Operational and Scientific Monitoring (OSM) Bridging Implementation Plan

Department	HSSE&SP
Document Number	HSE_PRE_16370
Document Status	Issued for Use
Revision Number	0.1
Issue Date	03/01/2020
Owner	Principle Environment Advisor
Author/s	Environment Advisor
Security Classification	Unrestricted
Export Control	No US Content

Controlled Document, Copy No:

** Copy No 01" is always electronic and published within the Shell Document Management system
** All printed copies of "Copy No 01" are to be considered uncontrolled
** All electronic copies of "Copy No 01" duplicated outside the Shell Document Management system are to be considered uncontrolled

REVISION HISTORY					
Ver.	**Change Description**	**Date**	**Originator**	**Reviewed by**	**Approved by**
0.1	Original document	3rd January 2020	Lucy Sands	Nathan Waugh	Dani Thompson

TABLE OF CONTENTS

List of Tables

List of Figures

Part A – Preparedness

This Plan is presented in two parts. Part A outlines the relationship between Shell Australia Pty Ltd's (Shell) environmental management document framework and the Joint Industry OSMP Framework (APPEA, 2019). Part B provides operationally focussed guidance for Shell personnel and OSMP Service Providers to coordinate the implementation of monitoring plans.

1 Introduction

As part of the Offshore Petroleum Greenhouse Gas Storage (OPGGS) (Environment) Regulations 2009 and various State/Territory regulations, titleholders are required to ensure they have a suitable Operational and Scientific Monitoring Plan (OSMP) for their offshore petroleum activities. To date, titleholders have worked independently to develop and implement their OSMP frameworks which has led to a variety of different procedures and methods being produced.

To create consistency across industry and strengthen the overall approach to monitoring, titleholders have been working on a collaborative 'Joint Industry OSMP Project' in the event of a spill. This collaboration has resulted in the development of a Joint Industry OSMP Framework and a suite of Operational Monitoring Plans (OMP's) and Scientific Monitoring Plans (SMP's). The objectives of the Framework are to:

- Provide a standardised approach and guidance to titleholders, consultants and contractors that are undertaking operational and scientific monitoring in the event of an oil spill;
- Describe the suite of OMPs and SMPs that provide the minimum content requirements to meet the monitoring objective/s of each plan; and
- Recommend a common set of implementation arrangements, resulting in improved industry-wide OSMP capability.

Shell has elected to use the Joint Industry OSMP Framework and supporting OMPs and SMPs as the foundation of its operational and scientific monitoring approach. However, use of the Joint Industry OSMP Framework requires each titleholder to develop a Bridging Implementation Plan (this plan) which fully describes how the OSMP Framework interfaces with titleholders own activities, spill risks and internal management systems.

Table 1-1 describes key documents that form Shell's environmental management document framework.

Table 1-1: Key documents in Shell's environmental management framework

Document	Description
Activity specific EP	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 sensitive receptors, potential impacts from hydrocarbon spills and the zone of potential impact
Activity specific OPEP	This plan provides the activation and response process for the credible spill scenarios, including incident management, spill impact mitigation analysis (SIMA) process and detailed implementation guidance for individual response strategies. Of particular relevance to this plan, it identifies the credible spill scenarios and protection priorities
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, with the exception of OSMP roles which are detailed in this plan
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 and includes relevant OSMP contacts

Figure 1-1 illustrates how the OSMP, OPEP and EP relate to each other during a spill response. Operational and scientific monitoring should commence when the initiation criteria outlined in Appendix A are met.

Note: the monitor and evaluate strategy in Shell's OPEPs includes a wide range of tactics, including oil spill trajectory modelling which is often addressed in operational monitoring. Shell has retained spill modelling in the OPEP to ensure data inputs are managed by the Shell IMT and rapidly fed into the Common Operating Picture with other monitor and evaluate tactics during the initial stages of the spill.

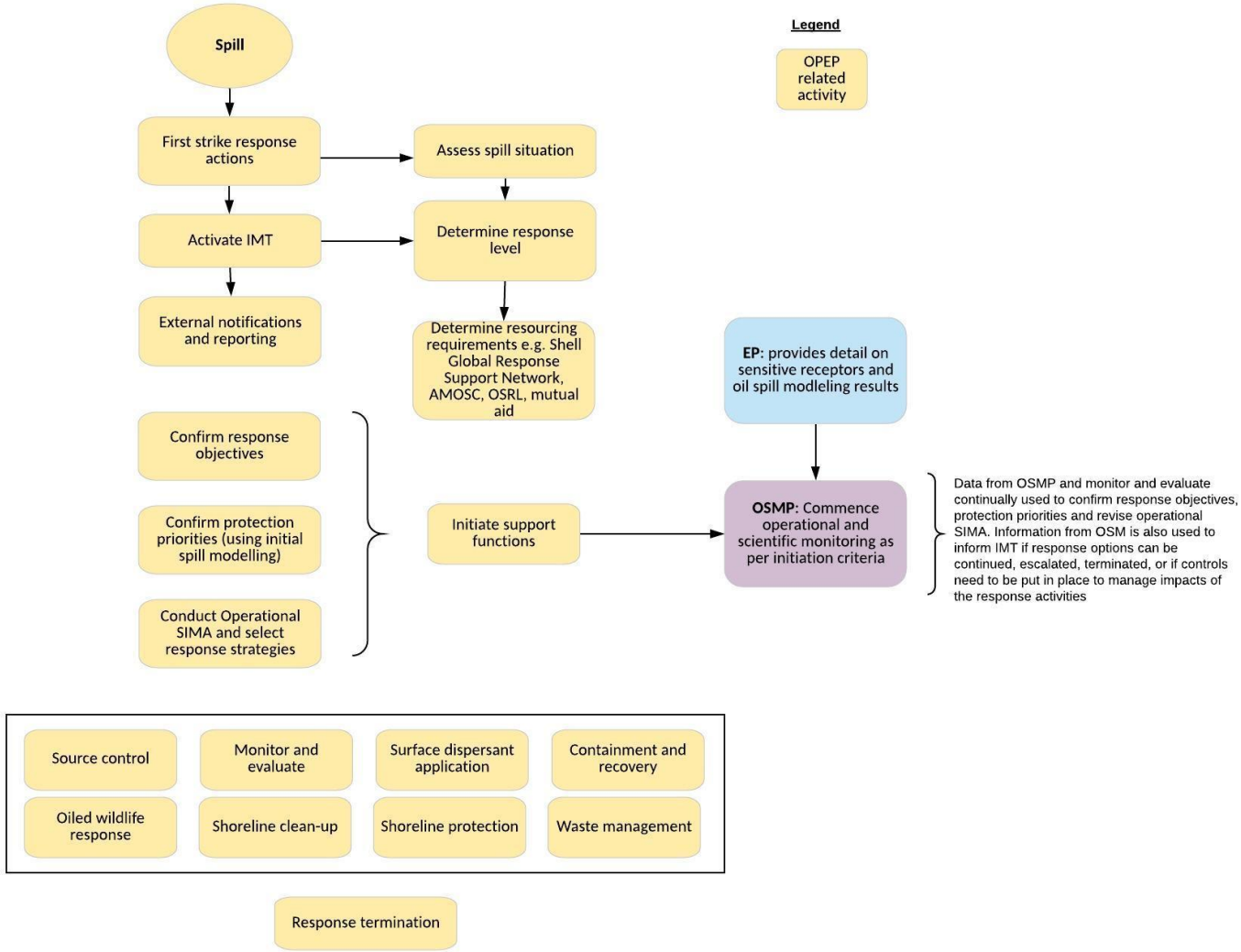


Figure 1-1: Relationship of OSMP, OPEP and EP during a spill response

2 Zone of Potential Impact and Monitoring Priorities

The Prelude FLNG facility has been taken as the basis for oil spill monitoring planning for all of Shell's activities in the Browse Basin. Prelude FLNG has larger geographical Zone of Potential Impact (ZPI) than Shell's other activities, including Bratwurst Drilling and Crux activities, as determined through oil spill trajectory modelling.

The outer boundary of the ZPI used for monitoring planning is based on the following thresholds (Refer to Table 9-70 of the Prelude EP (2000-010-S001-SS01-U01000-UA-5880-00002):

- 1g/m^2 floating oil thickness, which is considered to be below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface;
- 10g/m^2 for accumulated (shoreline) oil, which represents the area visibly contacted by the spill;
- 10 ppb for entrained hydrocarbons represents the lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in the ANZECC & ARMCANZ (2000) water quality guidelines; and
- 6ppb dissolved aromatic hydrocarbons represents the low exposure zone, although it is not considered to be of significant biological impact.

Monitoring priorities have been drawn from the protection priorities identified in the Prelude FLNG OPEP (HSE_PRE_013075). These priorities were identified through analysis of hydrocarbon spill modelling results against the location of key sensitive receptors with high conservation value, including habitat, species and important socio-economic/heritage values.

Detailed information on the spill risks and modelling analysis of scenarios is provided in the activity-specific EP and OPEP. The following tables provide a summary of the locations, key receptors and spill modelling results for the worst-case scenarios from the Prelude FLNG OPEP (HSE_PRE_013075). Table 2-1 presents the results for floating oil, including probability and time to contact at the low threshold, as described above. Table 2-2 presents the entrained oil results, understanding that 10ppb aligns with the lowest trigger levels also described above.

Using spill trajectory modelling to help prioritise resources to implement monitoring programs, (including the collection of baseline data) can be useful. For example, sensitive locations with a high probability of rapid contact with an oil spill should be the priority of a monitoring program, compared to similar locations with a lower probability and longer time for contact following a spill, where time may permit the collection of reactive (post-spill but pre-contact) baseline data.

Analysis of the Prelude FLNG oil spill modelling results indicates the probability of contact of floating oil with any receptor is low, with the highest probability of contact being 11.5% with Heywood Shoal (submerged receptor) for the vessel collision scenario (1,000 m^3 of HFO over 1 hour). The highest probability of entrained oil reaching a receptor is 96% with Heywood Shoal (submerged receptor) for the subsea well blowout scenario (254,400 m^3 over 80 days).

These results have been used to determine the priority monitoring locations and receptors within the ZPI. The priorities vary according to each spill scenario, although the vessel collision scenario (42,000 m^3 over 2 hours) typically presents the worst-case time to contact and probabilities for floating oil. Quickest time and highest probabilities for entrained oil are represented by the subsea well blowout scenario, however, the modelling results presented here are for the original estimated spill volume of ~3,180 m^3/day. This volume was revised down to ~1,611m^3/day following commencement of operations and further analysis of the wells. Therefore, the modelling results presented for this scenario are significantly conservative. As a result, planning for monitoring mobilisation throughout this plan is based on the vessel collision scenario (42,000 m^3 over 2 hours).

In addition to these locations, there are receptors that are transient (i.e. cetaceans, seabirds) and others that are broadscale, such as managed fisheries with large spatial extents. These receptors are described in detail in the activity-specific EP and OPEPs. Shell will work with its monitoring providers to include these receptors into its finalised monitoring design at the time of the spill to ensure current information on their location is used.

