Environmental Performance Standards and Measurement Criteria are listed in Table 13-7.

Table 13-5: Oiled Wildlife Implementation Guide

Responsibility	Task	Consideration	Complete
Stage 1: Initial wildlife assessment and notifications			
Operations Section Chief	Personnel conducting aerial surveillance activities (as part of monitor and evaluate and/or operational monitoring 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)	❑
Environment Unit Leader	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 IMT Leader prior to activating AMOSC Oiled Wildlife Advisor and/or DCBA Oiled Wildlife Advisor as outlined in Table 4-1. DoT will be the Control Agency for OWR in State waters	❑
Public Information Officer (or delegate)	Notify DoEE if there is a risk of death or injury to a protected species (including Matters of National Environmental Significance (MNES))	Refer to Table 4-1 for reporting requirements. A list of MNES is provided in the Existing Environment Section of the EP	❑
Environment Unit Leader	Review all wildlife reports from surveillance or opportunistic activities and contact personnel who made the reports (if possible) to confirm information collected		❑

Responsibility	Task	Consideration	Complete
Environment Unit Leader	Use information from initial assessments to prepare an Operational SIMA. Use this information to help determine: • Initial OWR Response Level (1-6), as defined in the WA OWRP (Table 13-2) • If OWR activities are likely to result in a net environmental benefit	Oiled wildlife response activities can cause additional stress and mortality on individuals than oil pollution alone. The EUL will determine via an Operational SIMA whether capture and cleaning of oiled wildlife will result in a net environmental benefit. This may be done in consultation with the DCBA and AMOSC Oiled Wildlife Advisors (if available, but an Operational SIMA should not be delayed if they are not immediately available)	❑
Stage 2: Mobilisation of wildlife resources			
Planning Section Chief Oiled Wildlife Advisor	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)	❑
Planning Section Chief Oiled Wildlife Advisor	Determine number of Oiled Wildlife Responders and IMT Wildlife related positions required based on the likely number of oiled wildlife and arrange access to resources via AMOSC and DCBA	Refer to Table 13-4 Consider need for veterinary care	❑
Logistics Section Chief	Commence mobilisation of equipment (including adequate PPE) and personnel to required location/s		❑
Logistics Section Chief	Contact OSRL to activate Sea Alarm if additional support is likely to be required to sustain an ongoing OWR		❑
Stage 3: Wildlife reconnaissance			

Responsibility	Task	Consideration	Complete
Wildlife Branch Director Oiled Wildlife Advisor	Determine reconnaissance plan including survey locations, techniques and priority species	Consult local experts, if available	❑
Wildlife Branch Director Oiled Wildlife Advisor Field personnel	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		❑
Stage 4: IAP wildlife sub-plan development			
Wildlife Branch Director Planning Section Chief Environment Unit Lead Oiled Wildlife Advisor	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	❑
Stage 5: Wildlife rescue and staging			

Responsibility	Task	Consideration	Complete
Wildlife Branch Director Operations Section Chief	Implement Wildlife Response Sub-plan for deterrence/hazing, pre-emptive capture, relocation	Trained personnel required to handle wildlife	❑
Wildlife Branch Director Operations Section Chief	Establish staging site/s	Wildlife first aid/stabilisation may be required at staging site if OWR treatment facility is more than 2 hours away	❑
Stage 6: Establishment of an oiled wildlife facility			
Wildlife Branch Director Operations Section Chief Oiled Wildlife Advisor Field personnel	Implement Wildlife Response Sub-plan for oiled wildlife facility	Utilise OWR containers where possible. One container/kit can treat up to 150 OWR units, so will be adequate to treat oiled wildlife from the worst-case spill. If insufficient, additional OWR containers can be requested via the IAP to AMSA Should oiled wildlife treatment be set up on vessels rather than onshore, the vessel needs to have adequate deck space to house the oiled wildlife equipment and be able to provide continuous hot water at constant pressure and temperature. The vessel must have the ability to properly contain and dispose of contaminated wastewater. Most Support Vessels are likely to be appropriate as they have mud and other tanks for water storage and oil-water systems for treating water	❑

Responsibility	Task	Consideration	Complete
Stage 7: Wildlife rehabilitation			
Wildlife Branch Director Operations Section Chief Oiled Wildlife Advisor Field personnel	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	❑
Stage 8: Oiled wildlife response termination			
Wildlife Branch Director Planning Section Chief IMT Leader	Liaise with Jurisdictional Authorities regarding OWR termination, using endpoints established in the IAP and supplementary Wildlife Response Sub-plan (Termination and Demobilisation section)		❑

Table 13-6: Oiled Wildlife Implementation Guide Resource Capability

Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
Processes					
N/A	N/A	N/A	WA Oiled Wildlife Response Plan	N/A	N/A
Equipment					

Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
N/A	N/A	N/A	2 x AMOSC owned OWR container (and box kits)	Fremantle and Geelong (Broome, Exmouth, Fremantle and Geelong)	34 hours from Fremantle to Broome + 30 hours by vessel (+ mobilisation times)
			4 x National Plan OWR containers - - available through National Plan request	Dampier, Darwin, Devonport and Townsville	5-6 days
			OSRL OWR equipment (Search, Rescue and Medical Kit; and Cleaning and Rehabilitation Kit)	Singapore and other international locations	>1 week
			Vessel – via Marine Brokers	Various locations in Western Australia	5-6 days
Personnel					
Untrained resources through personnel-hire arrangements	Perth	5-7 days	Shell is a participating member of AMOSC	Various locations around Australia	Core Group members can be available within 3 days

Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
			with access to Mutual aid arrangements. AMSA MoU and OSRL contracts, enabling access to national and international oiled wildlife expertise	and internationally	
			National Response Team trained Oiled Wildlife Responders	Various locations around Australia	>3 days

Table 13-7: Environmental Performance – Oiled Wildlife Response

Performance Standard	Measurement Criteria
Prepare Operational SIMA to help determine if OWR activities are likely to result in a net environmental benefit	Records indicate Operational SIMA 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

14. Waste Management Plan

Waste management is considered a support function to the overall response effort, so has no set objective, initiation or termination criteria. Waste management aims to ensure wastes are handled and disposed of safely and efficiently and prevent contamination of unaffected areas.

14.1. Overview

The implementation of some spill response strategies will collect and generate waste that will require management, storage, transport and disposal, and may consist of solid and liquid waste.

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.

14.2. Implementation Guide

Waste produced as a result of an oil spill will be managed in accordance with the Shell Oil Spill Waste Management Plan Template, MARPOL 73/78 (as appropriate to vessel class), relevant Commonwealth and WA regulations. Shell will engage its waste management contractor to finalise the waste management plan at the time of a spill, which will detail the types and volumes of waste that may be generated, finalise details of waste handling and storage and provide detailed waste disposal plans, using the information provided in the Shell Oil Spill Waste Management Plan Template.

Table 14-1 provides guidance to the ERT and IMT, on considerations, tasks and responsibilities that should be considered when implementing this response strategy. These actions are provided as a guide to the ERT and IMT. The OIM and/or Incident Commander are 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 14-2Table 14-2. Environmental Performance Standards and Measurement Criteria are listed in Table 14-3.

Table 14-1: Waste Management Implementation Guide

Responsibility		Task	Consideration	Complete
Initial Actions	Logistics Section Chief	Notify waste management contractor of spill and activate services		❑
	Planning Section Chief	Request waste management contractor to finalise Waste Management Plan, using template	All waste stored or transferred should be documented in Waste Management Plan, including details of the volumes and nature of the waste, receiver, destination of the waste and records of all regulatory approvals	❑
	Environment Unit Lead	Ensure Operational SIMA considers the impact of waste management activities in environmentally sensitive locations	Appropriate controls for sensitive locations should be incorporated into Waste Management Plan	❑

Table 14-2: Waste Management Resource Capability

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Processes					
	Oil Spill Waste Management Plan Template	N/A	N/A	N/A	N/A	N/A
	Equipment					
	N/A	N/A	N/A	Rusca Brothers	Broome	48-72 hours

Tactic	Shell Resources	Location	Mobilisation Time	Service Provider Resources	Location	Service Provider Activation Time
	Personnel					
	N/A	N/A	N/A	Rusca Brothers	Broome	48-72 hours

Table 14-3: Environmental Performance – Waste Management

Performance Standard	Measurement Criteria
Waste Service Provider shall track all wastes from point of generation to final destination	Waste Service Provider tracking records
Waste Service Provider to provide weekly waste management reports and more regular situation reports during the response until termination criteria are met	Waste Service Provider tracking records

15. Operational and Scientific Monitoring Plan

Shell has developed an Oil Spill Monitoring Implementation Plan (OSMP) which describes a program of monitoring oil pollution that will be adopted in the event of a hydrocarbon spill incident (Level 2-3) to marine waters. It is aligned to the Joint Industry Operational and Scientific Monitoring Plan Framework (APPEA, draft) and describes how this Framework applies to Shell's activities and spill risks in Australian waters.

