

ENVIRONMENT PLAN

Beehive-1 Exploration Drilling

WA-488-P

17 May 2024

Rev 6

9-Environmental Risk Assessment - Hydrocarbon Spill Response

eog resources

9. Environmental Risk Assessment – Hydrocarbon Spill Response

The section presents a risk assessment for the oil spill response activities in accordance with the requirements of Regulation 21(6)(b) of the OPGGS(E), which states that the evaluation of all impacts and risks, including those relating to potential emergency conditions, must be included in the EP.

A strategic Net Environmental Benefits Analysis (NEBA) of oil spill response options was conducted to determine which options are suitable for Beehive-1 and considered to result in a net benefit for the ecological and socio-economic receptors within the spill EMBA (see Appendix B of the OPEP). The approach used to develop the NEBAs is based on IPIECA's guideline *Response strategy development using NEBA: Good practice guidelines for incident management and emergency response personnel* (IPIECA, 2015c).

Table 9.1 summarises the response strategies selected for the OPEP from the strategic NEBA, noting that the combination of response options adopted in an actual response will depend on the trajectory of the spill.

Table 9.1. Hydrocarbon spill response strategies

Response option	Description
Source control	Vessel – SMPEP
	Relief well installation to kill well
Monitor & evaluate	Direct observation – aerial or marine, OSTM, satellite tracking buoys, satellite tracking
Dispersant application	Aerial dispersant application
	Vessel dispersant application
Containment & recovery	Use of booms and skimmers to contain surface oil in open waters. Relies on calm conditions and thicknesses > 10 µm to collect.
Protection and deflection	Booms and skimmers deployed to protect environmental sensitivities such as estuaries. Strong currents, waves, tidal ranges and poor access can limit the application of this response option.
Shoreline clean-up	Where impact is predicted, shoreline clean-up assessment technique (SCAT) is initiated. If SCAT and NEBA assess that clean-up will have a net benefit, clean-up can be initiated. Shoreline clean-up may take different forms, including manual removal if access is available.
Oiled wildlife response (OWR)	Consists of capturing, cleaning and rehabilitating oiled wildlife. It may also include hazing or pre-spill captive management.
Waste Management	Collection and disposal of large volumes of oily water and solid wastes.

Each of the response options identified as suitable for this activity from the strategic NEBA (see Appendix B of the OPEP) is assessed in accordance with the NOPSEMA Oil Pollution Risk Management Guidance Note (GN14488, Rev 2, Feb 2018) to ensure that the risks associated with the responses have been reduced to ALARP and acceptable levels.

The OPEP describes the arrangements for responding to and monitoring pollution in the event of a hydrocarbon spill during drilling for the Beehive-1 well. The OPEP is supported by a series of field response guidance documents and site-specific Tactical Response Plans (TRPs) for the implementation of applicable response strategies as identified via the strategic NEBA process.

The OPEP is supported by the following appendices:

- Appendix A Drilling Incident Management Team (DIMT) Requirements.
- Appendix B Basis of Design and Response Strategy Requirements.
- Appendix C Operational and Scientific Monitoring (OSM) Bridging Implementation Plan (BIP).
- Appendix D Cumulative Requirements and Demonstration of Capability.
- Appendix E Environmental Sensitivities.

9.1. Source Control – Relief Well Drilling

9.1.1. Background Information

In the event of a LoWC incident (Level 3), source control would be initiated. As indicated in the NEBA in Appendix B of the OPEP, relief well drilling requiring a second MODU would be the primary response strategy to stop hydrocarbon flow should BOPs and protective measures fail or become inoperable.

9.1.2. Scope of Activity

The scope of activities involved with drilling a relief well are the same as drilling a standard well. A second MODU, engaged and transported to site, would be offset from the original MODU by 1-2 km to commence relief well drilling. The drilling process for a relief well is described in Section 2.10.2, although it would be a deviated well (rather than vertical) due to the need to drill from outside the 500 m radius PSZ.

9.1.3. Hazards

The hazards associated with drilling a relief well are the same as drilling a standard well, as outlined in Chapters 7 and 8.

9.1.4. Known and Potential Environmental Impacts and Risks

The environmental impacts and risks associated with drilling a relief well are the same as drilling a standard well, as outlined in Chapters 7 and 8.

9.1.5. Evaluation of Environmental Impacts and Risks

The evaluation of environmental impacts and risks associated with drilling a relief well are the same as drilling a standard well, as outlined in Chapters 7 and 8.

9.1.6. Impact and Risk Assessment

Table 9.2 presents the impact and risk assessment for relief well drilling.

Table 9.2. Impact and risk assessment for relief well drilling

Summary	
Summary of risks	As per Chapters 7 and 8 of this EP.
Extent of risk	As per those described in Chapters 7 and 8 of this EP.
Duration of risk	For the duration of drilling – up to 77 days.
Level of certainty of risk	HIGH – the impacts associated with drilling are well understood.

Risk decision framework context	Decision type	A – good industry practice required with engineering risk-based tools applied.
	Activity	Nothing new of unusual, represents business as usual, well understood activity, good practice is well defined
	Risk & uncertainty	Risks are well understood, uncertainty is minimal.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a spill response strategy must be greater than no response.	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Relief well drilling (as per this EP)	Remote	Minor	Negligible

Assessment of Proposed Control Measures

The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP.

The controls for each response strategy was assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness – all preparedness EPS are presented in Appendix B of the OPEP.		
Response		
The Source Control Emergency Response Plan (SCERP) is implemented to stop the release of hydrocarbons.	**(RSK-09:EPS-01)** The Incident Controller initiates the SCERP within 3 hours of LoWC notification.	Incident logs.
	(RSK-09:EPS-02) EOG shall implement relief well operations in accordance with the SCERP.	Incident logs verify the SCERP was implemented.
	(RSK-09:EPS-03) The RWP will be implemented to kill the well within 77 days following a LoWC event.	Incident logs verify that all attempts were made to kill the well within 77 days.
	(RSK-09:EPS-04) Response shall only terminate when well kill has been achieved and barriers reinstated.	Incident logs verify that the response concluded only once the well was killed.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Relief well drilling	Remote	Minor	Negligible

The risk of relief well drilling activities to the identified receptors is assessed as negligible because:

- The control measures adopted are effective in reducing the risk to ALARP as per Chapters 7 and 8 of this EP.

Demonstration of ALARP		
A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.		
Demonstration of Acceptability		
Policy compliance	EOG's Safety and Environmental Policy objectives are met.	
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.	
External context	There have been no concerns raised from relevant persons regarding spill response activities.	

Legislative context	The EPS align with the requirements of:
	• OPGGS Act 2006 (Cth) and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• EPBC Regulations 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Marine Pollution Act* 1999 (NT).
	• *Waste Management & Pollution Control Act* 1998 (NT).	

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-09: all EPS)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-09: all EPS)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill response plans and guidelines	

	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are required and deployed. The EPS complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS complement AMOSPlan.
	WA Oil Spill Contingency Plan (2015)	DoT will implement this plan in the event their resources are required and deployed. The EPS complement the WA Oil Spill Contingency Plan.
	NT Oil Spill Contingency Plan (2014)	The NT IC will implement this plan in the event their resources are required and deployed. The EPS complement the NT Oil Spill Contingency Plan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
Environmental context	MNES	
	AMPs	Oil causing marine pollution is a threat identified in the North Marine Parks Network Management Plan 2018 (DNP, 2018). Relief well activities will not be undertaken in AMPs. No additional impacts to AMPs are predicted.
	Ramsar wetlands	Relief well activities will not be undertaken or impact upon Ramsar wetlands.
	TECs	Relief well activities will have no impacts on TECs.
	NIWs	Relief well activities will have no impacts on NIWs.
	Nationally threatened and migratory species	Relief well activity impacts to threatened and migratory species have been assessed in this EP and have demonstrated to be ALARP and acceptable. All impacts and risks assessed may affect individuals within a species, however no significant impacts on threatened and migratory species at a population level are predicted as a result of relief well drilling.
	Other matters	

	State marine parks	The North Kimberley Marine Park Management Plan has the strategic objective *to protect and conserve biodiversity and ecological health*. Relief well drilling will assist in maintaining this objective by eliminating oil which threatens Marine Parks. As such, relief well activities do not conflict with the park in terms of cultural, natural, recreational, tourism, community or cultural values detailed in the Management Plan.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (i.e., nesting beaches, important foraging grounds, corals, seagrasses AND manage anthropogenic activities to ensure that marine turtles are not displaced from identified habitat critical to their survival.* Relief well activities will eliminate the oil spill source and allow the environment to recover. Relief well activities support the identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Statement of acceptability	EOG considers the risk associated with the drilling of a relief well to be acceptable because: • It will adhere to the company's Environment Policy. • The residual risk ratings are negligible/low and ALARP. • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Relevant persons and stakeholders have not expressed concerns about this response method. • The activity complies with all relevant legislation and industry best practice. • Spill response activities will not have long-term or significant impacts on MNES. • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species. • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans. • Spill response activities are not inconsistent with ESD principles.	
Environmental Monitoring		
• As per Beehive-1 OPEP and OSMP requirements.		

Record Keeping	
• Contracts and agreements with third parties. • Equipment and service provider register. • Exercise drill reports. • Inspection/audit reports. • Incident and daily operations reports. • RWP.	• Operational NEBA. • Briefing records. • Photos. • IAP. • DIMT Training Records

9.2. Monitor and Evaluate

9.2.1. Background Information

Surveillance and tracking of a hydrocarbon spill, using trained and experienced personnel, is necessary to determine the extent, behaviour and trajectory of the spill to maintain situational awareness and inform the spill response strategy. Monitor and evaluate activities also support a natural dispersion and weathering response strategy.

The monitoring and evaluation response option will always be employed during a response for all oil spill levels to provide and maintain situational awareness.

Sole use of the monitor and evaluate strategy (i.e., allowing hydrocarbons to naturally weather) will only be considered when:

- The oil spill trajectory is moving away from sensitive shoreline and marine receptors;
- Shoreline areas contacted by hydrocarbons are inaccessible;
- The is no net environmental benefit of employing other response strategies; and/or
- Other response strategies are not feasible (e.g., type of hydrocarbon released such as MDO).