Table 2-1: Spill modelling results and monitoring priorities (Prelude FLNG) – Floating oil

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m³ Prelude Condensate[1])		Vessel collision (42,000m³ Prelude Condensate)		Vessel collision (1,000 m³ Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m²	Minimum time to contact (days) at ≥1.0 g/m²	Probability (%) of contact at ≥1.0 g/m²	Minimum time to contact (days) at ≥1.0 g/m²	Probability (%) of contact at ≥1.0 g/m²	Minimum time to contact (days) at ≥1.0 g/m²
Browse Island	40km SE	Marine turtles (Green turtle nesting and foraging), Coral Reefs, Ramsar wetland, Key Ecological Feature and Marine Park (IUCN Ia), intertidal and shoreline habitats	6	3.5	6.5	1.8	7	2
Cartier Island	134km N	Coral reefs, seabird breeding, foraging habitat for Whale Sharks, marine turtles (interesting and foraging), sea snakes, intertidal and shoreline habitats	2	9.5	5	4.5	5.5	8
Vulcan Shoal	146km NE	Coral reefs	2	21	2.5	6.3	6.5	3.5

[1] Modelling results for the original estimated spill volume of ~3,180 m³/day. This volume was revised down to ~1,611m³/day.

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate[1])		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
Echuca Shoal	61km ESE	Coral reefs	4	3	6.5	3.5	8.5	3
Heywood Shoal	81 km NE	Coral reefs	5	6	7.8	3	11.5	2.5
Seringapatam Reef, Scott Reef and Sandy Islet	131km W	Staging post for migratory shorebirds and a foraging area for seabirds, marine turtles (Green turtle nesting and foraging); and sea snakes, fish, coral reefs, Key Ecological Feature and Commonwealth Heritage Place	0.5	53	3	7.8	7.5	5.5
Ashmore Reef	162km NNE	Marine turtles (interesting and foraging), sea snakes, coral reefs, seabird rookery, dugong, Ramsar wetland; Marine Park (IUCN Ia) – including cultural heritage (Indonesian	3	8	5.8	5.5	8	7

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate[1])		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2	Probability (%) of contact at ≥1.0 g/m^2	Minimum time to contact (days) at ≥1.0 g/m^2
		artefacts); and Commonwealth Heritage Place, intertidal and shoreline habitats						
Buccaneer Archipelago	220km S	Mangroves, Marine reptiles (turtles and saltwater crocodile), fish (including Vulnerable Green Sawfish, Freshwater Sawfish), coral reefs, cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature)	0.5	NC	<0.25	NC	1.25	21
Indonesian Boundary	300km north	Mangroves, coral reefs	0.5	63	0.5	15	0.75	15

Table 2-2: Spill modelling results and monitoring priorities (Prelude FLNG) – Entrained oil

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate[2])		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
Browse Island	40km SE	Marine turtles (Green turtle nesting and foraging), Coral Reefs, Ramsar wetland, Key Ecological Feature and Marine Park (IUCN Ia), intertidal and shoreline habitats	94	0.5	45	1.7	<0.25	NC
Cartier Island	134km N	Coral reefs, seabird breeding, foraging habitat for Whale Sharks, marine turtles (interesting and foraging), sea snakes, intertidal and shoreline habitats	87	3.5	50	5	<0.25	NC
Vulcan Shoal		Coral reefs	86	3.5	40	4.5	<0.25	NC

[2] Modelling results for the original estimated spill volume of ~3,180 m^3/day. This volume was revised down to ~1,611m^3/day.

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate[2])		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
Echuca Shoal	61km ESE	Coral reefs	94	1.5	38	3.5	<0.25	NC
Heywood Shoal	81 km NE	Coral reefs	96	1.5	41	3.2	<0.25	NC
Seringapatam Reef, Scott Reef and Sandy Islet	131km W	Staging post for migratory shorebirds and a foraging area for seabirds, marine turtles (Green turtle nesting and foraging); and sea snakes, fish, coral reefs, Key Ecological Feature and Commonwealth Heritage Place	84	4.8	35	7	<0.25	NC
Ashmore Reef	162km NNE	Marine turtles (interesting and foraging), sea snakes, coral reefs, seabird rookery, dugong, Ramsar wetland; Marine Park (IUCN Ia) – including cultural	89	4.3	47	5.5	<0.25	NC

Location	Proximity to Prelude FLNG	Receptors	Subsea well blow out (254,400m^3 Prelude Condensate[2])		Vessel collision (42,000m^3 Prelude Condensate)		Vessel collision (1,000 m^3 Heavy Fuel Oil)	
			Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb	Probability (%) of entrained concentrations at ≥10 ppb	Minimum time (days) to receptor waters at ≥10ppb
		heritage (Indonesian artefacts); and Commonwealth Heritage Place, intertidal and shoreline habitats						
Buccaneer Archipelago	220km S	Mangroves, Marine reptiles (turtles and saltwater crocodile), fish (including Vulnerable Green Sawfish, Freshwater Sawfish), coral reefs, cultural heritage (Kimberley Marine Park and West Kimberley National Heritage Place, Key Ecological Feature)	21	21.5	1.25	23	<0.25	NC
Indonesian Boundary	300km north	Mangroves, coral reefs	43	15	11	15	<0.25	NC

3 Relevant Existing Baseline Information Sources

Shell has access to a number of different baseline data sources that are relevant to the high value receptors in the ZPI. These include:

Industry-Government Environmental Metadata System (I-GEMS)
The I-GEM Project is facilitated by the Australian Petroleum Production and Exploration Association (APPEA). The project is a collaborative approach between industry, marine research institutes and Western Australian government agencies to share metadata on quantitative ecological data for key receptors in the mid to north-west of WA (approximately from the Abrolhos Islands to the Timor Sea) and to represent these in a geospatial database.

The marine environmental metadata includes instant online access to a list of available data sets on key receptor sensitivities in the event of spill. Shell's login access information can be found in the Shell IMT Weekly Contact List (HSE_GEN_011648).

Australian Ocean Data Network
The Australian Oceans Data Network (AODN) is the primary access point for search, discovery, access and download of data collected by the Australian marine community. Data is presented as a regional view of all the data available from the Australian Ocean Data Network. Primary datasets are contributed to by Commonwealth Government agencies, State Government agencies, Universities, the Integrated Marine Observing System (IMOS) an Australian Government Research Infrastructure project, and the Western Australia Marine Science Institute (WAMSI).

Access is via the following link https://portal.aodn.org.au/search

Western Australian Oil Spill Response Atlas
The Western Australian Oil Spill Response Atlas (OSRA) is a spatial database of environmental, logistical and oil spill response data. Using a geographical information system (GIS) platform, OSRA displays datasets collated from a range of custodians allowing decision makers to visualise environmental sensitivities and response considerations in a selected location. Oil spill trajectory modelling (OSTM) can be overlaid to assist in determining protection priorities, establishing suitable response strategies and identifying available resources for both contingency and incident planning. OSRA is managed by the Oil Spill Response Coordination unit within Department of Transport (DoT) Marine Safety and is part funded through the National Plan for Maritime Environmental Emergencies and the Australian Maritime Safety Authority.

Access is via the following link https://www.transport.wa.gov.au/imarine/oil-spill-response-and-planning-tools.asp

The Atlas of Living Australia

The Atlas of Living Australia (ALA) is a collaborative, online, open resource that contains information on all the known species in Australia aggregated from a wide range of data providers. It provides a searchable database when considering species within the ZPI. The ALA receives support from the Australian Government through the National Collaborative Research Infrastructure Strategy (NCRIS) and is hosted by the Commonwealth Scientific and Industrial Research Organisation (CSIRO).

Access is via the following link https://www.ala.org.au/

The ZPI is also covered by the following government management plans that identify the current condition of key receptors being managed for protection:

- Rowley Shoals Marine Park Management Plan (2007) 2007-2017, Management Plan No. 56. DEC, Perth, WA
- Department of Parks and Wildlife (2014) Eighty Mile Beach Marine Park Management Plan 2014-2024, Management Plan No. 80, DPaW, Perth, WA
- Department of Parks and Wildlife (2016) North Kimberley Marine Park Joint management plan 2016. Uunguu, Balanggarra, Miriuwung Gajerrong, and Wilinggin management areas, No. 89. DPaW, Perth, WA
- Department of Parks and Wildlife (2013) Lalang-garram / Camden Sound Marine Park management plan No. 73 2013–2023, DPaW, Perth, WA

Species recovery plans for various protected species and ecological communities can be found in this link - http://www.environment.gov.au/cgi-bin/sprat/public/publicshowallrps.pl

In addition to these data sources, Shell has compiled a list of baseline data sources relevant to the high value receptors in the ZPI. These are provided in Appendix B: Baseline data sources.

4 Relevant OMPs and SMPs

Table 4-1 lists the Joint Industry OMPs and SMPs which are relevant to the receptors found in Shell's ZPI, aligning to those listed in Section 2. In addition, the OMPs are relevant to the response options listed in the Prelude FLNG OPEP, as outlined in Table 4-2.

These OMPs and SMPs will be activated when the individual initiation criteria (Appendix A) in each plan are met. The objectives for OMPs and SMPs can be found in the Joint Industry OSMP Framework and individual OMPs and SMPs. Detail on monitoring design considerations, survey techniques, standard operating procedures, equipment and personnel requirements, reporting and QA/QC can be found in the individual OMPs and SMPs.

Table 4-1: OMPs and SMPs relevant to receptors in Shell's ZPI

Receptor	Relevant OMP and SMP
Physical Environment	
Water quality	OMP: Oil properties and weathering behaviour at sea OMP: Water quality assessment OMP: Sediment quality assessment OMP: Chemical dispersant effectiveness and fate (surface and subsurface) SMP: Water quality impact assessment
Sediment quality	OMP: Water quality assessment OMP: Sediment quality assessment SMP: Sediment quality impact assessment
Biological Environment	
Benthic communities	
Benthic habitats	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Benthic habitat assessment
Corals, seagrass and macroalgae	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Mangroves	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Infauna, filter feeders and other sessile and mobile benthic invertebrates	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Intertidal and coastal habitat assessment SMP: Benthic habitat assessment
Marine habitats	
Shoreline and intertidal habitats	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique SMP: Intertidal and coastal habitat assessment
Marine fauna	
Seabirds and shorebirds	OMP: Pre-emptive assessment of sensitive receptors at risk OMP: Shoreline clean-up assessment technique OMP: Marine fauna assessment SMP: Seabirds and shorebirds
Marine megafauna	OMP: Pre-emptive assessment of sensitive receptors at risk

Receptor	Relevant OMP and SMP
	OMP: Shoreline clean-up assessment technique OMP: Marine fauna assessment SMP: Marine mega-fauna SMP: Fish impact assessment
Socio Economic Environment	
Commercial Fisheries and Aquaculture	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment
Recreational Fisheries	OMP: Pre-emptive assessment of sensitive receptors at risk SMP: Water quality impact assessment SMP: Commercial and recreational fisheries impact assessment