The OSMP is structured so that it can provide a flexible framework that can be adapted to individual spill incidents. A series of Operational Monitoring Plans (OMPs) and Scientific Monitoring Plans (SMPs) form part of the Joint Industry Framework and provide detail on monitoring design, standard operating procedures, data management and reporting. Details on personnel, resources, logistics and mobilisation times are outlined in Shell's OSMP Implementation Plan. Table 15-1 lists the plans that are relevant to Shell's activities and the aim of each monitoring plan.

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

- Operational Monitoring – which is undertaken during the course of the spill and includes any physical, chemical and biological assessments which may guide operational decisions such as selecting the appropriate response and mitigation methods and / or to determine when to terminate a response activity. The design of operational monitoring requires judgements to be made about scope, methods, data inputs and outputs that are specific to the individual spill incident, balancing the operational needs of the response with the logistical and time constraints of gathering and processing information. There is a need for information to be collected and processed rapidly to suit response needs, with a lower level of sampling and accuracy needed than for scientific purposes. For details on initiation and termination criteria for OM's refer to Shell's OSMP Implementation Plan.

- Scientific Monitoring - which can extend well beyond the termination of response operations. Scientific monitoring has objectives relating to attributing cause-effect interactions of the spill or associated response with changes to the surrounding environment. The SMs will be conducted on a wider study area, extending beyond the spill footprint, will be more systematic and quantitative and aim to account for natural or sampling variation. For further details on the SM's refer to Shell's OSMP Implementation Plan.

Table 15-1: Operational and Scientific Monitoring Plans

Monitoring Plan	Aim/Objective
Operational Monitoring	
Hydrocarbon properties and weathering behaviour at sea	To provide in field information on the hydrocarbon properties, behaviour and weathering of the spilled hydrocarbons to assist in spill response operations
Pre-emptive assessment of sensitive receptors at risk (desktop only)	To undertake a rapid desktop-based assessment of the presence, extent and current status of sensitive receptors at risk of being affected by a hydrocarbon spill, prior to contact
Shoreline clean-up assessment technique (SCAT)	Provide information on the physical and biological characteristics of shorelines within the predicted trajectory of the hydrocarbon spill or that have been exposed to the spill Conduct segmentation of shorelines to aid in response planning and implementation of response activities Inform suitable pre-impact and post-impact response options/activities to minimise the threat posed to sensitive receptors from the spill and establish clean-up end points for the shoreline Inform the IMT/EMT of any potential or actual impacts to sensitive receptors from response options/activities Inform the IMT of any sensitive receptors that may be relevant to scientific monitoring programs
Chemical dispersant effectiveness and fate (surface and subsurface)	To monitor the effectiveness, distribution and fate (surface and subsurface) of chemical dispersants to verify impact/contact predictions for response planning and other monitoring plans
Water quality assessment	To provide a rapid assessment of the presence, type, concentrations and character of hydrocarbons in marine water to assess the extent of spill contact and verify impact predictions for other monitoring plans
Sediment quality assessment	To provide a rapid assessment of the presence, type, concentrations and character of hydrocarbons in marine sediments to assess the extent of spill contact and verify impact predictions for other monitoring plans

Monitoring Plan	Aim/Objective
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs • Seabirds and shorebirds • Fish	To undertake a rapid assessment of marine fauna at risk to assist in decisions on appropriate management and response actions during a hydrocarbon spill event to minimise the potential impact on marine fauna
Air quality modelling (responder health and safety)	To assess the impact of the hydrocarbon spill on human health, particularly that of the public and response personnel
Scientific Monitoring	
Water quality impact assessment	Detect and monitor the presence, concentration and persistence of hydrocarbons in marine waters following the spill and associated response activities. The specific objectives of this SMP are as follows: • Assess and document the temporal and spatial distribution of hydrocarbons and dispersants in marine waters of sensitive receptors; • Consider the potential sources of any identified hydrocarbons • Verify the presence and extent of hydrocarbons (both on water and in water) that may be directly linked to the source of the spill • Assess hydrocarbon/dispersant content of water samples against accepted environmental guidelines or benchmarks to predict potential areas of impact • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs
Sediment quality impact assessment	Detect and monitor the presence, concentration and persistence of hydrocarbons in marine sediments following the spill and associated response activities. The specific objectives of this SMP are as follows:

Monitoring Plan	Aim/Objective
	• Assess and document the temporal and spatial distribution of hydrocarbons and dispersants in marine sediments of sensitive receptors • Consider the potential sources of any identified hydrocarbons; and • Verify the presence and extent of hydrocarbons that may be directly linked to the source of the spill • Assess hydrocarbon content of sediment samples against accepted environmental guidelines or benchmarks to predict potential areas of impact
Intertidal and coastal habitat assessment	To assess the impact (extent, severity, and persistence) and subsequent recovery of intertidal and coastal habitats and associated biological communities in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: - collect quantitative data to determine short-term and long-term (including direct and indirect) impacts of hydrocarbon (and implementation of response options) on intertidal and coastal habitats and associated biological communities, post-spill and post-response recovery - monitor the subsequent recovery of intertidal and coastal habitats and associated biological communities from the impacts of the hydrocarbon release
Seabirds and shorebirds	Document and quantify shorebird and seabird presence; and any impacts and potential recovery from hydrocarbon exposure. The objectives are to: • Identify and quantify, if time allows, the post-spill/pre-impact presence and status (e.g. foraging and/or nesting activity) of shorebirds and seabirds in the study area • Observe, and if possible quantify and assess, the impacts from exposure of shorebirds and seabirds to hydrocarbons (i.e. post-impact) and to the response activities, including abundance, oiling, mortality, and sub-lethal effects • Identify, quantify and evaluate the post-impact status and if applicable, recovery of key behaviour and breeding activities of shorebirds and seabirds (e.g. foraging and/or nesting activity and reproductive success) over time and with regard to control sites

Monitoring Plan	Aim/Objective
Marine mega-fauna assessment • Reptiles	Reptiles Identify and quantify the status and recovery of marine reptiles, including marine turtles, sea snakes and estuarine crocodiles, related to a hydrocarbon spill The objectives are to: • To observe and quantify the presence of marine reptiles (including life stage) within the area affected by hydrocarbons • Where possible, assess and quantify lethal impacts and/or sub-lethal impacts directly related to the hydrocarbon spill or other secondary spill-related impacts (including vessel strike and/or use of dispersants); • Assess the impact of the hydrocarbon spill on nesting turtles, nests, and hatchlings • Understand changes in nesting beach usage by marine turtles following the hydrocarbon spill
Benthic habitat assessment	To assess the impact (extent, severity, and persistence) and subsequent recovery of subtidal benthic habitats and associated biological communities in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: • collect quantitative data to determine short-term and long-term (including direct and indirect) impacts of hydrocarbon (and implementation of response options) on benthic habitats and associated biological communities, post-spill and post-response recovery • monitor the subsequent recovery of benthic habitats and associated biological communities from the impacts of the hydrocarbon release
Marine fish assemblages assessment	To assess the impacts to and subsequent recovery of fish assemblages associated with specific benthic habitats (as identified in SMP: Benthic Habitat Assessment) in response to a hydrocarbon release and associated response activities. The specific objectives of this SMP are as follows: • Characterise the status of resident fish populations associated with habitats monitored in SMP: Benthic Habitat Assessment that are exposed/contacted by released hydrocarbons

Monitoring Plan	Aim/Objective
	• Quantify any impacts to species (abundance, richness and density) and resident fish population structure (representative functional trophic groups) • Determine and monitor the impact of the released hydrocarbons and potential subsequent recovery to residual demersal fish populations
Fisheries impact assessment	To monitor potential contamination and tainting of important finfish and shellfish species from commercial, aquaculture and recreational fisheries to evaluate the likelihood that a hydrocarbon spill will have an impact on the fishing and/or aquaculture industry. The specific objectives of this SMP are as follows: • Assess any physiological impacts to important fish and shellfish species and if applicable, seafood quality and safety • Assess targeted fish and shellfish species for hydrocarbon contamination • Provide information that can be used to make inferences on the health of fisheries and the potential magnitude of impacts to fishing industries (commercial, aquaculture and recreational)

Table 15-2: Environmental Performance – Oil Spill Monitoring

Performance Standard	Measurement Criteria
Obtain annual capability reports from Monitoring Service Provider	Annual capability reports from Monitoring Service Provider
Initiation criteria of OMPs and SMPs will be reviewed during the preparation of the initial Incident Action Plan (IAPs) and subsequent IAPs; and if any criteria are met, relevant OMPs and SMPs will be activated	Incident Action Plan and Incident Log
Monitoring to be conducted in accordance with the Oil Spill Monitoring Implementation Plan	Incident log and monitoring records

16. Response Termination

Terminating the spill response may involve demobilising personnel and equipment from response locations, post-incident reporting, identifying improvement opportunities, reviewing and updating plans and restocking equipment supplies. Planning to demobilise should occur ahead of time, during the response, to facilitate rapid demobilisation of resources that are no longer needed, and which can significantly reduce response costs.