9.2.2. Scope of Activity

The scope of monitor and evaluate activities is briefly outlined below:

- OSTM – EOG can access OSTM services through its AMOSC membership. The OSTM assists in predicting the oil slick direction and time to impact on possible sensitive receptors thereby informing oil spill response activities.
- Deployment of tracking buoys – satellite tracking buoys will be available on the MODU and on each of the two support vessels. In the event of a level 2 or 3 oil spill, the tracking buoys will be deployed from the MODU/vessels to drift with the oil spill. Their signals will be satellite monitored and tracked to provide real-time information on oil slick movement.
- Vessel and aerial-based observation – vessels and aircraft containing trained oil spill observers will observe the oil slick (distribution, colour and consistency) and determine the slick's weathering characteristics to inform oil spill response options.
- Satellite imaging – EOG will access satellite imaging to monitor the oil slick to inform oil spill response activities.

9.2.3. Hazards

Hazards associated with aerial and vessel-based monitoring and evaluation activities are:

- Increased noise, air and light emissions from additional aircraft and vessels;
- Increased liquid and solid discharges from additional vessels; and
- Unplanned vessel incidents such as introduction of IMS, collision with other vessels and cetaceans, disruption to other marine users and possible spills from vessels.

9.2.4. Known and Potential Impacts and Risks

The impacts and risks associated with monitoring and evaluation activities are:

- Routine and non-routine impacts and risks associated with vessel operations (as outlined in Sections 7.2 – 7.5, 7.8 - 7.11 and Chapter 8).
- Noise disturbance to marine fauna and shoreline species by aerial flights (see Section 7.5 and evaluation below).

9.2.5. Evaluation of Impacts and Risks

The impacts and risks associated with routine and non-routine MARPOL-standard vessel operations are assessed in Chapters 7 and 8 of this EP and are not repeated here. Smaller vessels engaged in oil spill response activities will be required to adhere to MARPOL discharge requirements as legislated by Commonwealth Marine Orders with equipment for discharge treatment appropriate to the class of vessel.

Additional impacts and risks are associated with the presence of aerial resources operating at low altitudes. These are discussed below.

Helicopter operations produce strong underwater sounds for brief periods when the helicopter is directly overhead (Richardson *et al*., 1995). Sound generated from helicopter operations is typically below 500 Hz and sound pressure in the water directly below a helicopter is greatest at the surface but diminishes quickly with depth. Reports for a Bell 214ST (stated to be one of the noisiest) identifies that noise is audible in the air for four minutes before the helicopter passed over underwater hydrophones. The helicopter was audible underwater for only 38 seconds at 3 m depth and 11 seconds at 8 m depth (Richardson *et al*., 1995).

Sound levels from helicopters are not expected to cause physical damage to marine fauna, however temporary behavioural changes (avoidance) in species (cetaceans, turtles, fish) may be observed.

The behavioural reaction of cetaceans to circling aircraft (fixed wing or helicopter) is sometimes conspicuous if the aircraft is below an altitude of 300 m, uncommon at 460 m and generally undetectable at 600 m (NMFS, 2001; Richardson *et al*., 1995). Baleen whales sometimes dive or turn away during over-flights, but sensitivity seems to vary depending on the activity of the animals. The effect on whales seems transient, and occasional over-flights probably have no long-term consequences (NMFS, 2001).

Aerial surveillance flights will operate at between 300 – 500 m altitudes when undertaking observation activities (AMSA, 2003). In accordance with the EPBC Regulations (Part 8), a fixed-wing aircraft will maintain a buffer of 300 m and a helicopter will maintain 500 m from a cetacean. Any noise produced by surveillance aircraft is localised and temporary as they are in constant

movement. On this basis impact to marine mammals is expected to be temporary, localised, and recoverable.

9.2.6. Impact and Risk Assessment

Table 9.3 provides the impact and risk assessment for the monitor and evaluate response option.

Table 9.3. Impact and risk assessment for monitoring and evaluation

Summary			
Summary of risks	Disturbance to marine and nearshore fauna from increased vessel and aerial activity.		
Extent of risk	Localised (immediately around vessel or aircraft).		
Duration of risk	Medium- to long-term (depending on spill volume, trajectory and shorelines affected).		
Level of certainty of risk	HIGH – The impacts associated with vessel operations and noise disturbance to fauna from vessels and helicopters are well understood, and controls are documented in legislation.		
Risk decision framework context	Decision type	A – good practice is required	
	Activity	Nothing new or unusual, well understood activity, good practice is well defined	
	Risk & uncertainty	Risk is well understood, uncertainty is minimal	
	Stakeholder influence	No conflict with company values, no partner interest, some persons may object, may attract local media attention.	
Defined acceptable level	The net environmental benefit of a spill response strategy must be greater than no response (i.e., 'do-nothing').		
Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Occasional	Moderate	Medium
Assessment of Proposed Control Measures			
The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP. The controls for each response strategy were assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.			
Environmental Controls and Performance Measurement			
EPO	EPS	Measurement criteria	
General Activity Controls (*Common to other response strategies not repeated in subsequent response option assessments)*			
There is no increase in environmental harm from oil spill response activities.	**(RSK-10:EPS-01)** This response strategy is only undertaken if an EOG operational NEBA determines it is likely to have a net environmental benefit and it is safe to do so.	Operational NEBA.	
	(RSK-10:EPS-02) An EOG NEBA is undertaken during each operational period to determine if the response strategy is continuing to have a net environmental benefit.	Operational NEBAs.	

	(RSK-10:EPS-03) Helicopters will maintain a buffer distances of 500 m around cetaceans in accordance with EPBC Regulations 2000 (Part 8).	Flight instructions document these constraints.
	(RSK-10:EPS-04) Fixed wing aircraft will maintain a buffer distances of 500 m around bird colonies to avoid bird strikes.	Flight instructions document these constraints.
	(RSK-10:EPS-05) Vessels will maintain buffer distances around whales and dolphins in accordance with The Australian National Guidelines for Whale and Dolphin Watching (DoEE, 2017b) for those individuals not visibly affected by hydrocarbons (closer approaches may be necessary to determine impacts).	Incident reports note when cetaceans were sighted and what actions were undertaken.
Discharges from small vessels meet MARPOL requirements	**(RSK-10:EPS-06)** All vessels utilised in oil spill response activities will maintain pollution control equipment and/or observe discharge restrictions in accordance with MARPOL requirements according to vessel "Class".	Vessel Class Certificates.
Preparedness – all preparedness EPS are presented in Appendix B of the OPEP.		
Response (see also response timing in Appendix B of the OPEP.		
Provide situational awareness to inform DIMT decision-making.	**(RSK-10:EPS-07)** EOG will initiate monitoring and evaluation, inclusive of the Operational Monitoring Plans detailed in Table 5-1 of the AEP Joint Industry Operational and Scientific Monitoring (OSM) Plan Framework, within 2 hours of forming DIMT and in a manner consistent with the initiation criteria detailed within Table 9-1 of the of the AEP Joint Industry OSM Plan Framework.	Incident logs verifies that monitoring and evaluation was initiated.
	(RSK-10:EPS-08) EOG will undertake all monitoring and evaluation tasks within the defined timeframes as per Table 5.6 of the OPEP.	Incident log / communication records verify that timeframes were met.
	(RSK-10:EPS-09) EOG will implement operational monitoring as per Part B of the Beehive-1 Operational and Scientific Monitoring Bridging Implementation Plan (OSMBIP) (Appendix C of the OPEP).	Incident logs verify that operational monitoring was implemented.
	(RSK-10:EPS-10) EOG will meet all minimum standards relating to operational monitoring as per Appendix A of the AEP Joint Industry OSM Plan Framework.	Incident logs verify that minimum standards were met.
	(RSK-10:EPS-11) EOG will terminate monitoring and evaluation, inclusive of the Operational Monitoring Plans detailed in Table 5-1 of the AEP Joint Industry OSM Plan Framework, in accordance with the task-specific termination criteria detailed within Table 5.6 of the OPEP and in a manner consistent with the termination criteria detailed within Table 9-1 of the AEP Joint Industry OSM Plan Framework.	Sign-off reports verify that termination criteria have been met.
	(RSK-10:EPS-12) An incident management plan (IAP) is prepared by the DIMT planning officer within the first 24 hours of a spill using monitoring data, which is used to guide response activities.	The IAP is available and daily reports verify it is implemented.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Remote	Minor	Negligible
The risk of monitoring and evaluation spill response activities to the identified receptors is assessed as negligible because: The control measures adopted are effective in reducing the risk to ALARP.			
Demonstration of ALARP			
A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability, and independence/capability of each control measure.			
Demonstration of Acceptability			
Policy compliance	EOG's Safety and Environmental Policy objectives are met.		
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.		
External context	There have been no concerns raised from relevant persons regarding monitor and evaluate spill response activities.		

Legislative context	The EPS align with the requirements of:
	• *OPGGS Act* 2006 (Cth) and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• *EPBC Regulations* 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Marine Pollution Act* 1999 (NT)
	• *Waste Management & Pollution Control Act* 1998 (NT).		

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.		
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-10: all EPS)**.	
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.	
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-10: all EPS)**.	