Table 4-2: OMPs relevant to Shell's oil spill response options

Response Option	Operational Monitoring Plan							
	A	B	C	D	E	F	G	H
Source Control	X				X	X		X
Natural Recovery	X				X			
Surface Dispersant Application	X	X		X	X	X	X	X
Containment and Recovery	X						X	X
Shoreline Protection	X	X	X		X	X	X	X
Shoreline Clean-up	X	X	X		X	X	X	X
Oiled Wildlife Response	X	X	X				X	X
Waste Management	X	X	X			X	X	X

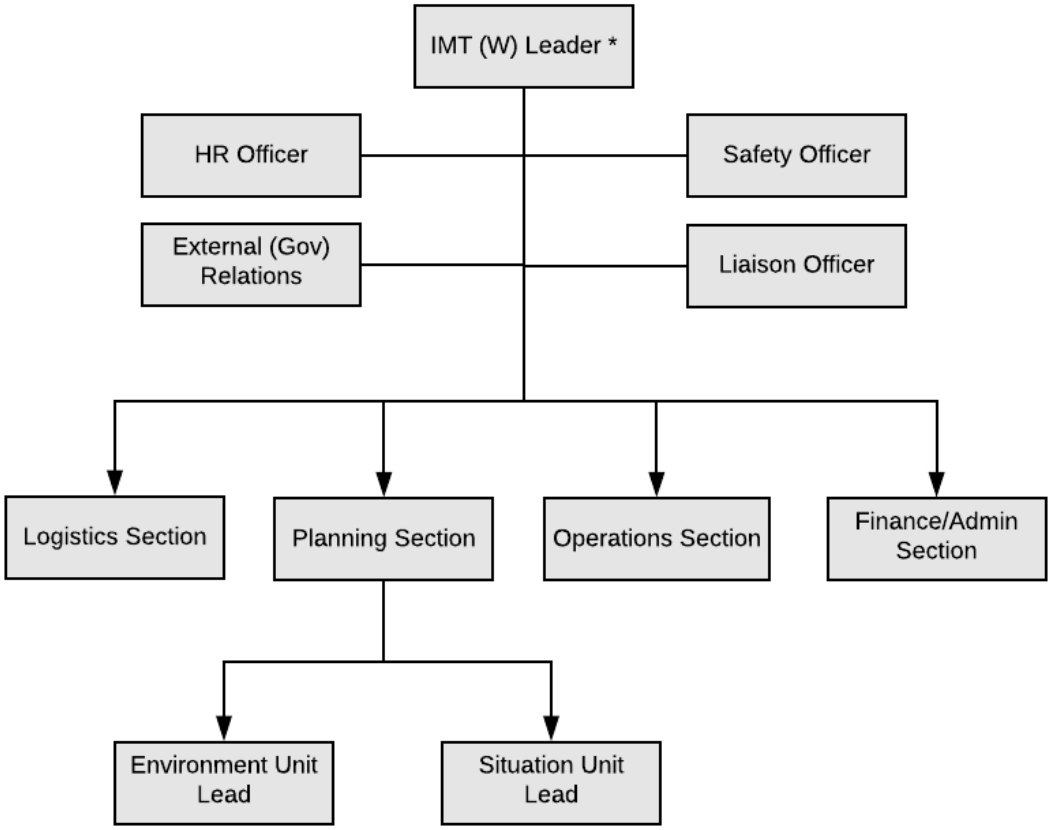
A. Hydrocarbon properties and weathering behaviour at sea
B. Pre-emptive assessment of sensitive receptors at risk (desktop only)
C. Shoreline clean-up assessment technique (SCAT)
D. Surface chemical dispersant effectiveness and fate
E. Water quality assessment
F. Sediment quality assessment
G. Marine fauna assessment
- *Reptiles*
- *Cetaceans (observational only)*
- *Dugongs*
- *Seabirds and shorebirds*
- *Fish*

H. Air quality monitoring (responder health and safety)

5 OSMP Organisational Structure

Shell uses the Incident Command System (ICS) to respond to incidents and therefore adopts the key roles and responsibilities used in this system, as described in the activity EPs and/or OPEPs. The Shell Australia Incident Management Team West (IMT (W)) will be responsible for coordinating OSMP activities, which will be led by the Planning Section within the IMT, with support from each Section, in particular the Operations Section. The Shell IMT (W) structure is shown in Figure 5-1. Where the Western Australian Department of Transport is the Control Agency, the IMT (W) will be managed through coordinated command and Shell will still be expected to continue monitoring activities in State waters, with oversight from DoT.

Figure 5-2 illustrates the structure of the OSMP Management Team during the response phase. The IMT (W) Leader is ultimately accountable for managing the response operation, which includes this plan. Depending on the scale of the event, individual people may perform multiple roles; similarly, multiple people may share the same role.



* In Level 2 and 3 spills where DoT is activated as the Control Agency for State waters response, the IMT (W) will be managed through coordinated command (DoT is Control Agency in State waters, Shell is Control Agency in Commonwealth waters)

Figure 5-1: Shell IMT (W) Structure

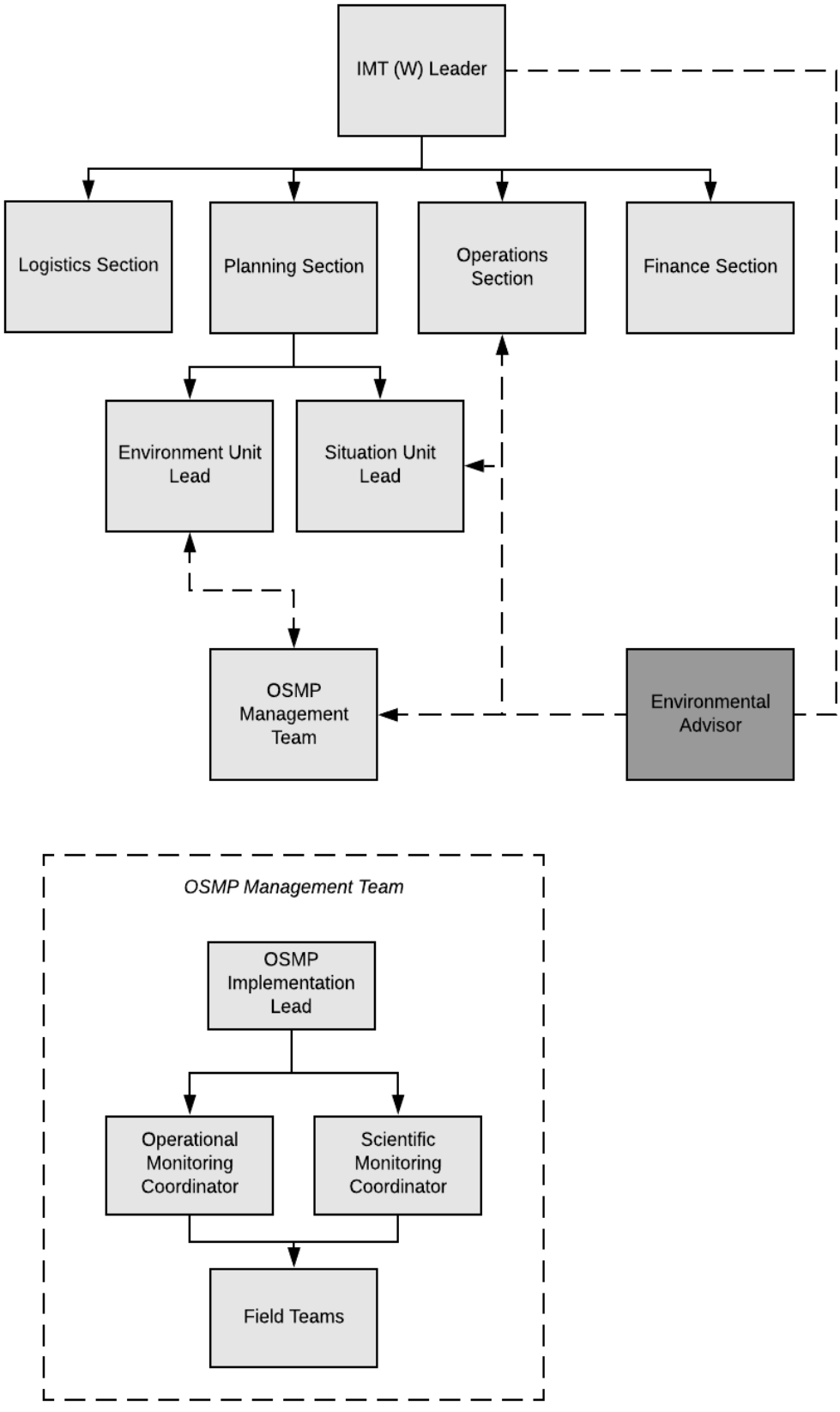


Figure 5-2: Shell IMT (W) Structure with OSMP Team

6 OSMP Roles and Responsibilities

The roles and responsibilities related to the management and implementation of operational and scientific monitoring for Shell's activities are outlined in Table 6-1. It should be noted that some of these roles will be filled internally, but the majority of OSMP personnel will be provided by Shell's OSMP Services Provider, BMT Australia Pty Ltd (BMT). The process to activate BMT is provided in Section 11.

Roles and responsibilities for other IMT positions (e.g. Planning Section Chief) are described in the activity-specific EP or OPEP.

Table 6-1: Roles and Responsibilities – Shell OSMP

Role	Key Responsibilities
IMT (W) Leader (Shell)	Ultimately accountable for the implementation of the OSMP. Specific responsibilities related to the OSMP include: • Ensure OSMP-specific roles are established • Integrate operational and scientific monitoring with the spill response • Ensure that OMP and SMP components are implemented according to their specific initiation criteria and within nominated response times • Ensure that the OSMP Implementation Lead and Environment Unit Lead are sufficiently resourced to oversee and guide implementation of OSMP activities
Environment Unit Lead (EUL) (Shell)	The EUL is the key position for relaying information between the IMT/EMT and the OSMP Implementation Lead. Key OSMP responsibilities include: • Mobilise OSMP Service Provider • Validate protection and monitoring priorities • Validate strategic SIMA to generate the initial operational SIMA • Main point of contact between IMT and OSMP Service Provider • Provide overarching technical advice • Analysing data received from monitoring teams (this task may be delegated to OSMP Management Team) and ensuring the information is incorporated into the current/next operating period's Incident Action Plan • Advise on environmental impact from implementing monitoring • Management of scientific monitoring components once spill response operation is terminated
Situation Unit Lead (SUL) (Shell)	The SUL is the key position for receiving data from monitoring teams and disseminating it to the relevant team within the IMT.
OSMP Implementation Lead (Shell or OSMP Monitoring Provider/s)	Responsible for overseeing implementation of OMP and SMP components in accordance with this Plan, specifically identify: • The relevant OMP and SMP components that may be triggered based on the information collected during the initial response and OMP monitoring • Implementation of response options to ensure that the relevant OMP and SMP components are implemented at the appropriate times • Liaise with Shell Environment Advisor for advice on scientific monitoring components