The decision to terminate individual response strategies will be made by the relevant Control Agency (Table 2-1), according to the termination criteria shown for each strategy (Sections 7, 9-12).

In order to terminate the overall response operation, Shell (where it is the Control Agency) will consult with the Jurisdictional Authority and affected stakeholders during the response regarding suitable termination criteria for the nature and scale of the specific incident.

Scientific monitoring may continue after response operations have ceased and may be used to inform remediation activities.

Table 16-1 provides guidance on termination activities.

Table 16-1: Implementation Guide – Response Termination

Responsibility	Task	Consideration	Complete
Planning Section Chief	Prepare a demobilisation plan, which should include: • Allocation of resources and personnel for demobilisation • Identification of roles and responsibilities to approve and implement demobilisation activities • Identification of equipment and resources to be demobilised • Prioritisation of demobilising resources with lower utilisation, higher costs, and greater decontamination needs.		❑
Incident Commander	Consult with the Jurisdictional Authority and affected stakeholders during the response regarding suitable termination criteria for the nature and scale of the specific incident		❑

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18. Abbreviations/Acronyms and Definitions

Abbreviation/Acronym	Definition
ADIOS	Automated Data Inquiry for Oil Spills
AMOSPlan	Australian Marine Oil Spill Plan
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
AIP	Australian Institute of Petroleum
APASA	Asia-Pacific Applied Science Associates
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
ARAT	Asia/ Russia/Australia Team
Bbl	Barrels
BAOAC	Bonn Agreement Oil Appearance Code
BOP	Blow-out preventer
CMT	Crisis Management Team
DENR	Northern Territory Department of Environment and Natural Resources
DFAT	Commonwealth Department of Foreign Affairs and Trade
DMIRS	Western Australia Department of Mines, Industry Regulation and Safety
DEE	Commonwealth Department of the Environment and Energy
DBCA	Western Australia Department of Biodiversity, Conservation and Attractions
DPAW	Department of Parks and Wildlife (now DCBA)
DPIRD	Western Australia Department of Primary Industries and Regional Development
DOR	Dispersant to oil ratio
DoT	Western Australia Department of Transport
DWER	Western Australia Department of Water and Environment Regulations
IMT Leader	Incident Management Team Leader. Equivalent to an Incident Controller or Incident Commander.
EP	Environment Plan
ER	Emergency Response
ERC	Emergency Response Centre

Abbreviation/Acronym	Definition
ERP	Emergency Response Plan
ERT	Emergency Response Team
FLNG	Floating Liquid Natural Gas
FPSO/ FSO	Floating Production Storage and Offloading /Floating Storage and Offloading
GRSN	Shell Global Response Support Network (activated through STASCo)
HFO	Heavy Fuel Oil
HMA	Hazard Management Agency
HSSE and SP	Health, Safety, Security, Environment and Social Performance
IAP	Incident Action Plan
ICS	Incident Command System
IMO	International Maritime Organisation
IMT	Incident Management Team
IMT (W)	Incident Management Team (West)
Level 1, Level 2 and Level 3	Tier 1, Tier 2 and Tier 3 per IPIECA definition and HSSE &SP Control Framework.
LOWC	Loss of Well Control
MARPOL	The International Convention for the Prevention of Pollution from Ships 1973/78
MEER	Maritime Environmental Emergency Response Unit
MODIS	Moderate-resolution Imaging Spectroradiometer
MDO	Marine Diesel Oil (Diesel)
MODU	Mobile Offshore Drilling Unit
MOSES	Marine Oil Spill Response Equipment System
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environment
NOPTA	National Offshore Petroleum Titles Administrator
NT	Northern Territory
OIE	Offset Installation Equipment
OIM	Offshore Installation Manager
OIS	Offset Installation System
OMP	Operational Monitoring Plan
OPEP	Oil Pollution Emergency Plan

Abbreviation/Acronym	Definition
OPGGS (E)	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations
OPRC	Oil Pollution Response and Cooperation
OSA	Oiled Shoreline Assessment
OSEC	Shell Oil Spill Expertise Centre
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OWR	Oiled wildlife response
POLREP	Statutory Pollution Report
ppb	parts per billion
ppm	parts per million
SART	Shell Americas Response Team
SFRT	Subsea First Response Toolkit
Shell	Shell Australia Pty Ltd
SIMA	Spill Impact Mitigation Assessment
SIMAP	Spill Impact Mapping and Analysis Program
SIRT	Subsea Incident Response Toolkit
SITREP	Situational Report
SHP-MEE	State Hazard Plan – Marine Environmental Emergencies
SMEEC	State Maritime Environmental Coordinator
SMP	Scientific Monitoring Plan
SOPEP / SMPEP	Shipboard Oil/Marine Pollution Emergency Plan
SSDI	Subsea dispersant injection
STASCo	Shell Tankers and Shipping Company (the group activates mobilisation of the GRSN)
TMPC	Territory Marine Pollution Controller
ZPI	Zone of Potential Impact

Appendix A - Types/characteristics of oils

Figure 0-1 outlines the generally accepted oil classification system of ITOPF. The Prelude condensate is a group 1 non-persistent oil, MDO/MGO: Group 2-3, IFO 180; Group 3, IFO 380: Group; HFO; Group 3-4.

Group 1 oils

A: °API > 45 (Specific gravity < 0.8)
B: Pour point °C
C: Viscosity @ 10–20°C: less than 3 CSt
D: % boiling below 200°C: greater than 50%
E: % boiling above 370°C: between 20 and 0%

	A	B	C	D	E
Aasgard	49	-28	2 @ 10°C	58	14
Arabian Super Light	51	-39	2 @ 20°C		
Cossack	48	-18	2 @ 20°C	51	18
Curlew	47	-13	2 @ 20°C	57	17
F3 Condensate	54	<-63	1 @ 10°C	81	0
Gippsland	52	-13	1.5 @ 20°C	63	8
Hidra	52	-62	2.5 @ 10°C	60	11
Terengganu condensate	73	-36	0.5 @ 20°C	>95	0
Wollybutt	49	-53	2@ 20°C	55	4
Gasoline	58		0.5 @ 15°C	100	0
Kerosene	45	-55	2 @ 15°C	50	0
Naptha	55		0.5 @ 15°C	100	0

Group 2 oils

A: °API 35–45 (Specific gravity 0.8–0.85)
B: Pour point °C
C: Viscosity @ 10–20°C: between 4 Cst and semi-solid
D: % boiling below 200°C: between 20 and 50%
E: % boiling above 370°C: between 15 and 50%

Low pour point <6°C

	A	B	C	D	E
Arabian Extra Light	38	-30	3 @ 15°C	26	39
Azeri	37	-3	8 @ 20°C	29	46
Brent	38	-3	7 @ 10°C	37	33
Draugen	40	-15	4 @ 20°C	37	32
Dukhan	41	-49	9 @ 15°C	36	33
Liverpool Bay	45	-21	4 @ 20°C	42	28
Sokol (Sakhalin)	37	-27	4 @ 20°C	45	21
Rio Negro	35	-5	23 @ 10°C	29	41
Umm Shaif	37	-24	10 @ 10°C	34	31
Zakum	40	-24	6@ 10°C	36	33
Marine Gas oil (MGO)	37	-3	5 @ 15°C		

High pour point >5°C

Amna	36	19	Semi-solid	25	30
Beatrice	38	18	32 @ 15°C	25	35
Bintulu	37	19	Semi-solid	24	34
Escravos	34	10	9 @ 15°C	35	15
Sarir	38	24	Semi-solid	24	39
Statfjord	40	6	7 @ 10°C	38	32

Note: High pour point oils only behave as Group 2 at ambient temperatures above their pour point. Below this treat as Group 4 oils.