	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill response plans/guidelines	
	NATPLAN (AMSA, 2020)	AMSA will implement this plan in the event their resources are required and deployed. The EPS listed in this table complement the NATPLAN.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event that their resources are required. The EPS listed in this table complement AMOSPlan.
	WA Oil Spill Contingency Plan (2015)	DoT will implement this plan for spills in WA waters in the event their resources are required and deployed. The EPS listed in this table complement the WA Oil Spill Contingency Plan.
	NT Oil Spill Contingency Plan (2014)	The NT IC will implement this plan for spills in NT waters in the event their resources are required and deployed. The EPS listed in this table complement the NT Oil Spill Contingency Plan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	Monitor and evaluate	In-water surveillance of oil spills at sea (IPIECA/IOGP, 2016a).
		Aerial observations of oil spills at sea (IPIECA/OGP, 2015)
		At-sea monitoring of surface dispersant effectiveness (IPIECA/OGP, 2014).
		An assessment of surface surveillance capabilities for oil spill response using airborne remote sensing (Polar Imaging, 2014).
		Aerial Observations of Marine Oil Spills (ITOPF, 2011b).
	MNES	

Environmental context	AMPs	Oil causing marine pollution is a threat identified in the North Marine Parks Network Management Plan 2018. Monitor and evaluate spill response helps to inform the spill response to prevent/limit impacts to AMPs are not realised (net benefit). Monitor and evaluate activities will not have any significant impacts on the AMP.
	Ramsar wetlands	Vessel or aircraft-based monitoring activities will have no impacts on Ramsar wetlands.
	TECs	Spill response will not be undertaken in areas where TECs exist. Vessel or aircraft-based monitoring activities will have no impacts on TECs.
	NIWs	Vessel or aircraft-based monitoring activities will have no impacts on NIWs.
	Nationally threatened and migratory species	Some threatened and migratory species may be present in spill response areas, however with the controls adopted vessel or aircraft-based monitoring and surveillance activities will not significantly impact threatened and migratory species.
	Other matters	
	State marine parks	Many of the WA/NT marine and coastal reserve management plans list the protection of marine and terrestrial ecological communities and indigenous flora and fauna, particularly threatened species, as a management aim. The North Kimberley Marine Park Management Plan has the strategic objective to *protect and conserve biodiversity and ecological health*. Monitor and evaluate activities do not conflict with the management objectives for the park in terms of cultural, natural, recreational, tourism, community or commercial values detailed in the Management Plan. With permission of State regulators, EOG may, at the direction of the state regulators, undertake spill response in coastal marine parks. Vessel or aircraft-based monitoring activities will not significantly impact on these marine parks or the management objectives of the parks' management plans.

	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (i.e., nesting beaches, important foraging grounds, corals, seagrasses AND manage anthropogenic activities to ensure that marine turtles are not displaced from identified habitat critical to their survival.* Monitor and evaluate activities will not impact upon turtles but will allow the spill response to have situational awareness and employ response options which mitigate impacts to turtle populations (very high protection priority). The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Statement of acceptability	EOG considers the impacts and risks around the monitoring and evaluation response strategy to be acceptable because: • It will adhere to the company's Environment Policy. • The residual risk ratings of the activity are negligible-low. • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Relevant persons and stakeholders have not expressed concerns about this response method. • Measures comply with relevant legislation and industry best practice. • Activities will not have long-term or significant impacts on MNES. • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species. • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans. • Spill response activities are not inconsistent with ESD principles.	
Environmental Monitoring		
As per Beehive-1 OPEP and OSMP requirements.		
Record Keeping		
• Contracts and agreements with third parties. • Equipment and service provider register. • Inspection/audit reports. • Incident and daily operations reports. • Flight Instruction Records • Vessel Class Certificates		• Operational NEBA. • Photos. • IAP. • OSMP Records • Incident Log

9.3. Dispersant Application

9.3.1. Background Information

Chemical dispersants are an important response option for consideration in an oil spill to reduce the amount of surface or shoreline oiling. This is particularly beneficial if a spill trajectory shows likely contact with coastal environmental sensitivities, such as critical habitat for turtle breeding, Ramsar wetlands or NIWs, seabird and shorebird habitats, mangroves, and inter-tidal coral reefs. Application of dispersants in offshore marine environments aims to prevent/reduce the area of sea surface oiling and oil residue arriving onshore reducing risk to sensitive protection priorities.

Chemical dispersants are solvents that move oil from the water surface to the water column by breaking oil into small droplets through reduced oil/water interfacial and increasing droplet surface area available to be degraded by microorganisms. Dispersants do not reduce the total volume of oil in the environment but changes its location and physical properties (Laleian & Azwell, 2011).

Dispersant application, particularly by aircraft, in offshore environments is a key response tool to large, offshore oil spills given it can be quickly activated and cover significant geographic areas (BP, 2013b).

IPIECA-IOGP (2014e) reports that dispersant use on oils with viscosity up to 5,000 cP is likely to be effective. The predicted Beehive oil viscosity, utilising Jabiru crude as an analogue, is 3.0 cP and fits this criterion, making dispersant application a suitable response option to consider in a Level 2 or 3 LoWC oil spill.

9.3.2. Scope of Activity

Dispersant may be applied in the event of a LoWC event to:

- Remove oil from the sea surface to reduce environmental impacts to sea-surface fauna (e.g., impacts to mammals, seabirds, turtles);
- Rapidly reduce oil toxicity by dilution through a large water mass;
- Enhance natural microbial biodegradation rates by increasing the surface area between oil and water;
- Reduce the extent and volume of stranded oil, minimising impacts to shoreline habitats and biota, lessening the scale of shoreline clean-up and the adverse effects of shoreline response actions; and
- Disperse oil into the water column to reduce the level of VOCs in areas where source control activities are being undertaken, thereby reducing worker exposure to potentially harmful VOCs (IPIECA-IOGP, 2014e).

Various methodologies exist to apply dispersant, which include direct application of dispersant at the subsea wellhead leaking oil (not applicable to Beehive given wellhead is at the surface) or application at surface from vessels or aircraft (applicable at Beehive-1).

Dispersant application from aircraft offers the advantage of rapid response, high treatment rates and optimum dispersant use. In Australia, agricultural aircraft (crop dusters) adapted for the application of dispersant (known as fixed wing aerial dispersant capability [FWADC] aircraft) are available for deployment. In addition, cargo aircraft with modular tanks for dispersant storage are available from overseas.

In Australia, the AMSA Protocol for the Register of Oil Spill Control Agents (OSCA) (AMSA, 2012a) is the recognised standard for the acceptance of chemical dispersants for use in Commonwealth marine waters. The OSCA protocol requires a dispersant to meet pre-determined requirements

for chemical constituents, efficacy, toxicity and biodegradation. Chemicals listed on the OSCA Register are considered to meet a standard that is acceptable under the NatPlan and meets the exemption requirements under the EPBC Act 1999. EOG will only use dispersants listed on the OSCA register or transitional arrangement dispersants for a Beehive LoWC incident.

Where possible, testing of a crude against the available chemical dispersants is preferred so that crude-specific efficacy and eco-toxicity data can be gathered. This process aids in selecting the dispersant most effective for a given crude oil. As Beehive-1 is an exploration project this data is not available. In the absence of possessing crude-specific dispersant effectiveness data prior to Beehive-1 drilling, testing will be undertaken as part of operational monitoring to validate dispersant efficacy (OSMP Operational Monitoring Plan: Surface Chemical Dispersant fate and Effectiveness Assessment).

Additionally, given the absence of crude-specific ecotoxicity data prior to drilling commencement, monitoring will be undertaken as part of the OSMP to determine the impacts of applied dispersants on the marine environment to inform the spill response.

Dispersant application will not take place in AMPs (or within 10 km of AMPs), within WA and/or NT marine parks or within WA and/or NT territorial waters without the permission of relevant authorities. This measure aims to protect high sensitivity marine park areas and nearshore, shallow water habitats at risk from dispersant application (such as seagrass meadows, mangroves, etc.).

The use of chemical dispersants is an environmental trade-off; it is recognised that dispersants have their own set of environmental impacts (though they are generally less toxic than the oils they break down), but they are used in an attempt to minimise contact with shorelines, where the oil can cause significantly more damage. After application in open water, elevated entrained oil concentrations are normally only observed in the upper layers of the water column (<10 metres) but are rapidly reduced by dilution through water movement. Studies on crude oils have shown that immediately after dispersant application, oil concentrations in the range of 30-50 ppm can be expected in the water just below the slick, diminishing to 1-10 ppm in the uppermost 10m of the water column after a few hours. The exposure for marine organisms is therefore acute rather than chronic and the limited exposure time reduces the likelihood of long-term adverse effects (ITOPF, 2011a).

The risks to marine life from dispersed oil are broadly similar to the oil spill impacts (water column) in Section 8.7 and the risks associated with the proportional increase of entrained and dissolved oil using dispersants are discussed further in Section 9.3.

9.3.3. Dispersant Modelling

EOG commissioned OSTM (RPS, 2022c) to determine the fate and trajectory of chemically dispersed oil from a Beehive-1 LoWC to assess the impact of applying dispersant and the resulting exposure of sensitive receptors to the greater concentrations of entrained oil. The modelling also examined the net benefits of the dispersant strategy in reducing impacts on coastal and shoreline receptors. This modelling is shown as the 'mitigation scenario in the Beehive-1 Crude Oil Spill Modelling with Surface Dispersant Application report (Appendix 13). Table 9.4 details the modelling assumptions and input and output parameters.

The OSTM undertaken for a LoWC scenario (see Section 8.7.4 and Appendix 13) included an assessment of the use of surface dispersants applied by aircraft and vessels. The dispersant was assumed to be applied on surface oil with an age between 12 and 72 hours from the time of release. This enabled the evaporation process to take place during the initial 12 hours following

the release while also avoiding any waste of dispersant on highly weathered oil, which would be ineffective.

The dispersant effectiveness was set at 65%, based on a combination of surface spraying using vessels and airplanes. It was assumed that that the dispersant will be effective on oil with a minimum thickness of 10 µm and a viscosity of up to 12,500 cP. The surface dispersant application was assumed continuous for 10 hours during daylight hours only, starting from 24 hours after the initial release until the end of the spill duration (77 days). Winds were capped at 35 knots to ensure safe operating conditions for planes, but also to allow for sufficient mixing of the chemical dispersants and oil at the water surface (API *et al*., 2001; NOAA, 2010). A dispersant to oil ratio of 1:20 was applied. A total volume of 9,066 m^3 of dispersant was modelled.