Role	Key Responsibilities
	• Approve sampling and analysis plans for the SMP components within the nominated time frame of the SMP component being triggered • Ensure mobilisation of resources for sampling and analysis plans within the nominated time frame of the SMP component being triggered • Liaise with relevant stakeholders and regulators on monitoring design, monitoring priorities, and results
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (OSMP Service Provider/s)	The Operational Monitoring Coordinator and Scientific Monitoring Coordinator are the technical leads for each monitoring type. Responsibilities include: • Finalise monitoring design for individual OMPs and/or SMPs • Understand the data metrics collected in the event of a spill • Advise the OSMP Implementation Lead on data collection, logistical support required, and monitoring priorities if constraints (e.g. safety, time, logistics) are encountered • Oversee data analyses and interpretation • Manage data, including spatial data • Present data in an appropriate and informative format to allow for timely decisions
OSMP Field Operations Manager (OSMP Service Provider/s)	Responsible of the coordination of resources and developing a schedule of movements, in close consultation with the IMT/EMT Logistics Section. Key responsibilities include: • Determine locations where monitoring teams are required and resource requirements for specific locations • Keep track of vessel/aerial movements associated with monitoring activities • Monitor resource availability • Direct communications with relevant Monitoring Coordinator and Field Team Leads • Monitor and coordinate simultaneous operations
OSMP Field Teams (OSMP Service Provider/s)	A Field Team includes one Field Team Lead, who is the key contact point to the relevant Monitoring Coordinator during a field deployment. The responsibilities of all Field Team members include: • Understand the details of monitoring methods • Ensure that they are supplied with adequate equipment and field data collection sheets to undertake the monitoring component • Ensure awareness and understanding of QA/QC procedures • Help with report preparation if required
Environment Advisor (Shell)	Oversight of scientific monitoring components both during and post-response

7 Mobilisation and timing of OMP and SMP implementation

The time it takes to mobilise and implement each OMP and SMP will vary according to the spill risk profile, proximity of the spill to sensitive receptors, mobilisation constraints and logistical requirements. Table 7-1 provides an indicative implementation schedule for OMP and SMPs in the ZPI and adjacent waters. The locations listed are aligned to the initial monitoring priorities described in Section 2.

Note: 'Initiation' means that the monitoring plan has been triggered and the IMT/Monitoring Provider has commenced finalisation of plan including implementation of the following actions (which may take 48-72 hours to complete all actions):

- Activate internal OSMP personnel and external contracts
- Select/confirm sites
- Finalise sampling technique
- Determine suitable sampling frequency
- Finalise standard operating procedures
- Allocate number of teams, personnel, equipment and supporting resource requirements
- Finalise HES documentation prior to mobilisation of field teams
- Confirm logistics (e.g. flights, accommodation, vessels)
- Commence deployment of Field Teams

For SMPs:

- Gather existing baseline data and/or establish control/reference sites
- Establish benchmarks and guidelines to be used
- Confirm indicator species
- Confirm parameters and metrics

Table 7-1: Indicative OMP and SMP implementation schedule for Shell OSMP activities

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks

Spill site and immediate surrounding waters	OM	Initiation of:
		• OMP: Air quality modelling (responder health and safety)
		• OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)
			Initiation of:
			• OMP: Oil properties and weathering behaviour at sea
			• OMP: Water quality assessment
			• OMP: Sediment Quality Assessment
			• OMP: Surface chemical dispersant effectiveness and fate (surface and subsurface)
			• OMP: Marine fauna assessment
			  ○ Seabirds and shorebirds
			  ○ Fish
				As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Seabirds and shorebirds	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Marine fish assemblages' assessment		
Browse Island	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment ○ Reptiles ○ Seabirds and shorebirds ○ Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment		

Cartier Island	OM	Initiation of:
		• OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)
			Initiation of:
			• OMP: Oil properties and weathering behaviour at sea
			• OMP: Water quality assessment
			• OMP: Sediment quality assessment
			• Shoreline clean-up assessment technique (SCAT)
			• Marine fauna assessment
			  ○ Reptiles
			  ○ Dugongs
			  ○ Seabirds and shorebirds
			  ○ Fish
				As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
Echuca and Heywood Shoal	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Marine fauna assessment	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			○ Fish	specifics of the actual spill until termination criteria are met	specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine fish assemblages assessment • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
Seringapatam Reef, Scott Reef and Sandy Islet	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Marine fauna assessment ○ Reptiles ○ Seabirds and shorebirds ○ Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine fish assemblages assessment • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
Ashmore Reef	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment • OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment ○ Reptiles	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			○ Dugongs ○ Seabirds and shorebirds • Fish		
	SM	Commence activation and mobilisation process Activation of SMP Team Leads	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met
Buccaneer Archipelago	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and	Initiation of: • OMP: Oil properties and weathering behaviour at sea	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
		at risk (desktop only)	used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	• OMP: Water quality assessment • OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment ○ Reptiles ○ Dugongs ○ Seabirds and shorebirds ○ Fish	used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	Commence activation and mobilisation process Activation of SMP Team Leads and finalisation of SMPs	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment • SMP: Marine mega-fauna assessment - reptiles • SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds	Continue SMP monitoring until termination criteria are met	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
			• SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment		
Indonesian Boundary	OM	Initiation of: • OMP: Pre-emptive assessment of sensitive receptors at risk (desktop only)	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met	Initiation of: • OMP: Oil properties and weathering behaviour at sea • OMP: Water quality assessment • OMP: Sediment quality assessment OMP: Shoreline clean-up assessment technique (SCAT) • OMP: Marine fauna assessment ○ Reptiles ○ Dugongs ○ Seabirds and shorebirds ○ Fish	As results from implemented OMPs are available, data is provided to relevant personnel in IMT (Situation Unit Lead) and used in the Incident Action Planning process for the next operational period. OMP is redesigned or reallocated according to the specifics of the actual spill until termination criteria are met
	SM	n/a	Commence activation and mobilisation process Activation of SMP Team Leads and finalisation of SMPs	Initiation of: • SMP: Water quality impact assessment • SMP: Sediment quality impact assessment	Continue SMP monitoring until termination criteria are met

Location	Monitoring Type	0-48 hours	2-4 days	5-10 days	2 weeks
				• SMP: Marine mega-fauna assessment - reptiles • SMP: Marine fish assemblages assessment • SMP: Intertidal and coastal habitat assessment • SMP: Seabirds and shorebirds • SMP: Benthic habitat assessment • SMP: Commercial and recreational fisheries impact assessment	

8 Resource Requirements

The resources required to implement operational monitoring components are presented in Table 8-1, which is based on the monitoring priorities in Section 2 and implementation schedule outlined in Table 7-1. This assessment is based on the vessel collision scenario (FLNG storage tank) of Prelude Condensate (42,000 m^3 over 2 hours). It should be noted that a single spill will not contact all locations and receptors listed in Table 8-1. In preparing for this capability, Shell has conservatively assessed its resource requirements to ensure it can obtain excess capability.

Table 8-1: Resources required for implementing operational monitoring programs weeks 1-3

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
Hydrocarbon properties and weathering behaviour at sea)*	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) *Total 4 team leaders and 8 team members (3 per team)*	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) *Total 5 team leaders and 10 team members (3 per team)*	1 team (spill site and surrounds) 1 team (Browse Island) 1 team (Cartier Island and Ashmore Reef) 1 team (Echuca Shoal & Heywood Shoal) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) 1 teams (Indonesian Boundary) *Total 7 team leaders and 14 team members (3 per team)*	BMT Australia Pty Ltd (BMT) Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Pre-emptive assessment of sensitive receptors at risk (desktop only)	1 team (all sites)	1 team (all sites)	1 team (all sites)	BMT Contract BMT Contract (includes provision of equipment)

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
Shoreline clean-up assessment technique (SCAT)	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef) *Total 3 team leaders and 6 team members (3 per team)*	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef) 2 teams (Indonesian Boundary) *Total 5 team leaders and 10 team members (3 per team)*	1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef) 3 teams (Indonesian Boundary) 1 team (Buccaneer Archipelago) *Total 7 team leaders and 14 team members (3 per team)*	BMT Contract (includes provision of sampling equipment) AMOSC (AMOSPlan) OSRL Master Services Agreement DoT and AMSA Marine contractors
Surface chemical dispersant effectiveness and fate	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (spill site and surrounds)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (spill site and surrounds) Additional team/s (various locations as required)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (spill site and surrounds) Additional team/s (various locations as required)	BMT Contract (includes provision of sampling equipment) Marine contractors
Water quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites) Additional teams, if required (dependent upon any modifications to sampling locations, frequency etc.)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement
Sediment quality assessment*	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	Refer to OMP: Hydrocarbon properties and weathering behaviour at sea resourcing* (all sites)	BMT Contract (includes provision of sampling equipment) Marine contractors Laboratory arrangement

OMP	Week 1 (total)	Week 2 (total)	Week 3 (total) onwards	Arrangement
			Additional teams, if required (dependent upon any modifications to sampling locations, frequency etc.)	
Marine fauna assessment	1 team to conduct initial aerial surveys for spill site, Browse Island, Ashmore Reef, Cartier Island, Echuca Shoal and Heywood Shoal (2 observers per aircraft)	<u>If vessel based surveys selected:</u> 1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef) 1 team (Echuca and Heywood Shoal) 2 teams (Indonesian Boundary) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) *Total 7 team leaders and 7 team members (2 per team)*	<u>If vessel based surveys selected:</u> 1 team (Browse Island) 1 team (Cartier Island) 1 team (Ashmore Reef) 1 team (Echuca and Heywood Shoal) 2 teams (Indonesian Boundary) 1 team (Seringapatam Reef, Scott Reef, Sandy Islet) 1 team (Buccaneer Archipelago) *Total 8 team leaders and 8 team members (2 per team)*	BMT Contract Aviation contractors Marine contractors
Air quality modelling (responder health and safety)	1 team (all sites)	1 team (all sites)	1 team (all sites)	Shell in-house personnel

* Initial co-mobilisation between OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate, OMP: Water quality assessment and OMP: Sediment quality assessment

8.1.1 Hydrocarbon properties and weathering behaviour at sea

Teams shall consist of one team lead and two team members. Initially teams may also conduct sampling for OMP: Surface chemical dispersant effectiveness and fate, OMP: Water quality assessment and OMP: Sediment quality assessment. This arrangement would rely upon suitable transportation arrangements for samples so that the sampling vessels can remain in-field.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.2 Pre-emptive assessment of sensitive receptors at risk (desktop only)

Teams shall consist of one to two personnel, who may also be able to fulfil other desktop based assessments or analysis. This monitoring component will rely upon GIS specialist personnel (from existing Shell Geomatics Team) to input data into relevant software.

8.1.3 Shoreline clean-up assessment technique (SCAT)

SCAT shall consist of 3 members per team, including one team lead, which should to be able to cover 8-10 km per day. This distance may be more, especially if UAVs are employed to cover shorelines that have access limitations. Shell has used the modelling data in Section 2 to plan worst case shoreline and habitat assessment personnel requirements. Team leaders will be sourced from BMT and supported by personnel from AMOSC and OSRL and will be trained in shoreline assessment techniques. Team members can include personnel who have completed basic training prior to mobilisation.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.4 Surface chemical dispersant effectiveness and fate

Initially, this monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Water quality assessment and OMP: Sediment quality assessment.