Group 3 oils

A: °API 17.5–35 (Specific gravity 0.85–0.95)
B: Pour point °C
C: Viscosity @ 10–20°C: between 8 CSt and semi solid
D: % boiling below 200°C: between 10 and 35%
E: % boiling above 370°C: between 30 and 65%

Low pour point <6°C

	A	B	C	D	E
Alaska North Slope	28	-18	32 @ 15°C	32	41
Arabian Heavy	28	-40	55 @ 15°C	21	56
Arabian Medium	30	-21	25 @ 15°C	22	51
Arabian Light	33	-40	14 @ 15°C	25	45
Bonny Light	35	-11	25 @ 15°C	26	30
Iranian Heavy	31	-36	25 @ 15°C	24	48
Iranian Light	34	-32	15 @ 15°C	26	43
Khafji	28	-57	80 @ 15°C	21	55
Sirri	33	-12	18 @ 10°C	32	38
Thunder Horse	35	-27	10 @ 10°C	32	39
Tia Juana Light	32	-42	500 @ 15°C	24	45
Troll	33	-9	14 @ 10°C	24	35
IFO 180	18–20	10–30	1,500–3,000 @ 15°C		–

High pour point >5°C

Cabinda	33	12	Semi-solid	18	56
Coco	32	21	Semi-solid	21	46
Gamba	31	23	Semi-solid	11	54
Mandji	30	9	70 @ 15°C	21	53
Minas	35	18	Semi-solid	15	58

Note: High pour point oils only behave as Group 3 at ambient temperatures above their pour point. Below this treat as Group 4 oils.

Group 4 oils

A: °API <17.5 (Specific gravity >0.95) or
B: Pour point >30°C
C: Viscosity @ 10–20°C: between 1500 CSt and semi-solid
D: % boiling below 200°C: less than 25%
E: % boiling above 370°C: greater than 30%

	A	B	C	D	E
Bachaquero 17	16	-29	5,000 @ 15°C	10	60
Boscan	10	15	Semi -solid	4	80
Cinta	33	43	Semi -solid	10	54
Handil	33	35	Semi -solid	23	33
Merey	17	-21	7,000 @ 15°C	7	70
Nile Blend	34	33	Semi-solid	13	59
Pilon	14	-3	Semi-solid	2	92
Shengli	24	21	Semi-solid	9	70
Taching	31	35	Semi-solid	12	49
Tia Juana Pesado	12	-1	Semi-solid	3	78
Widuri	33	46	Semi-solid	7	70
IFO 380	11–15	10–30	5,000–30,000 @ 15°C		

Figure 0-1: ITOPF Oil Classification Guide based on API Specific Gravity.

A1.1 Marine Diesel Oil (MDO) "Diesel"

The general behaviour of diesel at sea can be summarised as follows:

- a slick of diesel will elongate rapidly in the direction of the prevailing wind and waves;
- very rapid spreading of the low viscosity diesel will take place;
- some diesel fuel oils may form an unstable emulsion at the thicker, leading edges of the slick;
- speed of physical dispersion of the surface slick increases with wind speed. Up to 95% of a slick may disperse within about 4 hours of the spill in 15 knot winds, warm air and sea conditions; and
- evaporation of diesel is likely to be enhanced due to the warmer prevailing air and sea temperatures of the Prelude project area.

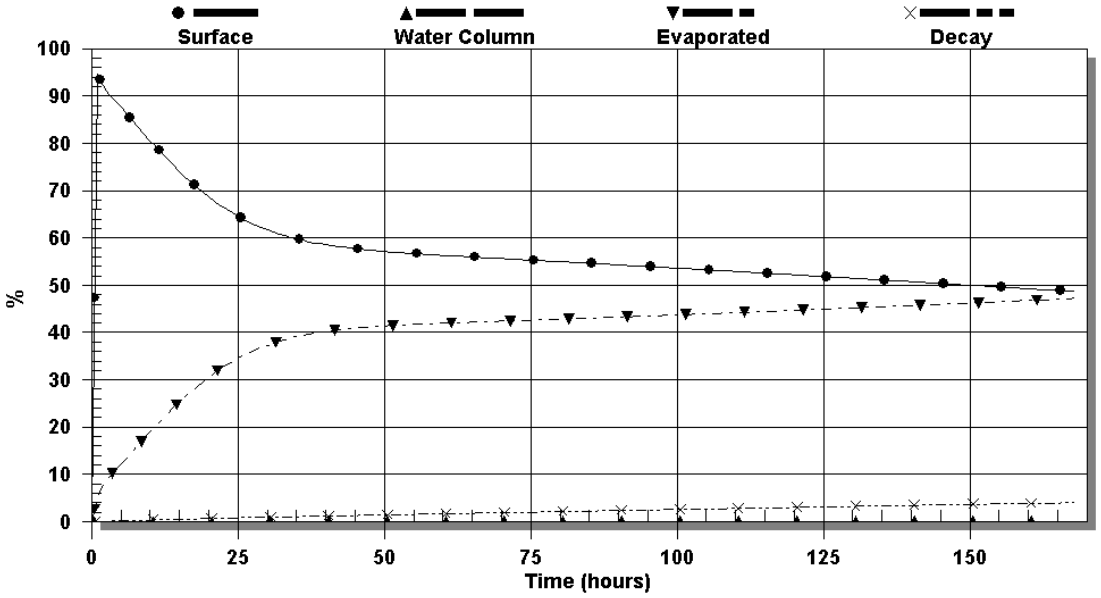


Figure 0-2: Proportional mass balance plot representing the weathering of marine diesel spilled onto the water surface as a one-off release (50 m3 over 1 hr) and subject to a constant 5 knot (2.6 m/s) wind at 27 °C water temperature and 25 °C air temperature.

A1.2 Intermediate Fuel Oil (IFO)

The general behaviour of IFO at sea can be summarised as follows:

- It is a mostly persistent oil.
- Emulsification will generally be noticeable after about 12 hours in water.
- More viscous and prone to be a thicker slick than MDO.
- It takes about 72-96 hours for a maximum of about 20% to evaporate.