Table 9.4. Assumptions factored into the dispersant modelling

Parameter	Input	
Dispersant to oil ratio	1:20 (only applied on oil >10 g/m^2)	
Dispersant effectiveness	65%	
Operational hours	10 (during daylight only)	
Application window (age of oil)	12 to 72 hours	
Dispersant application start	24 hrs after initial release	
Dispersant application – operational wind speed range (knots)	2-35 knots	
Aerial application	**Day 2**: 2 x FWADC delivering 24 m^3 dispersant **Day 3**: 6 x FWADC delivering 60 m^3 dispersant & 1 x C130 Hercules delivering 24 m^3/day **Aviation Base (initial):** Darwin (allows 4 FWADC sorties/day) FWADC flight time from Darwin: 60 minutes. **Aviation Base (Day 12):** Wyndham (allows 5 FWADC sorties/day) FWADC flight time from Wyndham: 32 minutes. **Aviation Base (77days):** Darwin (C130 Hercules – 2 sorties/day) C130 Hercules Flight Time from Darwin: <60 minutes. Figure 9.1 illustrates airfields closest to Beehive-1, distances and flight times (based on the AT-802 used by AMOSC).	
Vessel application	From Day 4/5: Vessel application commences (6 m^3 per 2 days; 3 vessels operating). Steaming Time from Marine Base (Darwin): 15 hrs. Marine Base: Darwin.	
Maximum dispersant application rate (based on assumptions)	126 m^3/day	
Dispersant application area	The following no-go zones for dispersant application are illustrated in Figure 9.2:	
	• JBG AMP (and a 10 km buffer around it).	To prevent impacts to listed values.
	• WA or NT marine parks (and a 10 km buffer around them).	
	• WA or NT waters.	To minimise impacts to sensitive coastal habitats such as mangroves and to coastal users.
	• Waters less than 20 m deep.	
	• 1 km around the drill site.	To allow maximum evaporation of fresh oil and prevent impacts to first responders on the MODU or support vessels.

OSTM Results for Surface (Floating) Oil

The stochastic modelling included 100 individual simulations for each season. The maximum distances recorded for floating oil at the lowest exposure threshold (1 g/m^2) was 1,048 km, 1,136 km and 1,517 km for the summer (Oct-Feb), transitional (Mar & Sept) and winter (Apr-Aug) seasons, respectively, for the unmitigated simulations (i.e., no dispersant used). This reduced to 994 km, 1,030 km and 1,257 km for the summer, transitional and winter seasons, respectively, for the mitigated simulations (i.e., dispersant used) (Table 9.5).

When the single worst simulation is removed, the 99th percentile maximum distance was 731 km, 903 km and 730 km for the summer, transitional and winter seasons, respectively, for the unmitigated simulations. A slight reduction to 728 km, 861 km and 686 km was predicted for the summer, transitional and winter seasons, respectively, for the mitigated simulations (see Table 9.5).

Table 9.5. Floating oil exposure for unmitigated and mitigated scenarios

Season	Distance travelled from the release location (km)	Zones of potential floating oil exposure					
		Unmitigated			Mitigated		
		Low	Moderate	High	Low	Moderate	High
Summer	Maximum	1,048	153	49	984	134	125
	99th percentile	731	95	45	728	121	46
Transitional	Maximum	1,136	79	49	1,030	115	50
	99th percentile	903	62	46	861	56	46
Winter	Maximum	1,517	79	61	1,257	84	63
	99th percentile	730	68	55	686	68	57

OSTM Results for Shoreline Oiling

Without applying dispersants, the maximum volume of oil predicted to wash ashore from a single simulation at, or above, the low threshold (10 g/m^2) ranged between 406.9 m^3 (winter) and 704.7 m^3 (summer) and the maximum length of shoreline contacted at the low threshold was 201 km for winter and 224 km for summer and transitional seasons (Table 9.6). With dispersants applied, the maximum volume ashore for a single spill trajectory ranged between 204.8 m^3 (winter) and 421.0 m^3 (summer), which represented a reduction of 50% in the maximum volume ashore in comparison to the unmitigated case.