Depending upon the nature and scale of the spill, and as resources are scaled, a dedicated sampling team may be deployed. Sampling teams shall consist of 2 to 3 personnel trained in the observation and verification of chemical dispersant effectiveness. It is difficult to quantify the number of teams that would be required to implement this monitoring program, although one team could assess multiple locations. A suitable sampling vessel would be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.5 Water quality assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate and OMP: Sediment quality assessment. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.6 Sediment quality assessment

Initially, this monitoring component may be conducted by the same team undertaking OMP: Hydrocarbon properties and weathering behaviour at sea, OMP: Surface chemical dispersant effectiveness and fate and OMP: Water quality assessment. Depending upon the nature and scale of the spill, a dedicated sampling team may be deployed for this monitoring component.

Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.7 Marine fauna assessment

Initially, monitoring for all relevant marine fauna groups may be conducted via aerial surveys. Depending on the nature and scale of the spill, this could be conducted by the same platform conducting aerial surveillance of the slick. However, trained marine fauna aerial observers would be required to undertake the assessment, which may mean additional personnel on each aircraft (unless personnel with a dual skill set in marine fauna aerial observation and aerial spill surveillance are available).

Aerial surveys provide a rapid and resource efficient method of collecting marine fauna assessment data, however, they do not enable the collection of detailed observations. If aerial surveys require validation then this may be performed via vessel based surveys and/or SCAT teams.

Aircraft will be sourced via Shell's existing aviation contracts. Vessels and remote accommodation may be required to implement this monitoring component. These will be sourced from existing contracts Shell has with marine contractors (Refer to Appendix B: Oil Spill Resource Directory in Shell FLNG OPEP HSE_PRE_013075).

8.1.8 Air quality modelling (responder health and safety)

Teams shall consist of one to two personnel, who may also be able to fulfil other desktop based assessments or analysis. This monitoring component will rely upon Shell in-house air quality specialists.

9 Capability Arrangements

Shell has contracted BMT to provide standby OSMP response and implementation services, which includes lead contract, logistics and reporting. BMT will be supported by Astron Environmental Services (Astron) and Curtin University of Technology. Details of OSMP services are provided in Table 9-1. Shell will maintain responsibility for implementing OMP: Air quality modelling (responder health and safety).

Table 9-1: BMT OSMP Standby and Implementation Services

Standby	Implementation
24/7 monitoring support accessed through 24 hr call out number	Provision of an OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT within 12 hours of notification
Provision of a suitably trained personnel, which includes support from Astron and Curtin University of Technology	Provision of a first-strike scientific team within 24 hours of notification, available in Perth and ready to deploy
Monthly reports on personnel and equipment availability	Development of scientific response and sampling plans (based on modelled hydrocarbon spill scenario)
Access to BMT's global network of scientific and engineering consulting expertise	Provision of a second-strike scientific team within 72 hours of notification, available in Perth and ready to deploy
Access to BMT's local network of terrestrial consultants, laboratories and field service providers	Priority access to BMT staff and equipment

9.1 Personnel competencies

Table 9-2 outlines the required competencies of key OSMP roles for Shell and its OSMP service providers. Shell will, where practicable, engage its most qualified local environmental advisors in the initial stages of the monitoring program to help activate and mobilise monitoring teams and work with BMT to finalise monitoring designs. Personnel selected for contracted OSMP standby services are competent personnel with considerable (10-20 years each) experience in various monitoring roles.

Availability of personnel will be listed on the BMT monthly report. Personnel listed on the monthly update will be contactable via mobile phone during this period and accessible to Perth airport or another suitable port within 48 hours of Shell's initial activation of OSMP Services.

Table 9-2: Key OSMP roles and competencies

Role	Competencies
OSMP Implementation Lead (Shell or BMT)	• Bachelor's degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200. • Participation in one incident management exercise every two years • Operational and Scientific Monitoring Plan Awareness Training
Operational Monitoring Coordinator and Scientific Monitoring Coordinator (BMT)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • PMAOMIR320 – Manage Incident Response Information or ICS 100 and ICS 200. • Participation in one incident management exercise per year • Operational and Scientific Monitoring Plan Awareness Training
OSMP Field Operations Manager (BMT)	• Bachelor degree in environmental management/science from a recognised institution or equivalent tertiary study in technical area • >5 years' experience in relevant scientific field
OSMP Field Teams (BMT)	• Refer to OMPs and SMPs

9.2 Equipment

Equipment requirements are listed in the individual OMPs and SMPs. A generalised breakdown of equipment types and the source is listed in Table 9-3. In accordance with the OSMP services contract, BMT will provide all specialised field monitoring equipment to implement individual OMPs and SMPs. Shell will remain responsible for support and field logistics, including monitoring platforms (e.g. vessels, vehicles and aircraft), flights and accommodation for personnel and transportation/couriers for samples to be sent back to laboratories.

Availability of equipment will be listed on the BMT monthly report.

Table 9-3: OSMP Equipment

Equipment type	Source
Desktop equipment (e.g. Oil Spill Response Atlas, GIS)	Coordinated through IMT (W) Geomatics Team
In-field specialised monitoring equipment (e.g. fluorometers, sample bottles, ROVs)	Coordinated through BMT's standby OSMP response and implementation services
Logistical equipment (e.g. in-field accommodation)	Refer to Appendix B: Oil Spill Resource Directory – Prelude FLNG OPEP HSE_PRE_013075

9.3 Exercises

Shell conducts annual incident management exercises to test oil spill response preparedness and arrangements. These exercises are scheduled in the Annual Exercise Plan and include a number of exercise types, as outlined in Table 9-4.

Table 9-4: Exercise Types

Exercise Type	Description
Notification drill	Test procedures to notify and activate the IMT, oil spill response organisations, third party providers (including OSMP contractors) and regulators
Desktop drill	Normally involves interactive desktop discussions of a simulated scenario. OSMP desktop drills may involve the following focus areas: • Test the time required to finalise monitoring design; • Test arrangements for delivery and use of data by IMT in decision making; or • Data exchange test with field (opportunistic when contractors in in the field)
Incident Management Exercise	Involves IMT activation to establish command, control, and coordination of a Level 2 or 3 incident. Can simulate several different aspects of an oil spill incident and may involve third parties. OSMP activation may be included as component of this exercise.

The purpose of this testing is to confirm that the response arrangements and capability in place is available when needed and function as intended. As part of the exercise process, Shell prepares a number of documents to ensure drills and exercises are well planned, conducted and evaluated. To support this, the following documents are used for level 2-3 exercises:

- Exercise Scope Document – provides background context to the exercise, outlines the exercise need, aim, objectives, details of the scenario, participating groups and agencies, exercise deliverables and management structure. This document can be used to engage a third-party contractor to assist in conducting the exercise
- Exercise plan and instructions – provide instructions and 'play' (including any injects) for conducting the exercise
- Post exercise report – includes an after-action review of the exercise, evaluating how the exercise performed against meeting its aim and objectives.

Shell routinely undertakes post-exercise debriefings following Level 2-3 exercises and drills to identify opportunities for improvement and communicate lessons learned. Actions that are derived from drills and exercises including debriefs are documented in an action tracking system.

10 Review of Plan

This document shall be reviewed, updated and submitted to regulators every 5 years from date of acceptance.

Part B – Implementation

11 Activation process

Shell's IMT Environment Unit Leader is responsible for activating OSMP components, subject to approval from the IMT (W) Leader. Table 11-1 outlines Shell's OSMP activation process.

Table 11-1: Shell OSMP Activation Process

Responsibility	Task	Timeframe	Complete
Environment Unit Leader (Shell)	Obtain approval from IMT (W) Leader to initiate OSMP	Within 4 hours of spill notification	❑
	Contact BMT and notify on-call officer of incident, requesting provision of OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT	Within 4 hours of spill notification	❑
	Provide monitor and evaluate data (e.g. spill trajectory modelling, aerial surveillance, fate and weathering modelling, tracking buoy data) to BMT	Within 1 hour of data being received by IMT	❑
	Liaise directly with BMT to determine which OMPs and SMPs are to be initiated	Within 3 hours of monitor and evaluate data being received from IMT	❑
	Assist BMT in determining monitoring locations for activated OMPs and SMPs	Within 4 hours of monitor and evaluate data being received from IMT	❑
	Provide purchase order to BMT (cross reference OSMP Standby Services Scope of Work)	Within 72 hours of initial notification to BMT	❑
	Record tasks in Personal Log.	At time of completion of task	❑
BMT	On-call officer to notify Manager of activation and contact OSMP Implementation Lead and Scientific Logistics Coordinator	Within 8 hours of notification being made to BMT	❑
	Send OSMP Implementation Lead and Scientific Logistics Coordinator to the Shell IMT	Within 12 hours of notification being made to BMT	❑
	Liaise directly with EUL to determine which OMPs and SMPs are to be initiated	Within 4 hours of monitor and evaluate data being received from IMT	❑
	Confirm availability of initial personnel and equipment resources	Within 5 hours of monitor and evaluate data being received from IMT	❑

12 Monitoring priorities

As described in Section 2, Shell has analysed the available spill trajectory modelling to understand the likely initial monitoring priorities for its activities in the ZPI. Table 12-1 provides a checklist to assist in the confirmation of monitoring priorities for individual spills.

Table 12-1: Checklist for determining monitoring priorities

Responsibility	Task	Timeframe	Complete
BMT with input from Environment Unit Leader (Shell)	Confirm monitoring locations for activated OMPs and SMPs based on: • Current monitor and evaluate data (including post-spill trajectory modelling and predicted time to receptor impact); • Seasonality and presence of receptors impacted or at risk of being impacted; • Current information on transient and broadscale receptors; • Current operational considerations (e.g. weather, logistics); and • Existing literature, baseline data, and monitoring programs.	Within 4 hours of monitor and evaluate data being received from IMT	❑
	Confirm if reactive baseline monitoring data is required for SMPs and determine suitable locations, noting that suitable control or reference sites may be outside of the ZPI	Within 12 hours of monitor and evaluate data being received from IMT	❑
	Continually re-evaluate monitoring priorities in consultation with Shell EUL throughout spill response (and with Shell Environment Advisor post-response)	Ongoing	❑

13 Finalising Monitoring Design

The methods presented in the Joint Industry OMPs and SMPs are designed to allow Monitoring Providers with the flexibility to modify the standard operating procedures, so that the latest research, technologies, equipment, sampling methods and variables may be used. Monitoring designs may also be varied in-situ, according to the factors presented in Section 10.6 of the Joint Industry OSMP Framework.

Shell's checklist for finalising monitoring designs post-spill is provided in

Table 13-1. The BMT OSMP Implementation Lead will be responsible for approving the finalised monitoring design used in the OMPs and SMPs.