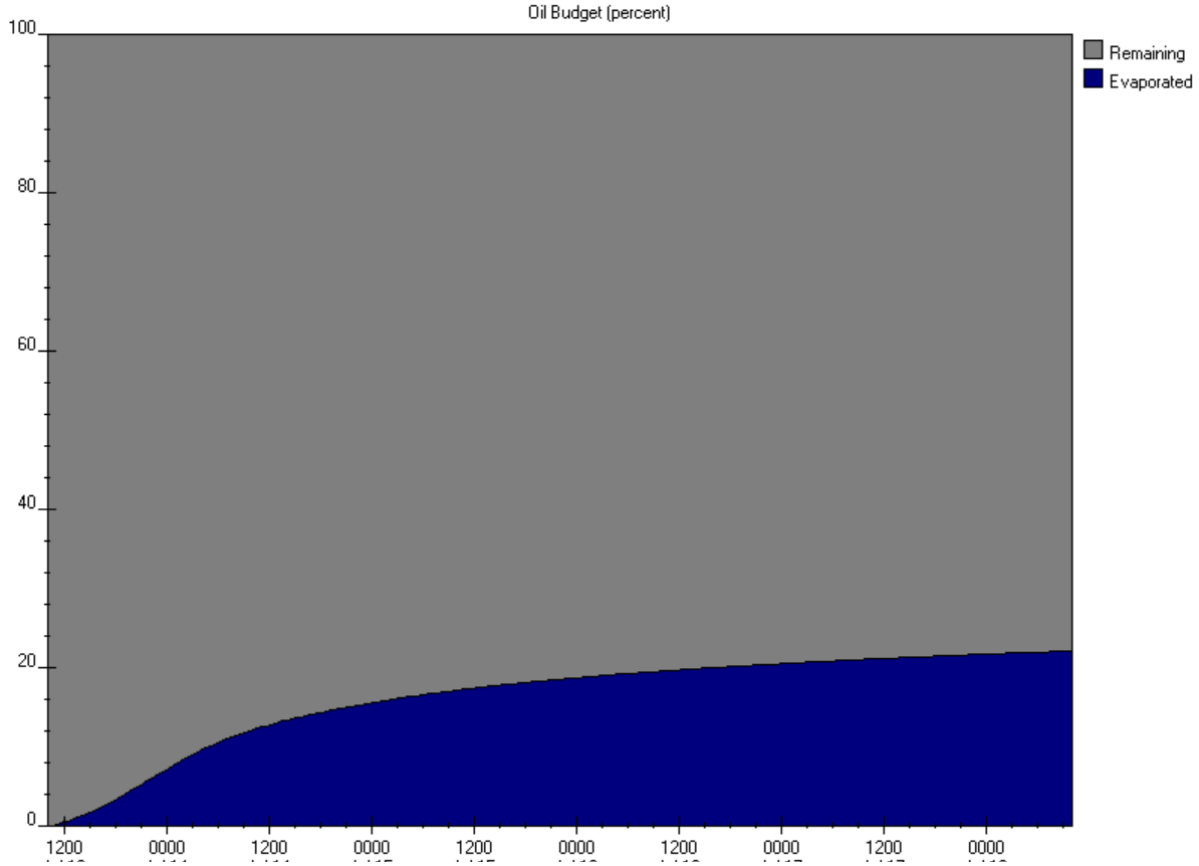


Figure 0-3: Proportional mass balance plot representing the weathering of intermediate fuel oil (IFO) spilled onto the water surface as an instantaneous one-off release (1,000 m3) and subject to a constant 5 knot (2.6 m/s) wind at 27 °C water temperature and 25 °C air temperature.

A1.3 Prelude Condensate

Condensates are typically light oils that rapidly evaporate and readily disperse. Testing was undertaken of the Prelude condensate in January 2007, when Prelude -1A was drilled. The major constituents of the Prelude condensate are provided in Prelude-1A Fluid Sampling and Evaluation Report (GS.08.51466) (Chang et al. 2008).

Prelude condensate is classified as a Group 1 oil (non-persistent) according the system used by AMSA (AMSA 2012), which is based on US (EPA & Coast Guard Regulations OPA90 Act), and the International Tanker Owners Pollution Federation (ITOPF 2011) (see Table 1 and 2). It has a specific gravity of 0.7927 at 25°C, 47 (see Table 1 and 2). However, while Prelude condensate is low viscosity (0.7433 cP at 25°C and 0.7307 cP at 40°C), low pour point (9-15°C (depending on sampling point) and highly evaporative condensate (36% lost in 2 hours and 58% lost in first 48 hours under test conditions (Downey et al. 2012)), it does have minor quantities of persistent hydrocarbons (waxes) by volume (Figures 4 and 5). Waxes, by definition are those petroleum hydrocarbons that would be solid at room/sea temperature, which is approximately that of C22 carbon in tropical sea conditions. Approximately 10% of the Prelude-1A condensate is hydrocarbons that have boiling points over the C22 carbon chain length (Figure 3). These are mostly straight chain aliphatic hydrocarbons (paraffin waxes).

Table A 1: Prelude Condensate Classification

Oil Classification	Oil Description	Specific Gravity	Boiling Point <340°C (>50%)	Boiling Point >370°C (<5%)
Group 1	**Non-persistent oil**	**0.7927 at 25°C** **47 API**	**~85%**	**~10 %**

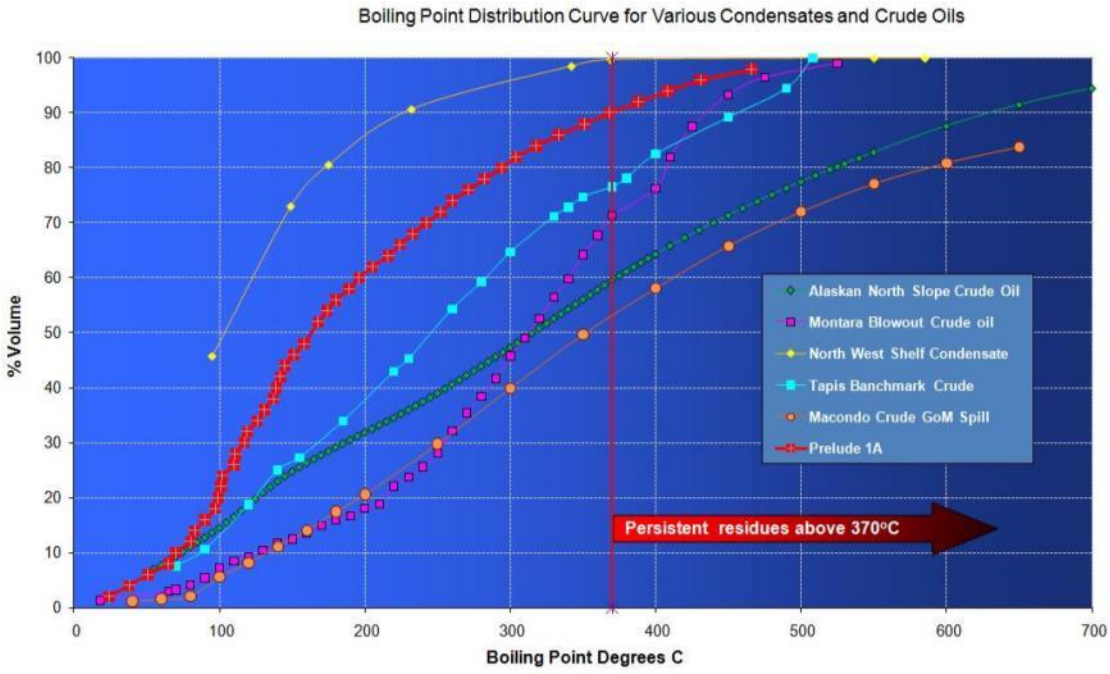


Figure 0-4: Comparison of the Persistent Residues of Prelude 1A Condensate and Other Condensates and Oils include the Montara, Macondo, Exxon Valdez spill (Alaska North Slope) and Tapis Benchmark Crude Oils

Table A 2: Chemical and physical parameters of Prelude 1A condensate

<table>
<tr><th>Parameter</th><th>Results</th></tr>
<tr><td>Wax content (% weight)</td><td>See Figure A12.1 above</td></tr>
<tr><td>Distillation profile</td><td>See Table 4.3 of GS.08.51466 and Figure A12.1 above</td></tr>
<tr><td>Total Volatile Organic Compounds (VOC)</td><td>See Table 4.3 of GS.08.51466 and Figure A12.1 above. ~50% < C14</td></tr>
<tr><td>PAH (total and detailed) GC/MS</td><td>For PIONA (Paraffin, Iso- Paraffin, Olefin, Napthene, Aromatic) analysis see Section 11.1.3 of GS.08.51466.

See also Figure A12.2 below for GC/MS analysis</td></tr>
<tr><td>C17/Pristane ratios and C18/Phytane ratios</td><td><table><tr><th>Name</th><th>Weight (%)</th><th>Carbon #</th></tr><tr><td>Pseudo C17</td><td>0.3550</td><td>17.13</td></tr><tr><td>Pseudo C17</td><td>0.3033</td><td>18.10</td></tr></table>From Table 4.3 of GS.08.51466</td></tr>
<tr><td>Aliphatic hydrocarbons</td><td>See Figure A12.2 for GC/MS analysis</td></tr>
<tr><td>Density (Specific Gravity) at 4oC (40oF) and 15oC (60ºF)</td><td>0.7794 cc at 4°C*

0.7820 cc at 20°C</td></tr>
<tr><td>Viscosity (cSt) at likely ambient temperatures and at 40ºC (104 ºF)</td><td>0.7433 cP at 25°C*

0.7307cP at 40°C

Low viscosity mostly 1-2 cSt as fresh condensate.</td></tr>
<tr><td>Pour Point (ºC)</td><td>9-15°C (depending on sampling point)</td></tr>
</table>