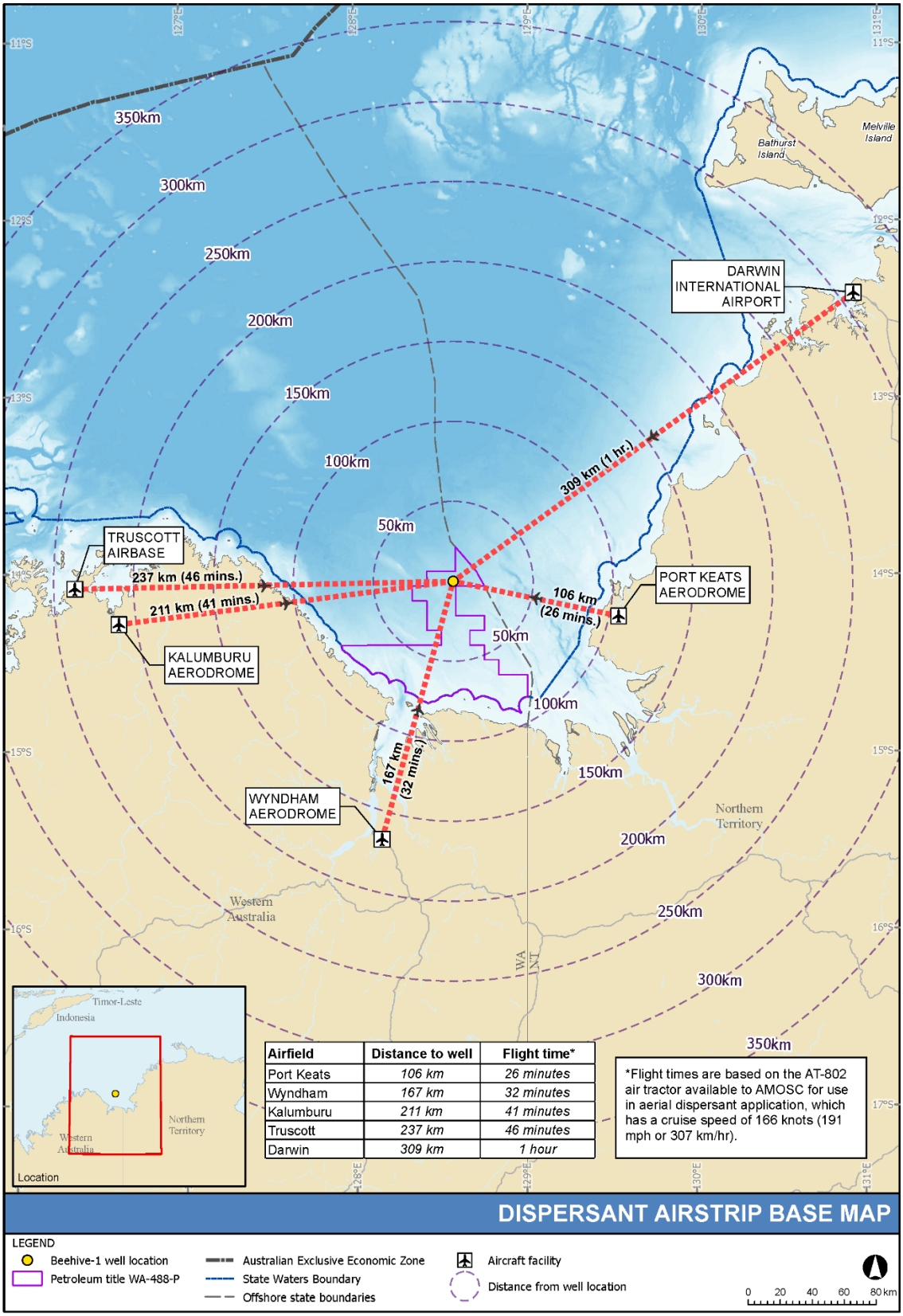


Figure 9.1. Air strips available for use for dispersant mobilisation

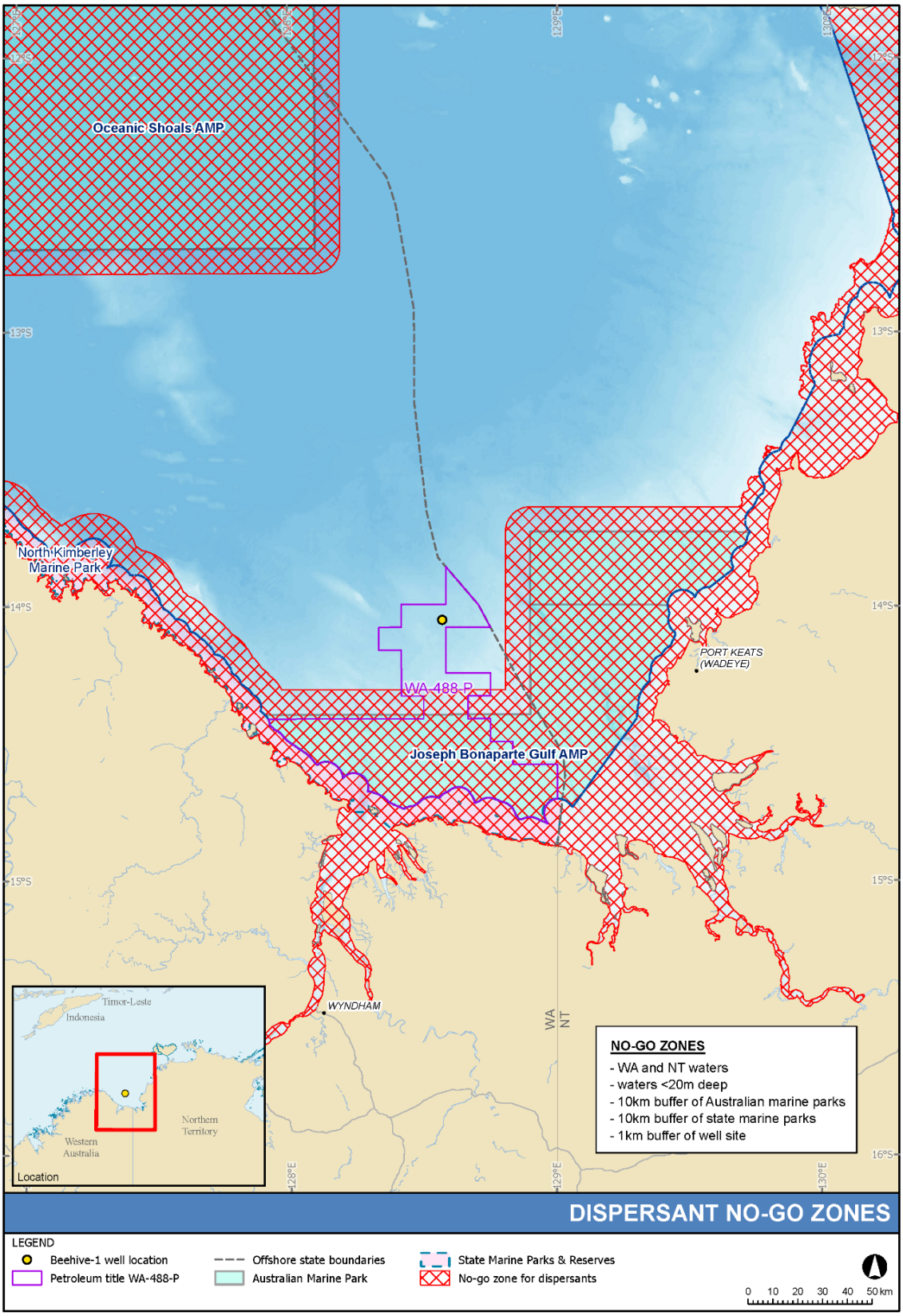


Figure 9.2. No-go zones for dispersant mobilisation

Table 9.6. Shoreline exposure for unmitigated and mitigated scenarios

Shoreline statistics	Unmitigated			Mitigated		
	Summer	Transitional	Winter	Summer	Transitional	Winter
Absolute minimum time for visible oil to shore (days)	11.58	10.29	11.25	13.17	10.79	10.71
Maximum volume of hydrocarbons ashore (m^3)	705.0	414.9	406.9	421.0	380.8	204.8
Average volume of hydrocarbons ashore (m^3)	259.5	176.9	145.8	178.6	96.8	64.2
Maximum length of the shoreline at 10 g/m2 (km)	225	224	201	151	143	132
Maximum length of the shoreline at 100 g/m^2 (km)	129	116	99	98	84	53
Maximum length of the shoreline at 1,000 g/m^2 (km)	16	9	8	13	6	2
Average shoreline length (km) at 10 g/m^2 (km)	119.7	82.6	90.9	92.9	54.4	55.2
Average shoreline length (km) at 100 g/m^2 (km)	61.6	45.5	40.9	43.6	26.2	19.1
Average shoreline length (km) at 1,000 g/m^2 (km)	5.2	3.5	2.7	3.5	2.2	1.3

The maximum length of shoreline contacted at the low threshold was 201 km for winter and 225 km for summer and transitional (unmitigated). With dispersant application (mitigated case), the maximum length of shoreline contacted at the low threshold ranged from 132 km for winter to 151 km for summer. For all seasonal conditions assessed, the modelling demonstrated a maximum reduction in the length of shoreline contact above the low (39%), moderate (27%) and high (21%) thresholds, when the surface dispersant was applied.

For the unmitigated case, the minimum time before shoreline accumulation at, or above, the low threshold ranged between 10.3 days (transitional) to 11.6 days (summer). For the mitigated case, the minimum time before shoreline accumulation at, or above, the low threshold increased ranging from between 10.7 days (winter) to 13.2 days (summer).

Table 9.7 assesses the benefits to protection priority areas (PPAs) and to nearshore subsea reefs and shoals in the JBG as a result of dispersant use (unmitigated vs mitigated). Priority protection areas are those that are likely to be contacted early (within the first 20 days of the release), are particularly sensitive to oil and hard to restore in the event of a spill (e.g., mangroves) and have ecological (e.g., Ramsar wetlands, turtle and bird nesting areas) or socio-economic (e.g., tourism) values that have a higher priority for protection than less sensitive areas (e.g., rocky shorelines).

Table 9.7. Benefits and drawbacks of dispersant use at priority protection areas within the JBG across all seasons

Location	Protection priorities	Change after dispersant application	Surface/Shoreline Loading (Prob%)			Dissolved Threshold (Prob%)		Entrained Threshold (Prob%)		Net benefit?
			Unmitigated	Mitigated	Net Benefit	Unmitigated	Mitigated	Unmitigated	Mitigated	
JBG AMP	Critical inter-nesting turtle habitat - **VERY HIGH** Intertidal coral reefs – **HIGH** Cetaceans – **MEDIUM** Sub-tidal coral reefs – **MEDIUM** Aboriginal cultural heritage - **MEDIUM** Commercial fisheries - **LOW** Tourism – **LOW** Sawfish (normal range) – **LOW**	Gain – reduced oil Gain – reduced oil Gain – reduced oil Marginal loss - ↑chance in-water exposure Overall gain – reduced oil Marginal loss - ↑chance in-water exposure No net change Marginal loss - ↑chance in-water exposure	**Summer** HIGH (5%)	HIGH (5%)	-	HIGH (89%)	HIGH (92%)	HIGH (100%)	HIGH (99%)	No
			Transitional HIGH (4%)	HIGH (4%)	-	HIGH (66%)	HIGH (67%)	HIGH (83%)	HIGH (84%)	No
			Winter HIGH (9%)	HIGH (6%)	-	HIGH (73%)	HIGH (73%)	HIGH (98%)	HIGH (99%)	Yes
Moyle River Estuary	Nesting Turtles – **HIGH** Shoreline/wetland birds (IBA) – **HIGH** NIW (Moyle Floodplain & Hyland Bay) – **HIGH** Mangroves – **HIGH** Saltmarsh – **HIGH** Exposed inter-tidal flats – **MEDIUM** Pupping areas – sawfish – **MEDIUM** Crocodile breeding area - **MEDIUM** Dugongs – **LOW** Sand Beach – **LOW** Rocky Shore – **LOW**	Gain – reduced oil Gain – reduced oil Gain – reduced oil Gain – reduced oil Gain – reduced oil Marginal loss - ↑chance in-water exposure Overall gain – reduced oil Marginal loss - ↑chance in-water exposure Gain – reduced oil Gain – reduced oil	**Summer:** 271.2m^3 (max) *74% (Mod)* *31% (High)* 54.9 m^3 (mean)	339.1 m^3 *70% (Mod)* *22% (High)* 36.8 m^3	**(67.9 m^3)** **18.1 m^3**	HIGH (34%) MOD (63%)	HIGH (27%) MOD (64%)	HIGH (77%)	HIGH (78%)	Yes
			Transitional: 164.9m^3 (max) *41% (Mod)* *21% (High)* 28.1 m^3 (mean)	54.4 m^3 *34% (Mod)* *6% (High)* 9 m^3	**110.5 m^3** **19.1m^3**	HIGH (28%) MOD (46%)	HIGH (27%) MOD (45%)	HIGH (51%)	HIGH (51%)	Yes
			Winter: 155.6m^3 (max) *35% (Mod)* *16% (High)* 16.9 m^3(mean)	45 m^3 *30% (Mod)* *2% (High)* 5.4 m^3	**110.5 m^3** **11.5m^3**	HIGH (21%) MOD (41%)	HIGH (20%) MOD (36%)	HIGH (7%)	HIGH (7%)	Yes
Victoria River Estuary	Mangroves – **HIGH** Saltmarsh – **HIGH** Exposed Inter-tidal Flats - **MEDIUM** Sawfish (Pupping Area) – **MEDIUM**	Gain – reduced oil Gain – reduced oil Gain – reduced oil Marginal loss - ↑chance in-water exposure	**Summer:** 258.3m^3 (max) *73% (Mod)* *28% (High)* 52.9 m^3 (mean)	133.6 m^3 *65% (Mod)* *19% (High)* 26.9 m^3	**124.7m^3** **26 m^3**	HIGH (19%) MOD (49%)	HIGH (16%) MOD (49%)	HIGH (70%)	HIGH (72%)	Yes
			Transitional: 228.8m^3 (max) *40% (Mod)* *14% (High)* 32.2m^3 (mean)	109.7 m^3 *34% (Mod)* *9% (High)* 13.6 m^3	**119.1 m^3** **18.6m^3**	HIGH (18%) MOD (39%)	HIGH (16%) MOD (40%)	HIGH (46%)	HIGH (47%)	Yes

Location	Protection priorities	Change after dispersant application	Surface/Shoreline Loading (Prob%)			Dissolved Threshold (Prob%)		Entrained Threshold (Prob%)		Net benefit?
			Unmitigated	Mitigated	Net Benefit	Unmitigated	Mitigated	Unmitigated	Mitigated	
			Winter: 160.7m^3 (max) *54% (Mod)* *17% (High)* 29.7 m^3 (mean)	48 m^3 *39% (Mod)* *0% (High)* 9.2m^3	**112.7 m^3** **20.5m^3**	HIGH (21%) MOD (41%)	HIGH (20%) MOD (36%)	HIGH (59%)	HIGH (58%)	Yes
Keep River Estuary/ Turtle Point	Turtle breeding habitat - **HIGH** Shoreline/wetland birds (IBA) – **HIGH** Mangroves – **HIGH** Saltmarsh – **HIGH** NIW (Legune) - **HIGH** Pupping Areas – sawfish – **MEDIUM** Inter-tidal flats – **MEDIUM** Non-threatened fish species - **LOW** Sandy beach – **LOW**	Gain – reduced oil Gain – reduced oil Gain – reduced oil Gain – reduced oil Gain – reduced oil Marginal loss - ↑chance in-water exposure Overall gain – reduced oil Marginal loss - ↑chance in-water exposure Gain – reduced oil	**Summer** 29.4 m^3 (max) *47% (Mod)* *0% (High)* 4.8 m^3 (mean)	26.4 m^3 *39% (Mod)* *1% (High)* 3.1 m^3	**3 m^3** **1.7m^3**	HIGH (10%) MOD (50%)	HIGH (9%) MOD (49%)	HIGH (66%)	HIGH (67%)	Yes
			Transitional: 20.1m^3 (max) *24% (Mod)* *0% (High)* 2.2 m^3 (mean)	10.5 m^3 *14% (Mod)* *0% (High)* 1m^3	**9.6m^3** **1.2 m^3**	HIGH (8%) MOD (39%)	HIGH (7%) MOD (39%)	HIGH (41%)	HIGH (42%)	Yes
			Winter: 23.8m^3 (max) *38% (Mod)* *0% (High)* 32 m^3 (mean)	8.9 m^3 25% (Mod) 0% (High) 1.2 m^3	**14.9 m^3** **30.8m^3**	HIGH (13%) MOD (41%)	HIGH (13%) MOD (40%)	HIGH (59%)	HIGH (58%)	Yes
Cambridge Gulf (including Ord River Floodplain, Lacrosse Island & Cape Domett) (WA) (DoT Cell 3)	Critical turtle breeding habitat - **VERY HIGH** RAMSAR Wetland - **VERY HIGH** Shoreline/wetland birds – **HIGH** Breeding BIA – dolphins – **MEDIUM**	Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Marginal loss - ↑chance in-water exposure	**Summer:** 69 m^3 (max) *26% (Mod)* *5% (High)* 5.4 m^3 (mean)	48.6 m^3 *20% (Mod)* *4% (High)* 3.6 m^3	**20.4 m^3** **1.8m^3**	HIGH (14%) MOD (46%)	HIGH (14%) MOD (42%)	HIGH (54%)	HIGH (55%)	Yes
			Transitional: 63 m^3 (max) *33% (Mod)* *2% (High)* 6.2 m^3 (mean)	34.6 m^3 *23% (Mod)* *0% (High)* 3.1m^3	**28.4m^3** **3.1 m^3**	HIGH (23%) MOD (40%)	HIGH (22%) MOD (39%)	HIGH (46%)	HIGH (47%)	Yes