Table 13-1: Checklist for finalising monitoring design

Responsibility	Task	Timeframe	Complete
BMT	Confirm survey objectives, sampling technique, for each initiated OMP and SMP		❑
	Determine suitable sampling frequency		❑
	Finalise standard operating procedures		❑
	Scientific monitoring: • Establish benchmarks and guidelines to be used • Confirm indicator species • Confirm parameters and metrics		❑

14 Mobilisation

When the monitoring design has been finalised for each OMP and SMP, the BMT Scientific Logistics Coordinator should work in conjunction with the Shell IMT Planning and Logistics Section to develop and execute a monitoring mobilisation plan, which should be incorporated into the Incident Action Planning process.

BMT will be required to coordinate the availability of personnel and equipment for all monitoring programs (with the exception of OMP: Air Quality Modelling). Shell will be responsible for flights, accommodation and victualing for field personnel. Shell will also be required to procure all vessels, aerial platforms and vehicles for OMP and SMP implementation.

Shell's checklist for mobilising monitoring teams is provided in Table 14-1.

Note: OMP: Pre-emptive assessment of sensitive receptors at risk and OMP: Air quality modelling are desk top assessments and should be mobilised as soon as practicable as they are not reliant on any mobilisation of field personnel.

Table 14-1: Checklist for mobilisation of monitoring teams

Responsibility	Task	Complete
BMT with input from Environment Unit Leader (Shell)	Confirm availability of all monitoring personnel (noting required competencies in OMPs/SMPs)	❑
	Allocate number of teams, personnel, equipment and supporting resource requirements	❑
	Undertake HAZIDs as required and consolidate/review field documentation including safety plans, emergency response plans, and daily field reports	❑
	Develop site-specific health and safety plans which is compliant with Shell health safety and environment systems (including call in timing and procedures)	❑

Responsibility	Task	Complete
	Conduct pre-mobilisation meeting with monitoring team/s on survey objectives, logistics, safety issues, reporting requirements and data management	❑
	Logistics	❑
	Confirm flights, accommodation, and car hire arrangements are in place	❑
	Develop field survey schedules, detailing staff rotation	❑
	Equipment	❑
	Arrange survey platform (vessel, vehicle, aircraft) as required to survey or access survey sites and ensure they are equipped with appropriate fridge and freezer space for transportation of samples (and carcasses if collecting)	❑
	Ensure vessels have correct fit-out specifications (e.g. winches, GPS, satellite, hiab, sufficient deck space, water supplies (fresh and/or salt), accommodation)	❑
	Confirm consumables (including personal protective equipment) have been purchased and will be delivered to required location	❑
	Liaise with NATA-accredited laboratories to confirm availability, limits of detection, sampling holding times, transportation, obtain sample analysis quotes and arrange provision of appropriate sample containers, Chain of Custody (CoC) forms and suitable storage options for all samples. Make arrangements for couriers (if necessary)	❑
	Confirm specialist equipment requirements and availability (including redundancy)	❑
	Check GPS units and digital cameras are working and that sufficient spare batteries and memory cards are available	❑
	Confirm sufficient equipment to allow integration of survey software and navigational systems (e.g. GPS, additional equipment and adaptors), and additional GPS units prepared	❑
	Confirm GPS survey positions (where available) have been QA/QC checked and pre-loaded into navigation software/positioning system	❑
	Check field laptops, ensuring they have batteries, power cable, and are functional	❑
	Check if a first aid kit or specialist PPE is required	❑
	Confirm arrangements for freight to mobilisation port is in place	❑

15 Permits and access requirements

Permit and access requirements apply to Marine Parks, Marine Protected Areas, restricted heritage areas, operational areas of industrial sites, defence locations and managed fisheries. Table 15-1 lists relevant protected areas within the ZPI and the jurisdictional authority to be contacted to obtain the necessary permit or access permission.

BMT are responsible for submitting access and permit applications to all relevant Jurisdictional Authorities to conduct monitoring for OMPs and SMPs.

Table 15-1: Permits required in ZPI

Receptor	Location	Jurisdictional Authority
State/Territory Marine Protected Areas; Fish Habitat Protection Areas	• Lalang-garram / Camden Sound • North Kimberley • Rowley Shoals • Eighty Mile Beach • Montebello Islands • Barrow Island • Muiron Islands • Ningaloo • Shark Bay	State/Territory government department with jurisdiction for parks and wildlife State/Territory government department with jurisdiction for fisheries
Ramsar wetland	• Browse Island • Ashmore Reef Marine Park • Cobourg Peninsula Ramsar site • Dales Ramsar site • Hosnies Spring Ramsar site	Commonwealth Department of Environment and Energy
Australian (Commonwealth) Marine Parks	• Oceanic Shoals Marine Park • Arafura Marine Park • Arnhem Marine Park • Agro-Rowley Terrace Marine Park • Kimberley Marine Park • Cartier Island Marine Park • Gascoyne Marine Park • Mermaid Reef Marine Park • Eighty Mile Beach Marine Park	Parks Australia
State/Territory Managed Fisheries	WA • Mackerel Fishery • Northern Demersal Scalefish Fishery • Northern Shark Fishery • Pearl Oyster Fisheries • West Coast Deep Sea Crustacean Fishery • Specimen Shell Managed Fishery • Marine Aquarium Fish Managed Fishery • Kimberley Gillnet and Barramundi Managed Fishery • WA Sea Cucumber Fishery • North Coast Prawn Fishery NT • Barramundi Fishery	State/Territory government department with jurisdiction for fisheries

Receptor	Location	Jurisdictional Authority
	• Coastal Line Fishery • Coastal Net Fishery • Spanish Mackerel Fishery • Demersal Fishery • Offshore Net and Line Fishery • Mud Crab Fishery • Aquarium Fish/Display Fishery • Trepang Fishery • Timor Reef Fishery • Fishing Tour Operator Fishery • Pearl Oyster Fishery • Bait Net Fishery	
Commonwealth Managed Fisheries	• Western Tuna and Billfish Fishery • Western Skipjack Fishery • Southern Bluefin Tuna Fishery • North West Slope Trawl Fishery • Northern Prawn Fishery • Western Deepwater Trawl Fishery	Australian Fishing Management Authority
Indigenous Cultural Heritage	Sites are located throughout EMBA	State/Territory government department with jurisdiction for indigenous heritage
Defence/restricted military area	North Australian Exercise Area (NAXA) offshore training area and the Browse Basin and Northern Carnarvon Basin offshore air-to-air weapons ranges (maritime military zones)	Department of Defence
Industry (e.g. operational zone of offshore oil or gas platform)	Montara FPSO Facility (Jadestone) Ichthys Facility (INPEX)	Operating company
Shipwrecks	• A number of unnamed Indonesian fishing vessels and the *Sinar Bonerate* are known to be in the vicinity of Ashmore Reef and Cartier Island • The *Unident* and *Selina* are known to be in the vicinity of Browse Island	State/Territory or Commonwealth government department with jurisdiction for maritime cultural heritage/archaeology

16 Use of data in response decision making

BMT is responsible for the collection of data by field teams, which shall be QA/QC checked by the Field Team Lead in accordance to the requirements listed in the finalised OMPs and SMPs (where applicable). The Team Lead will be responsible for communicating data back to the OSMP Management Team (led by BMT) via field reporting forms, debriefs and reports. Laboratory analysis reports should also be directed to the OSMP Management Team.

The OSMP Management Team is responsible for the interpretation and analysis of data. OMP data should be rapidly analysed so that it may be used to inform planning and decisions in the current and/or next operating period. SMP data is designed to be more scientifically robust and long-term in nature and is not relied upon by the IMT for decision making. Therefore, SMP data will be analysed more thoroughly by the OSMP Management Team.

Once data is analysed, it will be provided to the IMT Situation Unit Lead, who will then distribute the data from each monitoring component to the relevant IMT Unit and/or Section. Table 16-1 provides guidance on the type of data generated from each OMP, which IMT Section/Unit requires the data and how the data may be used during a response. All SMP data received during a response will be received by the IMT Situation Unit Lead and IMT Environment Unit Lead simultaneously.

Analysed data would then be incorporated into the Common Operating Picture (managed by the Situation Unit Lead) and used by the Environment Unit Lead during development of the operational SIMA, which would then be included in the IAP for the current or next operating period.

As ultimately responsible for the IAPs, the Planning Section Chief will be required to determine if the response options can be continued, escalated, terminated, or if controls need to be put in place to manage impacts of the response activities. These decisions will be communicated to the broader IMT during regular situation debriefs.

Table 16-1: Data generated from each OMP and how this may be used by IMT/EMT in decision making

Operational Monitoring Plan	Data generated[3]	IMT Section requiring data	How data may be used by IMT/EMT
Hydrocarbon properties and weathering behaviour at sea	Hydrocarbon physical characteristics (e.g. viscosity, asphaltene content, fingerprinting, weathering ratios of hydrocarbon chains)	Planning Section to aid in response option selection / modification	Changes to the hydrocarbon properties will affect the window of opportunity for particular responses and the associated logistical requirements of these responses, such as use of chemical dispersants, recovery and pumping equipment suitability, hydrocarbon storage and hydrocarbon disposal requirements
Pre-emptive assessment of sensitive receptors at risk (desktop only)	Location of sensitive receptors in relation to known spill extent (derived initially from spill modelling and any surveillance data)	Planning Section to aid in IAP development	Confirm initial protection priorities in ICS 232 form (or similar); understand extent of baseline data; provide an understanding of stakeholders to be contacted to obtain local knowledge and validate current information
Shoreline clean-up assessment technique (SCAT)	Assessment of shoreline character; assessment of shoreline oiling; recommendations for response activities; post-treatment surveys	Planning Section to aid in IAP development and response option selection / modification	Confirmation of shoreline character, habitats and fauna present which may influence selection of response tactics (e.g. no mechanical recovery if turtles are known to be nesting); Oil removal rate for a shoreline sector will help determine effectiveness of relevant tactics (e.g. shoreline protection and/or clean-up operations); SCAT teams provide ground truthing of sites that are not possible via satellite imagery, therefore the IMT can rely on recommendations SCAT teams (e.g. flagging access issues, suitable tactics, likely resourcing needs)
Surface chemical dispersant effectiveness and fate	Visual observations of dispersant efficacy; concentration of hydrocarbons in water column (see also water quality assessment);	Environment Unit for use in operational SIMA; Planning Section to aid in IAP development; Operations Section to confirm dispersant effectiveness for decision	Determine the effectiveness of dispersant in removing oil from sea surface and how dispersed oil is being distributed through the water column. This information can be used in SIMA to help decide if dispersants are being effective at treating high value receptors (SIMA to evaluate any trade-offs between receptors

[3] Summary only. For additional detail, please refer to individual OMPs. Also note data outputs will be reliant on finalised monitoring design.