*Assured Prelude 10 component PVTsim model

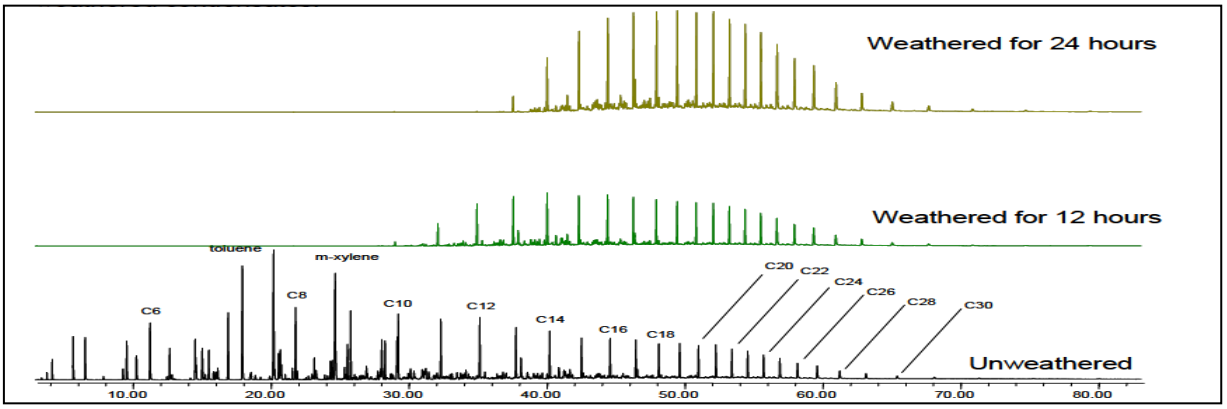


Figure 0-5: A comparison of total ion chronographs of Prelude 1A unweathered and weathered condensates

Weathering of Prelude condensate

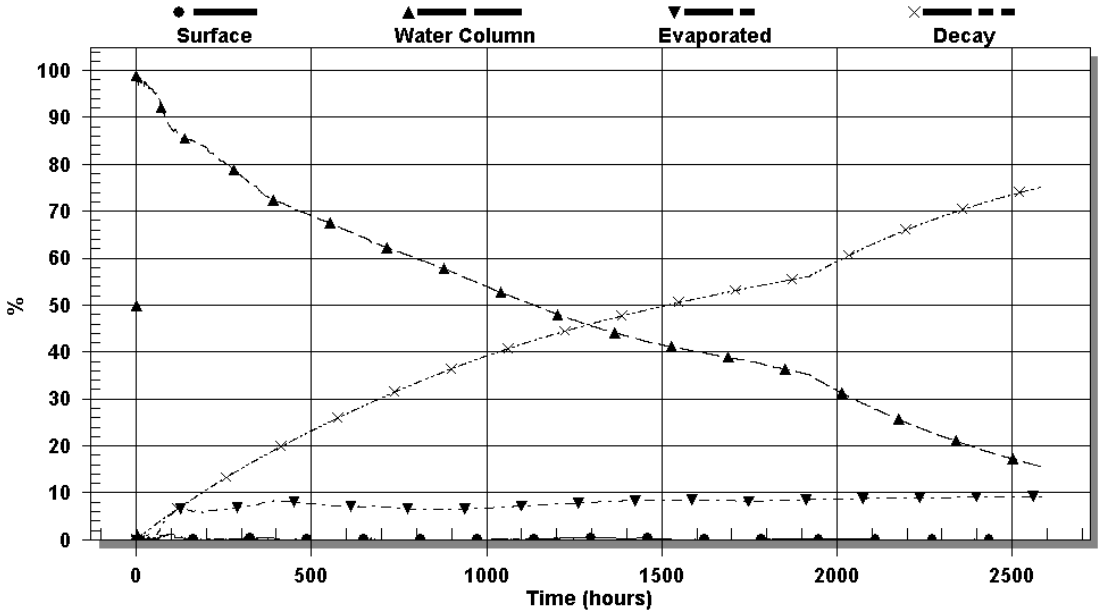


Figure 0-6: Predictions for the partitioning of oil mass over time through weathering processes for a subsea blowout releasing Prelude Condensate for 80 days (1,600,000 bbl), involving pressurised release, with gas, from 237 m depth, assuming the droplet size distribution forecast by OILMAP-Deep. Estimates are plotted as proportions. Predictions are based on one example of time-varying environmental conditions and outcomes will vary with different conditions.

A1.4 Prelude Condensate Dispersant Efficacy

Prelude 1A condensate, along with Ichthys Condensate (INPEX), has undergone testing to determine the effectiveness to oil dispersants in seawater under tropical conditions (see (Downey et al. 2012) for full report). Initial screening was done against six dispersants previously approved and available for use in Australia (Tergo R-40, Ardrox 6120, Corexit 9500, and, Slick gone LTSW and NS) (see Figure 6). Based on the initial screening, the best performing two dispersants (Ardrox 6120 and Corexit 9500) were selected for more detailed analysis. The results of the more detailed analyses are presented in the box below and Figure 7.

In summary,

- Prelude 1A condensate is highly evaporative condensate (36% lost in 2 hours and 58% lost in first 48 hours under test conditions) with a persistent waxy residue (>C17 for this analysis)
- The remnant waxy material, solid or near solid at normal seawater temperatures, is less conducive to dispersion compared to the whole condensate.
- The effectiveness of dispersants decreased over time with the maximum efficacy observed within the first two hours. This is because the weathering of the condensates increases both the viscosity and pour point, therefore reducing the effectiveness of condensate dispersants.
- Dispersants are most effective when applied to fresh unweathered condensates and are less effective if they are applied 12 to 24 hours after the spill has occurred.
- The preferred dispersants, based on dispersant efficiency only, for use on Prelude 1A condensate are Ardrox 6120 and Corexit 9500.
- Both Ardrox 6120 and Corexit 9500 performed similarly. Corexit 9500 performs slightly better than Ardrox 6120 if applied to unweathered condensate in the first 8hrs. Ardrox 6120 performs slightly better than Corexit 9500 over a wider range of condensate weathering states.

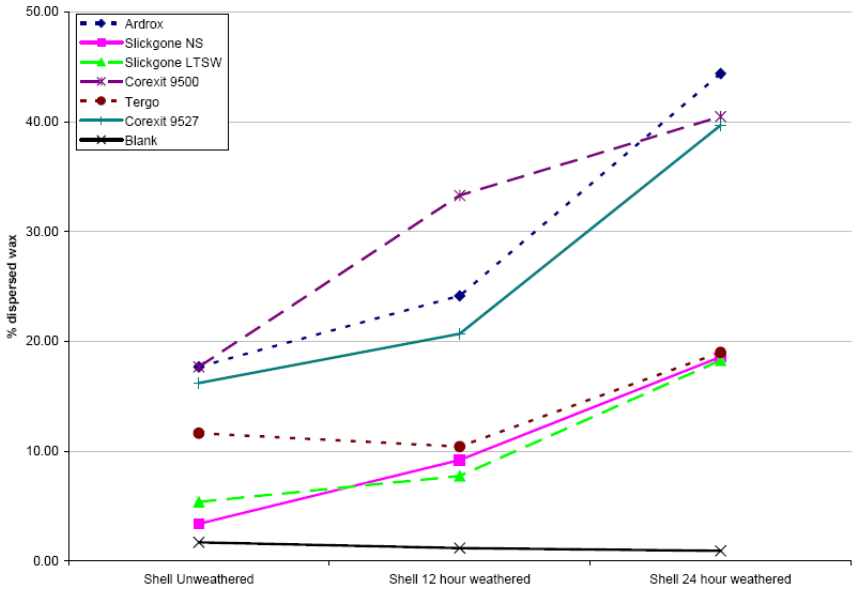


Figure 0-7: A comparison of the percentage dispersed wax fraction (C17 +) for Prelude-1A.

Table 5: A summary of the percentage of dispersed unweathered and weathered Prelude-1A condensate across 48 hours using Ardrox 6120 and Corexit 9500 dispersants.

Percentage Dispersed Condensate	Prelude-1A unweathered	Prelude-1A weathered 12 hours	Prelude-1A weathered 24 hours	Prelude-1A unweathered hours	Prelude-1A weathered 12 hours	Prelude-1A weathered 24 hours
Dispersant	Ardrox 6120			Corexit 9500		
15 minutes	24	17	27	32	12	6
2 hours	27	15	23	24	11	10
4 hours	8	10	14	22	9	11
8 hours	8	10	14	12	6	14
24 hours	8	4	4	5	1	14
48 hours	4	1	2	1	1	8

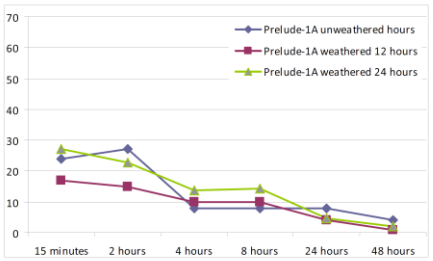


Figure 10: A comparison of the percentage efficacy of Ardrox 6120 on unweathered and weathered Prelude 1A condensate over 48 hours.