Location	Protection priorities	Change after dispersant application	Surface/Shoreline Loading (Prob%)			Dissolved Threshold (Prob%)		Entrained Threshold (Prob%)		Net benefit?
			Unmitigated	Mitigated	Net Benefit	Unmitigated	Mitigated	Unmitigated	Mitigated	
	Pupping Areas – sawfish – **MEDIUM** Non-threatened fish species - **LOW** Mangroves – **HIGH** Saltmarsh – **HIGH** Inter-tidal flats – **MEDIUM** Sandy beach – **LOW** Exposed rocky shore – **LOW** Ports/harbours – **LOW** Shoreline invertebrates – **LOW** Commercial fisheries – **LOW** Aboriginal Cultural Heritage – **HIGH**	Marginal loss - ↑ chance in -water exposure Marginal loss - ↑ chance in -water exposure Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Marginal loss - ↑chance in-water exposure Overall gain – reduced oil	**Winter:** 47.1 m^3 (max) *35% (Mod)* *1% (High)* 4.9 m^3 (mean)	11.6 m^3 *20% (Mod)* *0% (High)* 1.6 m^3	**35.5 m^3** **3.3m^3**	HIGH (24%) MOD (59%)	HIGH (25%) MOD (61%)	HIGH87%)	HIGH (87%)	Yes
Berkeley River (DoT Cell 10)	Turtles breeding – **HIGH** Aboriginal Cultural Heritage – **HIGH** Shoreline/wetland birds breeding – **HIGH** Cetaceans (normal range) – **MEDIUM** Seagrass – **MEDIUM**	Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Marginal loss - ↑chance in-water exposure	**Summer:** 101.3 m^3 (max) *29% (Mod)* *8% (High)* 7.7 m^3 (mean)	40.1 m^3 *33% (Mod)* *7% (High)* 5.5 m^3	**61.2 m^3** **3.2m^3**	HIGH (31%) MOD (57%)	HIGH (29%) MOD (60%)	HIGH (67%)	HIGH (67%)	Yes
			Transitional: 97.9 m^3 (max) *37% (Mod)* *11% (High)* 13 m^3 (mean)	87.26 m^3 *30% (Mod)* *8% (High)* 7.9 m^3	**10.64m^3** **5.1 m^3**	HIGH (42%) MOD (81%)	HIGH (40%) MOD (82%)	HIGH (83%)	HIGH (84%)	Yes

Location	Protection priorities	Change after dispersant application	Surface/Shoreline Loading (Prob%)			Dissolved Threshold (Prob%)		Entrained Threshold (Prob%)		Net benefit?
			Unmitigated	Mitigated	Net Benefit	Unmitigated	Mitigated	Unmitigated	Mitigated	
	Inter-tidal Flats – **MEDIUM** Tourism Resort - **MEDIUM** Dugongs (normal range) – **LOW** Sawfish (normal range) – **LOW** Sand Beaches – **LOW** Rocky Shoreline – **LOW**	Marginal loss - ↑ chance in -water exposure Overall gain – reduced oil Overall gain – reduced oil Marginal loss - ↑ chance in -water exposure Marginal loss - ↑ chance in -water exposure Overall gain – reduced oil Overall gain – reduced oil	**Winter:** 183.8 m^3 (max) *68% (Mod)* *15% (High)* 25.1 m^3 (mean)	95.7 m^3 57% (Mod) 1% (High) 14.7 m^3	**88.1 m^3** **10.4m^3**	HIGH (92%) MOD (97%)	HIGH (91%) MOD (97%)	HIGH (97%)	HIGH (97%)	Yes
King George River (DoT Cell 13)	Aboriginal Cultural Heritage – **HIGH** Shoreline Birds – **HIGH** Corals (Inter-tidal) - **HIGH** Turtles (normal range) – **MEDIUM** Cetaceans (normal range) – **MEDIUM** Seagrass – **MEDIUM** Tourism Resort – **MEDIUM** Sub-tidal reef - **MEDIUM** Dugongs (normal range) – **LOW** Sawfish (normal range) – **LOW** Sand Beaches – **LOW** Rocky Shoreline - **LOW**	Overall gain – reduced oil Overall gain – reduced oil Overall gain – reduced oil Marginal loss - ↑chance in-water exposure Marginal loss - ↑ chance in -water exposure Marginal loss - ↑ chance in -water exposure Overall gain – reduced oil Marginal loss - ↑ chance in -water exposure Marginal loss - ↑ chance in -water exposure Marginal loss - ↑ chance in -water exposure Overall gain – reduced oil Overall gain – reduced oil	**Summer:** 52.2 m^3 (max) *23% (Mod)* *1% (High)* 3.9 m^3 (mean)	25.6 m^3 *20% (Mod)* *0% (High)* 2.2 m^3	**26.6 m^3** **1.7m^3**	HIGH (30%) MOD (52%)	HIGH (29%) MOD (50%)	HIGH (54%)	HIGH (54%)	Yes
			Transitional: 51 m^3 (max) *25% (Mod)* *0% (High)* 6.2 m^3 (mean)	21.3 m^3 24% (Mod) 0% (High) 3.2 m^3	**29.74m^3** **3 m^3**	HIGH (41%) MOD (74%)	HIGH (43%) MOD (76%)	HIGH (72%)	HIGH (73%)	Yes
			Winter: 28.7m^3 (max) *49% (Mod)* *0% (High)* 4 m^3 (mean)	10.2 m^3 17% (Mod) 0% (High) 2.2 m^3	**18.5 m^3** **1.8 m^3**	HIGH (80%) MOD (95%)	HIGH (77%) MOD (93%)	HIGH (95%)	HIGH (96%)	Yes

Receptor sensitivity ratings as per Table 8.23.

9.3.4. Hazards

The process of dispersant application creates the following hazards:

- The use of additional vessels increases the risk of strikes to megafauna, vessel collisions and vessel routine discharges;
- The use of additional aircraft (noise and emissions);
- Dispersant application to the sea increases dispersed/entrained oil within the water column (possible increased toxicity impacts) placing marine habitats at risk; and
- Dispersant application directly on marine megafauna present in the dispersant application zone.

9.3.5. Known and Potential Impacts and Risks

The potential environmental risks of the application of chemical dispersant are:

- Planned light, air and noise emissions from aircraft as per Sections 7.3, 7.4 and 7.5;
- Planned liquid and solid discharges from vessels as per Sections 7.8, 7.9, 7.10 and 7.11;
- Unplanned events from vessels as per Sections 8.1 to 8.6; and
- Toxicity impacts to marine habitats and pelagic fauna and flora species (see below).

9.3.6. Evaluation of Impacts and Risks

Dispersant application increases the amount of entrained/dissolved oil in the water column, reducing exposure of coastal ecosystems to floating weathered oil and reducing the exposure risk of seabird, turtle and marine mammal populations to floating oil (Bock *et al*., 2018; French-McCay *et al*., 2018; NRC 2005, 2013). This, however, can increase the risk of toxic effects on plankton, pelagic, demersal and benthic organisms (Hook & Lee, 2015).

Exposure of marine organisms to dispersed and dissolved oil compounds in the water column will be dependent on their proximity to the release, their position within the water column, the drift direction of the plumes, and the ability of the marine organisms to detect oil and move away from the oil.

There are advantages and disadvantages with applying dispersants depending on the receptors targeted for protection, discussed here.

Advantages

The benefits of the use of dispersant were demonstrated during the Macondo (Gulf of Mexico) oil spill in 2010. Macondo oil that reached the shoreline was heavily weathered and degraded, and contained only a small fraction of compounds of concern (PAHs), according to the multi-agency Operational Science Advisory Team study (OSAT-2) released in February 2011. That study found that PAH concentrations in residual oil or 'tar balls' were below EPA-established levels of concern for human health. According to the OSAT-2 study, weathered oil samples showed 86-98% depletion of total PAHs. The study also found that the tar balls contain mostly sand (87-96%). Extensive government seafood testing results (tested by the FDA, the US NOAA and the Gulf states) and landing information indicated no seafood exceeded the FDA's human health threshold for dispersant constituents. In fact, 99% of the samples showed no detectible residue at all (BP, 2013).