Operational Monitoring Plan	Data generated[3]	IMT Section requiring data	How data may be used by IMT/EMT
		making purposes in current operations period.	
Hydrocarbon spill modelling	Forecasting and movement of spill; simulations of spill with different response options applied (e.g. dispersants)		Trajectory will help understand movement of spill and identify receptors that may be at risk of exposure to help direct resources for best effect; modelling will help predict hydrocarbon concentrations, which can be verified when used in conjunction with water quality monitoring and surveillance tactics; simulations with different response options could help the IMT/EMT predict the outcome of applying different response options in different locations (e.g. dispersants in deeper waters and containment and recovery in nearshore waters)
Water quality assessment	Distribution of oil in water column and change in hydrocarbon concentrations (e.g. total recoverable hydrocarbons, BETEXN, PAH), physio-chemical parameters and dispersant detection	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill within the water column and verify spill modelling and surveillance data; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites. Data can also influence ongoing use of dispersant through ongoing operational SIMA.
Sediment quality assessment	Distribution of oil in sediment and change in hydrocarbon concentrations (e.g. Total recoverable hydrocarbons, BETEXN, PAH)	Situation Unit Lead to validate surveillance and modelling data; Planning Section for use in IAP	Confirm spatial extent of spill; extent of spill can in turn influence location of other OMP and SMP monitoring components and sites
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs	Rapid assessment of presence and distribution of marine fauna; evaluate impact of spill and response activities on fauna	Planning Section for use in IAP; Oiled Wildlife Unit/Division to help in developing Wildlife Response Sub-plan	Understanding of species, populations and geographical locations at greatest risk from spill impacts. IMT can use this information to help qualify locations with highest level of protection priority (e.g. dugong nursery area is at risk of high contact therefore dispersant use closest to spill source may be a preferred option); understanding the impacts of spill response activities can help IMT to modify or terminate activities if they are assessed as creating more harm than the oil alone (e.g. large shoreline clean-up teams and

Operational Monitoring Plan	Data generated[3]	IMT Section requiring data	How data may be used by IMT/EMT
• Seabirds and shorebirds • Fish			staging areas may disturb shorebird nesting resulting in adults abandoning chicks)
Air quality modelling (responder health and safety)	Modelled outputs of airborne hydrocarbons, gases and chemicals and their predicted distribution	Operations Section to help determine safe zones in close vicinity of spill; Planning Section for use in IAP	Determine safe distances from spill source for response personnel; determine the presence and persistence of volatile organic compounds (VOCs) to know if response areas are safe for personnel

17 Data Management

The following reporting to Shell should be undertaken:

- Operational monitoring reports will be provided to the IMT as soon as possible to maintain situational awareness and advise response option requirements.
- Daily field survey reports detailing activities undertaken, HSE performance and survey progress.
- All sampling data and data interpretation provided in spatial data format (e.g. shape file) and spreadsheets as appropriate.
- Technical survey reports detailing whether the termination criteria have been reached, including recommendations on the requirements of future monitoring. Where possible, reports will investigate if monitoring results indicate that the concentrations of hydrocarbons/chemicals are equal to or below reference/baseline data or benchmark levels. Reporting should also include the spatial assessment of the distribution of hydrocarbons/chemicals over time. Where possible, reporting should also include an assessment of the performance of the response options against the environmental performance objectives in the relevant regulatory environmental permits other relevant environmental management documentation.

18 Quality Assurance and Quality Control

Robust quality assurance and quality control (QA/QC) measures are required to instil confidence in the operational and particularly the scientific monitoring programs. The requirements for QA/QC for Shell's monitoring plans include:

- Use of chain of custody forms, procedures for sampling, data collection templates, data management, statistical analysis and interpretation;
- Adhering to handling, storage, holding times and transport requirements in accordance with the finalised monitoring design;
- Collection and analyses of QA/QC samples in accordance with the finalised monitoring design;
- Archiving of samples where applicable;
- Maintenance and calibrations of systems and equipment;
- Certifications of competency for personnel and required training;
- Maintenance of metadata; and
- Data backup, storage and archiving.

19 Communication Protocol

Communication protocols between Shell and BMT with respect to delivery of the OMPs and SMPs (during both preparedness and implementation) are intentionally defined to ensure clear and consistent information is provided in both directions. This clear and consistent messaging is critical in what would be a highly dynamic and evolving situation.

The following communication protocols must be observed:

- Communication between Shell and BMT during the preparedness phase (pre-spill) and during activation (prior to deployment) will be between the Environment Unit Lead (EUL) (or delegate) and BMT Lead respectively.
- During implementation (post deployment), primary communication occurs via two pathways:
    - EUL and BMT Lead for contractual, management, scientific and general direction matters; and
    - Shell On-Scene Commander and BMT's Field Operations Manager for on-site matters.
- All OSMP operational decisions should be logged in an OSMP decision log by key personnel
- All OSMP tasks, actions and requirements should be documented in an IAP during the response phase of the spill
- The Shell EUL will keep the Operations Section Chief, Logistics Section Chief and Planning section Chief briefed of the OSMP status as required
- All correspondence (copies of emails and records of phone calls) between Shell and BMT during a response should be recorded and kept on file
- All communication received by BMT not in line with these protocols should be reported to the EUL who will seek guidance on the accuracy of the information received
- Unless related to safety (e.g. evacuation), any direction or instruction received by BMT outside of these protocols should be confirmed via the Shell EUL or On-Scene Commander prior to implementation.

During the post-response phase all communications shall be between the Shell Environment Advisor and BMT OSMP Implementation Lead.

20 Stakeholder communications protocol

Results of OMPs and SMPs will be discussed with relevant stakeholders. Information will be shared with regulatory agencies/authorities as required and inputs received from stakeholders will be evaluated and where practicable, will be used to refine the ongoing spill response and/or ongoing operational and/or scientific monitoring.

Shell's IMT Public Information Officer and/or Liaison Officer (initially be will same individual) will be the focal point for external engagement during the response operation.

Stakeholder communications post-response will be managed by Shell's External (Government) Relations Team.

21 Stand down process

Monitoring for each component will continue until termination criteria for individual components are reached. Typically, OMPs will terminate when agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response. SMPs will continue after the spill response has been terminated and until

such time as their termination criteria are also reached. A list of criteria is provided in Appendix A.

After OMPs are terminated, the OMP monitoring teams will be advised to stand down. Following this stage, BMT will run a lessons-learnt meeting between Shell, all monitoring providers and other relevant stakeholders. It is the responsibility of Shell to ensure that lessons learnt are communicated to the relevant stakeholder groups. The lessons discussed should include both positive actions to be reinforced and lessons for actions that could be improved in future standby or response campaigns.

22 References

APPEA (2019). Joint Industry Operational and Scientific Monitoring Plan. Report prepared by BlueSands Environmental for APPEA Marine and Environmental Science Working Group.

BMT Australia Pty Ltd (2019).Oil Spill Operational and Scientific Monitoring Plan (OSMP) Response and Implementation Capability - Scope of Work. Report prepared for Shell Australia Pty Ltd.

Appendix A: Initiation and Termination Criteria

Table A1: Operational Monitoring Plan Initiation and Termination Criteria

Operational Monitoring Plan	Initiation criteria	Termination criteria
Hydrocarbon properties and weathering behaviour at sea	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • This OMP is no longer contributing to or influencing spill response decision-making; or • Relevant scientific monitoring components initiation criteria have been triggered.
Pre-emptive assessment of sensitive receptors at risk (desktop only)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • A probable hydrocarbon impact (or impact of dispersed hydrocarbon) on a resource, habitat or shoreline is anticipated on the basis of trajectory modelling or other assessment of the incident; or	• Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The assessment of sensitive receptors that were identified as being potentially impacted/contact by the hydrocarbon spill are completed.

Operational Monitoring Plan	Initiation criteria	Termination criteria
	• Damage to a natural resource or sensitive receptor is possible as a result of that impact.	
Shoreline clean-up assessment technique (SCAT)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Analysis of data from hydrocarbon spill modelling, monitoring, evaluation and/or surveillance predicts an exposure of hydrocarbons to shoreline habitat; or • Relevant response activities are being undertaken.	• This OMP will not result in a change to the scale or location of active response options; or • Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.
Chemical dispersant effectiveness and fate (surface and/or subsurface)	• Application of dispersant has been selected as a response option.	• Dispersant operations have ceased; and • Measurements indicate that dispersed hydrocarbons are diluted to below levels of detection or below levels of concern; or • Monitoring data indicates that dispersant operations are unlikely to cause harm; or • Continuation of monitoring of this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation criteria have been triggered.

Operational Monitoring Plan	Initiation criteria	Termination criteria
Hydrocarbon spill modelling	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• Hydrocarbon spill modelling is no longer beneficial to predict spill trajectory and concentrations; or • Agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response.
Water quality assessment	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred.	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The spill is or is likely to be below visible criteria for surface oil (0.5g/m^2), and low thresholds for entrained (10ppb) and dissolved (6ppb) oil concentrations; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.

Operational Monitoring Plan	Initiation criteria	Termination criteria
Sediment quality assessment	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Modelling and/or analysis of data from MES predicts an exposure of hydrocarbons to marine and/or coastal sediment.	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Marine fauna assessment • Reptiles • Cetaceans (observational only) • Dugongs • Seabirds and shorebirds • Fish	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Modelling and/or analysis of data from MES predicts, or has reported, an exposure of hydrocarbons to known sensitive fauna habitat.	• The IMT (W) Leader (or delegate) considers that continuation of monitoring under this OMP will not result in a change to the scale or location of active response options; or • The IMT (W) Leader (or delegate) has advised that agreement has been reached with the Jurisdictional Authority relevant to the spill to terminate the response; or • The Monitoring Coordinator (or delegate) considers that continuation of monitoring under

Operational Monitoring Plan	Initiation criteria	Termination criteria
		this OMP is likely to increase overall environmental impact; or • Relevant scientific monitoring components initiation triggers have been assessed.
Air quality modelling (responder health and safety)	• The IMT has determined that Level 2 or 3 hydrocarbon spill to marine or coastal waters has occurred; and • Response operations that may pose a risk to the air quality of response personnel and/or public will occur.	• Completion of the gas, vapour and hydrocarbon discharge, containment and recovery, dispersant operations and shoreline clean-up operations; and • Continuing hazardous and noxious plume detection modelling has a low probability of contributing or influencing spill response decision making.

Table A2: Scientific Monitoring Plan Initiation and Termination Criteria

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Water quality impact assessment	• Spill modelling (see OMP: Hydrocarbon spill modelling) has indicated that contact on a sensitive resource is possible and it is considered likely that ongoing (scientific) monitoring of impacts will be required, supported by scientifically rigorous water quality monitoring; or • OMP: Water quality assessment has identified hydrocarbon and/or dispersant concentrations exceed accepted guidelines and benchmarks; or	• Hydrocarbon concentrations in marine waters are below benchmark levels which can be defined as: ○ ANZECC water quality objectives for the protection of aquatic ecosystems; or ○ the relevant regulatory site-specific trigger level (where these exist); or ○ below baseline levels; or ○ control site values (whichever is applicable).

Scientific Monitoring Plan	Initiation criteria	Termination criteria
	• Chemical dispersants have been applied as part of the spill response program.	
Sediment quality impact assessment	• OMP: Sediment quality assessment has identified hydrocarbon concentrations exceed accepted guidelines and benchmarks; or • Spill modelling has indicated that an impact on a sensitive resource that is closely linked to marine sediments is possible, and it is considered likely that ongoing (scientific) monitoring of a biological parameter will be required that supported by scientifically rigorous sediment quality monitoring.	• All hydrocarbon concentrations in sediments are below benchmark/guideline levels, which can be defined as: ○ Revised ANZECC/ARMCANZ sediment quality guidelines related to petroleum hydrocarbons; or ○ the relevant regulatory site-specific trigger level (where these exist); or ○ below baseline levels; or ○ control site values (whichever is applicable).
Intertidal and coastal habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of coastal or intertidal habitats or communities to hydrocarbons.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact to coastal and intertidal habitats and associated biological communities (confirmation that habitats and species were not exposed to hydrocarbons); or • Measured parameters of coastal and intertidal habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites.