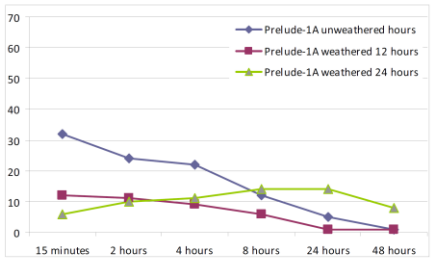


Figure 11: A comparison of the percentage efficacy of Corexit 9500 on unweathered and weathered Prelude 1A condensate over 48 hours.

Figure 0-8: A comparison of the percentage dispersed wax fraction (C17 +) for Prelude-1A following application of Ardrox 6120 and Corexit 9500 (Downey, 2012).

Appendix B: Oil Spill Resource Directory

This Appendix lists sources of oil spill response resources, including equipment, in alphabetical order. Contact details for these organisations are provided in the Shell IMT Weekly Contact List (HSE_GEN_011648). Equipment transport times and stockpile locations are provided below in subsequent tables.

Table B 1: Spill Response Support Directory

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
Aerial surveillance contractors	Level 2-3	Aerial logistical support for aerial surveillance and spill assessment.	N/A	As per Shell IMT Weekly Contact List (HSE_GEN_011648)	Shell holds contract for exclusive use and aircraft are available 24/7
	Mobilisation	Helicopter aerial surveillance aircraft will be contracted through contract providers, as per Shell IMT Weekly Contact List (HSE_GEN_011648). Additional aviation support may be provided through AMSA.			
Airstrips	Level 2-3	The primary Shell Air Support Base is at Broome International Airport with Djarindjin Airport being used as a refuelling point for aerial ops supporting OPEP operations if required.	N/A	N/A	N/A

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
AMOSC	Level 2-3	• Manned 24/7 Duty Officer support; • AMOSC Staff availability – 8 staff provided at best endeavours within 3 hours and guaranteed onsite (terrestrially) within 12 hours as per AMOSC website • Equipment availability per monthly status reporting at; http://amosc.com.au/member-login/ & performance indicators as per AMOSC website • Core Group availability per monthly reporting status at; http://amosc.com.au/member-login/ • Mutual aid for equipment per http://amosc.com.au/member-login/ • Access to the National Plan via AMSA within 1 hour on a 24/7 basis • Access to the Fixed Wing Aerial Dispersant capability within 1 hour on a 24/7 basis • Access to RPS Trajectory Modelling within 60 minutes • Access to KSAT Satellite imagery within 60 minutes of notification – imagery to be determined at the time of request will dictate supply timeframes depending on satellite availability	AMOSPlan	Shell holds a current agreement and pays an annual associate company subscription	• Monthly AMOSC Core Group report for personnel availability distributed to member companies monthly • Annual Joint Industry Audit by member companies, including auditing of systems, controls, competencies and equipment stockpiles

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
		• Access to Broome equipment, co-owned by WA DoT, Kimberley Ports and AMSOC. This equipment is designed to respond to spills in the sheltered waters of Broome, so has limited use offshore. However, The following AMOSC managed equipment to be used in an initial Level 2 response whilst more substantial equipment is mobilised from further afield: ○ 15 m^3 of Ardrox 6120 dispersant, an AFEDO Spray set and spay arms. ○ 400 m of Lamor offshore boom and skimmer system (12 tonnes/ hr). ○ 200 m of sorbent boom. ○ additional tracker buoys.			
	Mobilisation	Refer to Table 3-1 for activation instructions.			

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
AMSA	Level 2-3	AMSA manage the National Plan and can provide both oil spill response equipment[12] and personnel as appropriate to the required level.	The National Plan, for Maritime Environmental Emergencies	N/A	AMSA coordinates State and National Plan exercises to test and assess the preparedness of Commonwealth, State and Territory responders under the National Plan.
	Mobilisation	Refer to Table 3-1 for activation instructions.			
Marine contractors	All Levels	Supply vessels to convey and deploy oil spill equipment.	N/A	As per Shell IMT Weekly Contact List (HSE_GEN_011648)	Shell holds contract for exclusive use and vessels are available 24/7
	Mobilisation	IMT Leader to mobilise as per contract arrangements			

[12] AMSA's full inventory of equipment can be found at https://amsa-forms.nogginoca.com/public/equipment.html

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
OSRL	Level 2-3	Contracted oil spill response equipment and personnel appropriate to the required level to support response strategy deployment, satellite surveillance and operational monitoring. As a member of OSRL, Shell has access to OSRL's full range of equipment[13] and is entitled to 50% of the OSRL global stockpile	N/A	Shell holds a current service agreement and pays an annual subscription	OSRL conduct an annual self-audit
	Mobilisation	Refer to Table 3-1 for activation instructions.			
Operational and Scientific Monitoring Providers	As per OSMP initiation criteria	Deliver the activated OMPs and SMPs for the duration of the Project. The services will include operational readiness to enable fast deployment of personnel and resources during a response.	OSMP	TBC	Conduct annual capability checks of key providers.
	Mobilisation	IMT IC to give direction to the EUL to mobilise as per contract arrangements			
RPS Group	All Levels	Spill modelling to determine real-time predictions at the time of the spill. The spill trajectory and probability information is used in planning and implementing response options.	N/A	TBC	RPS Group maintain records of call outs and time to respond with initial results.

[13] OSRL's monthly inventory of equipment can be found at https://www.oilspillresponse.com/activate-us/equipment-stockpile-status-report

Organisation	Relevant Level	Services provided	Relevant plan	Contract details	Maintenance of capability
	Mobilisation	Shell has an agreement in place with RPS to allow rapid marine hydrocarbon spill modelling capability to be activated at any time during activities, which will be undertaken for any spill greater than Level 1. AMOSC can also run modelling on behalf of Shell, if required, as part of contracting arrangements with RPS. Refer to Table 3-1 for activation instructions.			
Waste management contractor	All Levels	Waste and hazardous waste collection and disposal, including oily water.	N/A	As per Shell IMT Weekly Contact List (HSE_GEN_011648)	
	Mobilisation	IMT Leader to mobilise as per contract arrangements			

Appendix C: Aerial Surveillance Observation Log

Date	Incident	Aircraft type	Call sign	Start time	End time	Av altitude/ air speed
Wind speed (kts)	**Wind direction**	**Visibility (nm)**	**Cloud base (ft)**	**Sea state**	**Observer name/s**	**Spill source**
Survey start /end coordinates	**Survey start time**	**Survey end time**	**Time high tide**	**Time low tide**	**Current speed (nm)**	**Current direction**
Notes (e.g. wildlife or sensitive receptors observed, any response activities observed):						

SLICK DETAILS

Slick	Time local	Slick (centre or start)		Slick (end)		Slick Degrees Orient	Oil slick length			Oil slick width			Area km^2	Coverage %	Oiled area km^2
		LAT N/S	LONG E/W	LAT N/S	LONG E/W		SOG KT	Time seconds	Distance km	SOG KT	Time seconds	Distance km			
A															
B															
C															
D															
E															

Slick	Oil appearance coverage - %						Minimum volume - m^3	Maximum volume - m^3	Type of detection (etc. visual, IR)	Edge description (clear or blurred)	General description (windrows/patches)
	1	2	3	4	5	other					
A											
B											
C											
D											

The Bonn Agreement Oil Appearance Code (BAOAC)			
No	Oil appearance	Min. Volume m3 / km2	Max. Volume m3 / km2
1	Sheen	0.04	0.30
2	Rainbow	0.30	5.00
3	Metallic	5.00	50.0

E												4	Discontinuous true colour	50.0	200
												5	True colour	200	>200

NOTE: Ground Speed (SOG) is the speed of the aircraft relative to the ground (sea) measured in knots (kt). One knot is one nautical mile (nm) per hour. 1 kt = 1 nm per hour = 1.85 Kilometres (km) per hour = 0.03 km (31m) per minute = 0.0005 km per second

Appendix D: Vessel Surveillance Observation Log

Date	Incident	Vessel type	Call sign/Ship No.	Sea state
Observer name/s	**Spill source**	**Survey start /end coordinates**	**Survey start time**	**Survey end time**
Time high tide	**Time low tide**	**Current speed (nm)**	**Current direction**	**Vessel speed**
Notes (e.g. wildlife or sensitive receptors observed, any response activities observed):				