The EPA Administrator at the time of the Macondo spill stated that the surface application of dispersants was effective in breaking up the oil and reduced risk to shorelines and to surface-dwelling organisms (BP, 2014b). However, the Federal On-Scene Coordinator (FOSC) limited BP's use of dispersant five weeks after the blowout started. In the After-Action Report, it was stated the decrease in dispersant use led to increased surface oil that could not be recovered, and that this oil most likely found its way to the shores of the Gulf of Mexico (BP, 2014b).

Disadvantages

The application of chemical dispersants to a crude oil spill has the following disadvantages:

- It results in more oil moving into the water column (dissolved & entrained);
- If chemical dispersant is applied but not effective, it may decrease the effectiveness of other response measures (such as oleophilic recovery);
- It is not effective on all types of oil under all conditions;
- It adds additional extraneous substances into the marine environment; and
- There is a limited time window for use.

The use of chemical dispersants is an environmental trade-off; it is recognized that dispersants have their own set of environmental impacts (though are generally less toxic than the oils they break down), but they are used in an attempt to minimize contact with shorelines, where the oil can cause significantly more damage.

Based on the most studied dispersant formulations, the increased risk for most taxa from dispersants comes from the increased solubility (and therefore bioavailability) of the toxic components of the oil, not the dispersant itself (Negri *et al*., 2018). Many other recent studies (e.g., Brakstad *et al*., 2018b; Fingas, 2002; 2011; Hansen *et al*., 2014), found modern dispersants to be significantly less toxic than the oil alone or the dispersed oil.

Results from studies looking at potential synergetic effects of dispersants in oil exposure have suggested that the dispersants make it easier to move hydrocarbons across membranes – and thus may enhance exposure (NRDA, 2012).

Shortly after the Macondo oil spill, reports suggested that oil and dispersant constituents became entrained in the pelagic food web (Tjeerdema *et al*., no date). Dispersed oil in the shallow water column became incorporated into at least two trophic levels beyond prokaryotic hydrocarbon consumers. Dispersed oil was also observed in blue crab larvae. Contaminants from dispersed oil may result in long-term adverse effects such as carcinogenesis, impaired reproduction, shortened life spans and decreased population numbers in planktonic organisms. Additionally, exposure to contaminants found in oil and dispersants during early phases of the life cycle can lead to infertility and a host of developmental problems (Tjeerdema *et al*., no date).

Effective dispersion of oil may increase the acute (short-term, sometimes lethal) impacts on marine life living in the top few metres of the sea in the vicinity of the spill due to the dissolution of the smaller more volatile molecules into the water column rather than evaporating from the sea surface. However, these impacts are usually time-limited because of the rapid dilution of the dispersed oil (IPIECA-IOGP, 2014a). This is supported by earlier research that states where the dilution potential is greatest (i.e., the open ocean), concentrations of dispersed oil high enough to cause adverse effects are unlikely to persist for more than several hours (API, 2001).

The ultimate long-term effects will depend on the concentration, location and persistence of dispersed oil and the duration and timing of exposure to organisms (Tjeerdema *et al*., no date).

Impacts to receptors

Table 9.8 assesses the risk of increased exposure to dissolved and entrained oil to the receptors in the spill EMBA as a result of chemical dispersion.

Table 9.8. Consequence evaluation for increased dissolved and entrained hydrocarbons

General impacts and risks	Beehive-1 specific impacts and risks
Plankton (described in Section 5.4.3 and Appendix 11, Section 11.3.3)	
Plankton may be directly impacted by in-water and surface hydrocarbons. Plankton are an important food source for commercially targeted fish species (such as prawns) and planktonic larval stages of pelagic and benthic biota are broadly distributed in low densities across the region. Larval densities are expected to be lower further from shore and from source populations in the shallower waters of the shelf. Field observations from oil spills show minimal or transient effects on marine plankton (Volkman *et al*., 2004). Oil can affect the rate of photosynthesis and inhibit growth in phytoplankton, depending on the concentration. For example, photosynthesis is stimulated by low concentrations of oil in the water column (10–30 ppb) but becomes progressively inhibited above 50 ppb. Conversely, photosynthesis can be stimulated below 100 ppb for exposure to weathered oil (Volkman *et al*., 2004). Reproduction by survivors or migration from unaffected areas would be likely to rapidly replenish any losses from permanent zooplankton (Volkman *et al*., 2004). Once background water quality conditions have re-established, the plankton community will take weeks to months to recover (ITOPF, 2011a), allowing for seasonal influences on the assemblage characteristics. Plankton found in open waters of the JBG are expected to be widely represented across the northern tropics. Migration from outside affected areas is expected to aid in the re-establishment of plankton communities if there was a population decline.	The modelling shows that in-water exposure at high dissolved and entrained thresholds may result in a large area around the source of the spill. At these levels, some sensitive mature individuals and early life stages (larvae, gametes and juveniles) may experience mortality upon exposure. Modelling indicates that exposure to in-water concentrations is unlikely to have an adverse effect on plankton in areas of biological significance, such as the Sahul Shelf bank and terrace (min. water depth- 30m); Pinnacles of the Bonaparte Basin (min. water depth of 30m); Van Diemen Rise carbonate banks and terrace system (min. water depth 10m); Ancient coastline (125m water depth); and the fringing reef systems of Ashmore Reef, Cartier Island, Mermaid Reef, Rowley Shoals, Scott and Seringapatam Reef systems and thus effects on higher trophic levels are not expected. Dispersant application is predicted to have the following effects on in-water hydrocarbon concentrations within these KEFs as follows: - **Sahul Shelf Carbonate Bank & Terrace System KEF** (Untreated - Dissolved: High, probability up to 95%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 95%; Entrained – High, probability up to 100%)) - **Van Diemen Rise carbonate bank and terrace system KEF** (Untreated - Dissolved: Moderate, probability up to 6%; Entrained – High, probability up to 20%. With Dispersant Use – Dissolved: Moderate probability up to 5%; Entrained – High, probability up to 20%)) - **Pinnacles of the Bonaparte Basin KEF** (Untreated - Dissolved: High, probability up to 3%; Entrained – High, probability up to 37%. With Dispersant Use – Dissolved: High, probability up to 3%; Entrained – High, probability up to 38%)) - **Seringapatam/Scott reef complex KEF** (Untreated - Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 8%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 8%)

General impacts and risks	Beehive-1 specific impacts and risks
	- **Reef System of Ashmore Reef (**Untreated - Dissolved: Low, probability up to 5%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 3%) - **Reef system of Cartier Island** (Untreated - Dissolved: Low, probability up to 4%; Entrained – High, probability up to 15%. With Dispersant Use – Dissolved: Low, probability up to 3%; Entrained – High, probability up to 15%) - **Reef system of Mermaid Reef/Rowley Shoals** (Untreated - Dissolved: Moderate, probability up to 2%; Entrained – Low, probability up to 7%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – Low, probability up to 6%) Exposure to greater concentrations of dissolved and entrained hydrocarbons due to the use of dispersants may result in marginally higher short-term impacts to local plankton populations. Taking into consideration the role of plankton at the base of the marine food web, dispersant application is expected to have a **minor** consequence.
Benthic invertebrates, habitats and communities (described in Section 5.4.1 and Appendix 11, Section 11.3.1)	
Sessile organisms on the seabed (especially in shallow waters) that cannot relocate may experience higher exposures compared with marine organisms that can relocate. Sessile organisms close to the release location can be exposed to high concentrations of dispersed oil for prolonged periods, though it is recognised that the risk to benthic habitats in deeper waters is less than that closer to the sea surface (IPIECA-IOGP, 2015a). Impacts from entrained (including chemically entrained) oil may include the effects of oxygen depletion in bottom waters resulting from the metabolic processes of bacteria degrading the oil (biological oxygen demand). Chemical oil dispersants, such as those used during the Macondo spill (e.g., Corexit 9500) may affect transport of oil from the water column by forming marine oil 'snow' with detritus, plankton/phytoplankton and microbes/bacteria that sinks to the seabed (Passow *et al*., 2016). While some of the 'snow' biodegrades before reaching the seabed, some accumulates on the seabed, resulting in increased oil in sediments where it is biodegraded by sediment microbes.	Resident fauna such as worms, molluscs and crustaceans may suffer impacts from oil in marine snow that penetrates the sediments. Given the depth of benthic species within the KEFs (refer to 'plankton' above), benthic species and habitats in these areas are not likely to be exposed to levels of in-water hydrocarbons above thresholds of ecological significance. Deepwater hard corals, if present, occur at minimum water depths of 10-20m in the JBG and surrounding waters (e.g., Barracouta Shoals, Big Bank Shoals, Cootamundra Shoals, Eugene McDermott Shoal, Goree Shoal, Vulcan Shoal) and minimum water depths of 30m on the Sahul Shelf and van Diemen Rise carbonate bank and terrace systems. These systems would be adversely affected by increased sedimentation of oiled detritus and entrained hydrocarbons. It is possible that shoals and reefs in the region would be exposed to hydrocarbons in the water column at moderate to high levels given their proximity to the source.