Scientific Monitoring Plan	Initiation criteria	Termination criteria
Seabirds and shorebirds	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to seabirds and/or shorebird populations or any of their habitats of importance for breeding, nesting or foraging; or • Monitoring (OMP: Marine fauna assessment seabirds and shorebirds) has identified contact or an impact to seabirds and/ or shorebird populations as a result of the hydrocarbon spill; or • There are reports or scientific evidence of oiled seabirds and/or shorebird populations.	• Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor; and • There has been no impact on seabirds and/or shorebirds or their key biological activities; or • The extent of damage and rate of recovery of key seabird and/or shorebird behaviour and breeding activities has been quantified; and ○ Measured parameters have returned to baseline conditions (taking into account natural variability) in terms of breeding population (for seabirds) or counts (for shorebirds) and impacts on species and taxa are no longer detectable, with regard to control sites; or ○ Oil pollution effects/impacts on critical species and taxa are no longer detectable.
Marine mega-fauna assessment a. reptiles	a. Reptiles • Spill trajectory modelling, surveillance or monitoring predicts contact is possible at important habitat locations for turtles (foraging and rookery), sea snakes and/or estuarine crocodiles; or • Monitoring (OMP: Marine fauna assessment - reptiles) has identified contact or an impact to	a. Reptiles • There has been no impact on reptiles or their key biological activities from the hydrocarbon spill; or • The extent of damage of impacted reptiles has been quantified; and • Measured parameters of turtle (and sea snakes and/or estuarine crocodiles, if determined

Scientific Monitoring Plan	Initiation criteria	Termination criteria
	reptiles (dead, oiled, or injured reptiles) within area affected by hydrocarbons	appropriate) communities impacted by hydrocarbon spill have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Benthic habitat assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure of benthic habitats or communities to hydrocarbons.	• There has been no impact to benthic habitats and associated biological communities (confirmation that benthic habitats were not exposed to hydrocarbons); or • Measured parameters of benthic habitats and associated biological communities impacted by hydrocarbons spills have returned to within the expected natural dynamics of baseline state (taking into account natural variability) and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Marine fish assemblages assessment	• Spill trajectory modelling, surveillance or monitoring predicts or confirms exposure to fish areas or fish habitat.	• There has been no impact on fish and fish population structure; or • Measured parameters of fish, fish habitat, and marine fisheries locations impacted

Scientific Monitoring Plan	Initiation criteria	Termination criteria
		by hydrocarbon spills have returned to within the expected natural dynamics of baseline state and/or control sites; and • Agreement has been reached with the relevant stakeholders and Jurisdictional Authorities to cease monitoring this receptor.
Fisheries impact assessment	• Spill trajectory modelling, surveillance or monitoring predicts contact is possible to commercial, recreational, traditional species and or aquaculture species; or • Advice has been provided to government to restrict, ban or close a fishery; or • Declarations of intent by commercial fisheries or government agencies to seek compensation for alleged or possible damage.	• Agreement has been reached with the relevant Jurisdictional Authorities to cease monitoring of fisheries; and • Contamination in the edible portion or in the stomach/intestinal contents attributable to the spill is no longer detected; or • No differences are detected in commercial, recreational or aquaculture fisheries from control and impact sites; or • The physiological and biochemical parameters in the studied species have returned to baseline levels; or • Evidence that catch rates, species composition, community abundance, distribution and age structure of commercial fisheries and their by-catches have returned to baseline levels.

Appendix B: Baseline data sources

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent	Temporal extent
Water and sediment quality	Hydrocarbon abundance and distribution in the vicinity of the Prelude/Ichthys fields of the Browse Basin	CSIRO/AIMS	East Browse Basin	2017
	Ocean current model validation	CSIRO/AIMS	East Browse Basin	2015
	Occurrence of natural seeps in the vicinity of the Prelude/Ichthys fields.	CSIRO/AIMS	East Browse Basin	2018
	McAlpine, KW, Sim, CB, Masini, RJ and Daly, T 2010, Baseline petroleum hydrocarbon content of marine water, shoreline sediment and intertidal biota at selected sites in the Kimberley bioregion, Western Australia. Marine Technical Report Series No. MTR3, Office of the Environmental Protection Authority (OEPA), Perth, Western Australia.	WA EPA	Kimberley bioregion (15 shoreline sites, mainland and island, spanning 340 km)	2009
	Prelude condensate assays and dispersant testing laboratory reports Limited hydrocarbon levels (e.g. TPH/PAH /alkylPAH/BTEX) for both water and sediment collected for EISs at/around proposed production facilities and pipeline routes (Browse, Ichthys, Prelude EIS).	Shell / INPEX		
	Montara Reports 'Control site water quality data' (Operational Monitoring Study O2 – Monitoring of Oil Character, Fate and Effects, Report 02 Water Quality and Monitoring of Oil Character, Fate and Effects, Report 03 Dispersant Treated Oil Distribution	PTTEP		
	Habitat descriptions of Browse Island	INPEX	Browse Island	2010

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent	Temporal extent
Shorelines and intertidal habitats				
	Kimberley survey (included 6 sites around Browse)	Western Australian Museum	Browse Island	2012
	Montara Reports: Shoreline Ecological Assessment Aerial and Ground Surveys 7-19 November 2009 (Kimberley Coast); Shoreline Assessment Ground Survey: An operational component of the Monitoring Plan for the Montara Well Release Timor Sea (Ashmore, Cartier and Hibernia Islands).	PTTEP	Kimberley Coast Ashmore, Cartier and Hibernia Islands	2009
Mangroves	Montara Reports: Shoreline Ecological Assessment Aerial and Ground Surveys 7-19 November 2009 (Kimberley Coast)	PTTEP	Kimberley Coast	2009
	Historic satellite /aerial imagery		Kimberley region	Various
Benthic communities	Browse LNG Scott Reef Status reports and long-term monitoring of fish and coral communities.			
	Montara: Vulcan, Barracouta East and Goeree Shoals Survey 2013; Heyward et al 2013; Report for PTTEP Australasia (Ashmore Cartier) Pty Ltd. Australian Institute of Marine Science, Perth.	PTTEP	Barracouta and Vulcan Shoals	2013
	Montara: Barracouta, Goeree and Vulcan Shoals Survey 2016 Report for PTTEP Australasia (Ashmore Cartier) Pty Ltd. Australian Institute of Marine Science, Townsville.	PTTEP	Barracouta and Vulcan Shoals	2016
	Montara reports: Final Report on Benthic Surveys at Ashmore, Cartier and Seringapatam Reefs. Note that there is also data on Echuca and Heywood shoals that has not been released publicly to date but will be released in due course	PTTEP	Ashmore, Cartier and Seringapatam Reefs Echuca and Heywood shoals	
	Kimberley survey (included 6 sites around Browse)	Western Australian Museum	Browse Island	2012

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent	Temporal extent
	Browse Island habitat descriptions and quantitative date from the Maret	INPEX	Browse Island	2010
	Quantitative information on the abundance, diversity and temporal variability of benthos and associated fish – Browse Island reef	AIMS	Browse Island	2019
	Baselines of benthic communities, herbivory and reef metabolism at Browse Island	CSIRO/UWA/AIMS	Browse Island	2018
Marine reptiles	Browse LNG Long-term Scott Reef Turtle monitoring Program (includes data from Browse). Additional studies into the turtles of the Dampier Peninsular and Lacepede Is		Browse Island	
Seabirds and shorebirds	Monitoring at Ashmore Reef, undertaken for the Montara spill currently provides an appropriate baseline for the period 2010-2014 - see Montara Reports : The status of seabirds and shorebirds at Ashmore Reef, Cartier Island and Browse Island (Clarke 2010). Note that data exists for Browse and Cartier Islands but these islands are not considered significant locations for birds in the Browse Basin	PTTEP	Ashmore Reef	2010-2014
	An annual monitoring program for shorebirds utilising Roebuck Bay and Eighty Mile Beach has also been active at these sites since 2001 and 2004 respectively (Rogers et al. 2011). As outlined above, appropriate baseline data currently exists for both Ashmore Reef and potential shorebird reference areas		Roebuck Bay and Eighty Mile Beach	2001 – present
	Adele Island counts of all seabirds and shorebirds conducted by WA DEC and R.Clarke in April 2012 (Clarke, pers. comm.) and being repeated November 2012 (funded by Shell). The Lacepede Islands and Cambridge Gulf are also recognised as important areas for birds but	Shell	Adele Island	2012-2014

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent	Temporal extent
	these are significant distances beyond Prelude's ZPI and are not considered further.			
	Lacepede Islands: Report comparing the diet composition, foraging habitat and breeding between species and between years on Lacepede islands	Monash/UWA/AIMS	Lacepede Islands	2015
	Comparison of Lacepede and Adele Islands: Investigating the breeding and foraging parameters of seabird species in the Browse Basin to determine their vulnerability to impacts associated with potential oil spills, and their ability to recover. Comparison between the Lacepede and Adele Islands in 2014	Monash/UWA/AIMS	Adele and Islands	2015
	Adele Island: Seabirds and shorebirds at Adele Island.	Monash/AIMS	Adele Island	2015
Marine mammals	RPS (2012). Humpback Whale Survey Report. Browse MMFS 2011	Woodside	Browse Basin	2011
	Browse LNG Vessel and aerial Marine Megafuana and Humpback Whale surveys		Scott Reef, Lacepede Is and the Dampier peninsular	
	Cetacean studies undertaken for the Browse, Ichthys and Prelude EIS (Jenner et al. 2009)	INPEX / Shell		2009
	Report synthesising existing marine wildlife data and recommendations for future work	CSIRO/AIMS	East Browse Basin	2018
Fish assemblages	Limited sampling collected for EISs (Browse, Ichthys, Prelude EIS)	INPEX / Shell		
Commercial fisheries	Commercial Fisheries data collected by WA Department of Fisheries (WA DoF) and Australian Fishing Management Authority (AFMA)	WA Department of Fisheries / Australian Fishing Management Authority		
	Montara Reports: Assessment of Fish catch for the presence of Oil, Olfactory analysis of Timor Sea fish			

Receptor	Existing baseline monitoring	Source / Data Custodian	Spatial extent	Temporal extent
	fillets, Assessment of effects on Timor Sea Fish and Fisheries			
	Monitoring the Northern Demersal Scalefish Managed Fishery: Establishing Baseline Biomarker Levels in Commercially Important Demersal Fishes	Curtin/AIMS	East Browse Basin	2018
	Monitoring the Northern Demersal Scalefish Managed Fishery: accounting for spatial variability and detecting change in key fish populations	Curtin/CSIRO/AIMS	East Browse Basin	2018