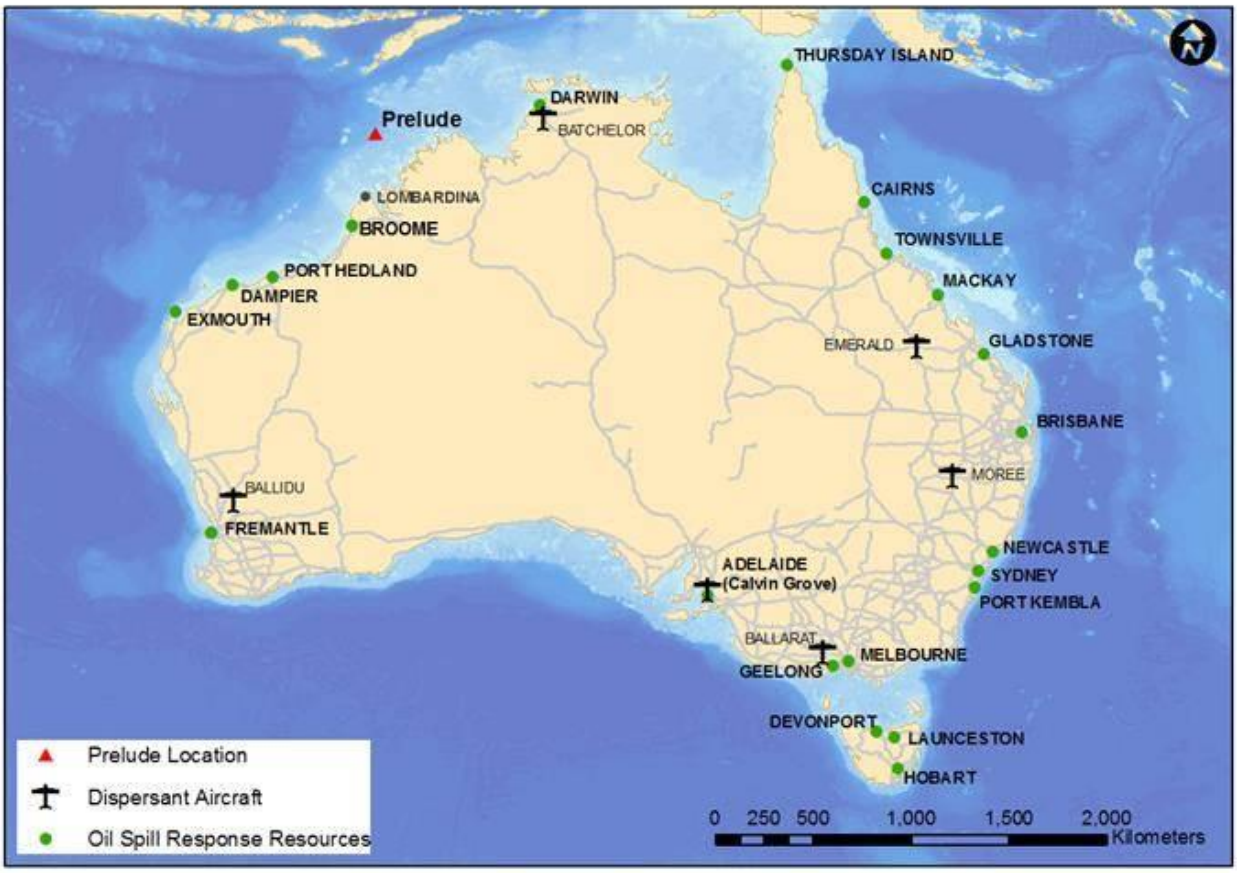
SLICK DETAILS

Slick	Time local	Slick (centre or start)		Slick (end)		Slick Orient Degrees	Oil slick length	Oil slick width	Area km^2	Coverage %	Oiled area km^2
		LAT N/S	LONG E/W	LAT N/S	LONG E/W		Approx. distance km	Approx. distance km			
A											
B											
C											
D											
E											

Slick	Oil appearance coverage - %						Minimum volume - m^3	Maximum volume - m^3	Type of detection (etc. visual, IR)	Edge description (clear or blurred)	General description (windrows/patches)	The Bonn Agreement Oil Appearance Code (BAOAC)			
	1	2	3	4	5	other						No	Oil appearance	Min. Volume m3 / km2	Max. Volume m3 / km2
A															
B												1	Sheen	0.04	0.30
C												2	Rainbow	0.30	5.00
D												3	Metallic	5.00	50.0

E												4	Discontinuous true colour	50.0	200
												5	True colour	200	>200

D1.1 Oil spill response stockpile locations in relationship to Prelude



D1.2 Equipment transportation times in relationship to Prelude

	Sea (hrs) to Prelude	Air (hrs) to Prelude	Air (hrs) to Broome (direct- non stop)	Road (hrs) to Broome
Broome	24	2	NA	NA
Darwin	40	3		22
Dampier	65	4		7
Geelong	NA	15		53
Wyndam	24	2		
Lombardina	NA	1	1	8
Batchelor	NA	NA	1.2	NA
Jandakot	NA	NA	1.7	NA
Adelaide/ Calvin grove	NA	NA	3	44
Newcastle	NA	NA	NA	60
Sydney	NA	NA	4	58
Port Kembla	NA	NA	NA	58
Melbourne	NA	NA	3.4	53
Devonport	NA	NA	NA	61*
Launceston/ Bell Bay	NA	NA	NA	62*
Hobart	NA	NA	4	65*
Fremantle	NA	NA	2	24
Port Hedland	NA	NA	NA	7
Cairns	NA	NA	NA	47
Gladstone	NA	NA	NA	49
Mackay	NA	NA	NA	47
Brisbane	NA	NA	3.6	53
Townsville	NA	NA	NA	43
Exmouth	NA	NA	NA	16

**including sea transport to Melbourne*

Appendix E – Chemical Spill Response for the Marine Environment

INITIAL RESPONSE

- Take appropriate personal protective measures.
- Call for medical assistance if an injury has occurred.
- Restrict access to the spill site and adjacent area as the situation demands. Take any other steps to minimize any threat to health and safety.
- Identify/Isolate the source and minimize the loss of product.
- Eliminate possible sources of ignition in the near vicinity of the spill.
- Establish air monitoring to determine potential safety hazards, as the situation demands.
    - Take the appropriate safe guarding measures, as the situation demands
- Secure water intakes, as the situation demands.
- Notify internal/external key stakeholders.
- Verify the type of product and quantity released.
- Notify STASCO for subject matter expert consultation.
    - Outside of the Americas +44 20 7934 7777 and within the Americas +1 713 241 2532
- Follow the initial response actions detailed in the site or vessel response plan; refer to the Chemical Spill Response for the Marine Environment Interface Tool to determine or validate response strategies and tactics.
- Engage trajectory/plume modelling services to verify extent of impact.
- Provided that a safe operating environment exists and there is tactical benefit, deploy spill response equipment to prevent/mitigate spill impact (spreading of spill).
- Chemical Spill Response Contractors;

- National Response Corporation (NRC, NRC-SRS) emergency centre contact number (worldwide service): +1-631-224-9141
- APME ALERT-SGS 24 Emergency Response Process ALERT-SGS provides 24-hour "Level 1" Emergency Response Service in the APME (Cargo SDS Information). The number + 65 6542 9595 (or + 800 2537 8747) can be called during an emergency involving a Shell Chemical product. "Level 2" and "Level 3" services are available, but at a non-negotiated rate.
- Braemar-Howells Available 24/7, incident response teams provide a rapid response and professional approach to dealing with oil spill incidents or hazardous (MAZMAT/HNS) spills. 24 Hour Response Line UK: 08700 73 77 66 73, INTL: +44 1646 697041

- Key Chemical Spill Response Information for Prelude

Mono Ethylene Glycol (MEG)	Mono Ethylene Glycol is a colourless, practically odourless, low-volatility, low-viscosity, hygroscopic (Picks up water from the air) liquid. It is completely miscible with water and many organic liquids and depresses the freezing point when mixed with water.	Model underwater plume for intake and environmental impacts. Use deterministic modelling to predict movement and concentration. **No recovery, containment or surveillance is possible due to no visible slick.** Remove all sources of ignition and earth any equipment deployed. Use air purifying respirator with organic/particulate cartridge or SCBA as required. If spilt on land, dam the flow path and vacuum/pump the material away in road transport. Interceptor pits can be effective to prevent the product from flowing into water courses
Methyl diethanolamine (MDEA)	Methyl diethanolamine is a clear, colorless or pale yellow liquid with an ammonia odour. It is completely miscible with water.	Model underwater plume for intake and environmental impacts. Use deterministic modelling to predict movement and concentration. **No recovery, containment or surveillance is possible due to no visible slick.**

Appendix F: Browse Island Incident Management Guide

Refer to hard copy of Browse island Incident Management Guideline