General impacts and risks	Beehive-1 specific impacts and risks
Surface deposit or detritus feeders such as annelid worms, gastropods, or echinoderms are most likely to be affected by sedimented hydrocarbons rather than from entrained/dissolved oil. While exposure can lead to impacts including mortality, recovery of benthic habitats exposed to entrained hydrocarbons would be expected to be rapid, following return to background water quality conditions within weeks to months of contact (Burns *et al*., 1993; Dean *et al*., 1998). The ecological implications of potential reduction in diversity and abundance of benthic invertebrates will be dependent on the habitat affected. Areas of highly mobile sediment, where diversity and abundance are relatively low, will likely recover quickly. Complex assemblages (e.g., sponge habitat) or slow-growing sessile invertebrates are likely to recover more slowly. Persistent toxic components in some dispersants have been found in deep sea corals (White *et al*., 2014). Filter feeding organisms that prey on plankton can ingest naturally- or chemically dispersed oil droplets when they are of a similar size to some plankton. Relatively simple organisms, such as bivalves, cannot biochemically process the higher molecular weight PAHs in the oil, and these PAHs can build up (bioaccumulate) in some organs (IPIECA-IOGP, 2015a). Predators that consume oil-contaminated bivalves can therefore be exposed to elevated concentrations of the higher molecular PAHs by this ingestion route.	Following the Macondo spill (White *et al*., 2014), deep water corals were found to have been impacted by flocculant material (containing oil) up to approximately 20 km from the release location in the direction of prevailing current. The modelling indicates that deposition of drill muds and cuttings around the wellhead during drilling is omni-directional, so it is possible that benthic communities on shoals and reefs may also be affected to those distances. Overall, predicted impacts to benthic habitats vary widely according to species and location (nearshore versus offshore). Additional impacts associated with marine oil snow is expected to be localised and short to medium term and is assigned a consequence of **moderate**.
Fish (described in Section 5.4.4 and Appendix 11, Section 11.3.4)	
Pelagic fish may be exposed to greater concentrations of dissolved and entrained hydrocarbons as a result of dispersant application if they within the modelled plume of entrained oil. However, generally these species are highly mobile and only a small proportion would be expected to remain at the depth of the entrained plume for long enough to suffer extended exposure to moderate–high concentrations of oil. The richer assemblages of fish and cephalopods in the shallower waters of the JBG are unlikely to be exposed to moderate–high concentrations of entrained oil as a result of dispersant use being restricted to offshore waters. Organisms that possess livers, such as fish, can quickly metabolise PAH although some of these metabolites may be harmful.	Fish present in the deeper waters of the EMBA include the grey nurse shark (15-40m depths); great white shark, shortfin and longfin mako sharks and oceanic whitetip sharks. Areas of high productivity which attract aggregations of fish are predicted to be impacted by entrained or dissolved hydrocarbons as follows: - **Arafura AMP** (Untreated - Dissolved: Low, probability up to 1%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Low, probability up to 2%; Entrained – High, probability up to 3%); - **Argo-Rowley AMP** (Untreated – Dissolved: Moderate, probability up to 5%; Entrained – High, probability up to 10%. With Dispersant Use – Dissolved: Low, probability up to 3%; Entrained – High, probability up to 8%);

General impacts and risks	Beehive-1 specific impacts and risks
	- **Ashmore Reef AMP** (Untreated – Dissolved: Low, probability up to 5%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 3%); - **Cartier Island AMP** (Untreated – Dissolved: Low, probability up to 4%; Entrained – High, probability up to 15%. With Dispersant Use – Dissolved: Low, probability up to 3%; Entrained – High, probability up to 15%); - **Mermaid Reef AMP** (Untreated – Dissolved: Moderate, probability up to 2%; Entrained – Low, probability up to 7%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – Low, probability up to 6%); - **JBG AMP** (Untreated – Dissolved: High, probability up to 89%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 92%; Entrained – High, probability up to 99%); - **Kimberley AMP** (Untreated – Dissolved: High, probability up to 24%; Entrained – High, probability up to 88%. With Dispersant Use – Dissolved: High, probability up to 22%; Entrained – High, probability up to 88%); - **Oceanic Shoals AMP** (Untreated – Dissolved: High, probability up to 2%; Entrained – High, probability up to 49%. With Dispersant Use – Dissolved: High, probability up to 2%; Entrained – High, probability up to 50%); - **Ancient coastline KEF** at 125m depth (Untreated – Dissolved: High, probability up to 2%; Entrained – High, probability up to 47%. With Dispersant Use – Dissolved: High, probability up to 2%; Entrained – High, probability up to 47%); - **Sahul Shelf Carbonate Bank & Terrace System KEF** (Untreated – Dissolved: High, probability up to 95%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 95%; Entrained – High, probability up to 100%); - **Van Diemen Rise carbonate bank and terrace system KEF** (Untreated – Dissolved: Moderate, probability up to 6%; Entrained – High, probability up to 20%. With Dispersant Use – Dissolved: Moderate probability up to 5%; Entrained – High, probability up to 20%); - **Continental slope Demersal Fish Communities KEF** (Untreated – Dissolved: High, probability up to 1%; Entrained – High, probability up to 32%. With

General impacts and risks	Beehive-1 specific impacts and risks
	Dispersant Use – Dissolved: High, probability up to 1%; Entrained – High, probability up to 32%); - **Pinnacles of the Bonaparte Basin KEF** (Untreated – Dissolved: High, probability up to 3%; Entrained – High, probability up to 37%. With Dispersant Use – Dissolved: High, probability up to 3%; Entrained – High, probability up to 38%); - **Seringapatam/Scott reef complex KEF** (Untreated – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 8%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 8%). While modelling predicts that some AMPs and KEFs may be affected by moderate to high levels of hydrocarbon exposure, increases in exposure levels and the associated probability of exposure do not vary significantly between the unmitigated and mitigated spills (i.e., dispersant used). On this basis, given the mobility of fish in open waters, that fish can metabolise PAHs and the limited exposures predicted, only a small increase in impact to pelagic fish could be expected due to dispersant use. The consequence is assigned as **minor.** Shallow inshore species include various syngnathids (seahorses, pipefish, pipe horses and sea dragons) and sawfish. Given that dispersants will be applied close to the well site and not within WA/NT waters, AMPs or marine parks, the consequences to shallow water fish species will be limited to affected water inflows. Modelling predicts the following in-water hydrocarbon water concentrations for inshore areas: - **Emu Reef** (NT) (Untreated – Dissolved: High, probability up to 35%; Entrained – High, probability up to 81%. With Dispersant Use – Dissolved: High, probability up to 38%; Entrained – High, probability up to 82%); - **King Shoals** (WA) (Untreated – Dissolved: High, probability up to 92%; Entrained – High, probability up to 83%. With Dispersant Use – Dissolved: High, probability up to 91%; Entrained – High, probability up to 84%); - **North Kimberley MP** (Untreated – Dissolved: High, probability up to 88%; Entrained – High, probability up to 97%. With Dispersant Use – Dissolved: High, probability up to 90%; Entrained – High, probability up to 97%);

General impacts and risks	Beehive-1 specific impacts and risks
	Shallow inshore species are less likely to be able to move away from in-water hydrocarbons and may be exposed for longer periods. As fish are most vulnerable to hydrocarbons during their embryonic, larval and juvenile life stages, nursery areas are more likely to suffer developmental effects, morbidity or mortality at lower concentrations. For shallow water areas, the use of dispersant does not significantly change exposure levels or probabilities of exposure between dispersed and non-dispersed scenarios. As per offshore areas, the consequence to inshore fish as a result of using dispersant is assessed as **minor,** given thepredicted impacts associated with the unmitigated spill and the localised nature of the potential impact.
Seagrass (described in Appendix 11, Section 11.3.2)	
Dispersants can injure aquatic vegetation by breaking down the thin waxy cuticle of the plant, allowing greater penetration of oil fractions into leaves, thereby increasing phytotoxicity. In addition, this physical damage to the cuticle could cause a reduction in growth due to the increased physiological stress on the plant (NRDA, 2012). A study of the effects of oil and dispersed oil on temperate seagrasses by the Sydney University of Technology (Wilson, 2011) found that in most cases, the non-dispersed oils had less of an impact (photosynthetic stress) to the seagrasses *Zostera capricorni* and *Halophila ovalis* than the dispersed oil treatments. Wilson (2011) reports that seagrasses absorb more aliphatic and aromatic oil fractions when the oil is dispersed, thereby increasing its toxicity. The dispersants may affect the waxy cuticle of the seagrass blade, thereby increasing the penetrability of the dispersed oil to the photosynthetic organs, particularly the thylakoid membrane. As dispersed oil is more susceptible than non- dispersed oil to microbial breakdown, this leads to greater oxygen demand by microbes. A reduction in the oxygen in the seagrass community may impact on the seagrass system, as they have a high respiratory demand to support their large non-photosynthetic underground biomass (Wilson, 2011). Subtidal seagrasses can be exposed to oil by direct contact with the WAF and by rhizomal uptake from contaminated sediments. In addition, seeds may be affected by contact with oil contained within sediments (NRDA 2012) and the buoyant	While it is unlikely the effects of dispersant application will manifest themselves along the coast of the spill EMBA (because dispersant will be sprayed in offshore areas a significant distance from the coast), if such effects do occur, they are likely to be isolated given the patchy distribution of macroalgal communities along the coastline. Seagrass beds are present around Cape Londonderry, Ashmore Reef, Cobourg Peninsula, Vernon islands and Berkeley River. Given the distance from the potential source of the spill, and the natural distribution of seagrass communities, the OSTM predicts that these locations will be exposed to the following levels of in-water hydrocarbon (worst seasonal results quoted for all locations): - **Cape Londonderry** (Untreated – Dissolved: High, probability up to 74%; Entrained – High, probability up to 94%. With Dispersant Use – Dissolved: High, probability up to 68%; Entrained – High, probability up to 95%); - **Ashmore Reef AMP** (Untreated – Dissolved: Low, probability up to 5%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 3%); - **Cobourg Peninsula** (Untreated – Dissolved: Low, probability up to 1%; Entrained – High, probability up to 6%. With Dispersant Use – Dissolved: Low, probability up to 1%; Entrained – High, probability up to 6%);

General impacts and risks	Beehive-1 specific impacts and risks
seedlings of seagrass species may also be exposed to floating oil; however, this effect would be reduced by dispersant application. When seagrass leaves are exposed to hydrocarbons, sub-lethal quantities of the soluble fraction can be incorporated into the tissue, causing a reduction in tolerance to other stress factors (Zieman *et al*., 1984). Ballou et al (1987) conducted field experiments to assess the effects of dispersants, untreated crude and chemically dispersed oil on shallow water sub-tidal seagrasses. No significant effects on seagrass growth rates were measured at the untreated or chemically dispersed sites following treatment. Seagrass density declined at the chemically dispersed site following treatment but returned to greater than pre-spill levels after 7 months. The density of seagrasses at the untreated crude spill site also declined after treatment but did not return to pre-treatment levels. The abundance of sea urchins reduced dramatically at the chemically dispersed site such that no live sea urchins were present 4 months after treatment, however populations reappeared after 12 months. For the untreated spill site, there was a slight decrease in sea urchin abundance after site treatment followed by large increases in abundance recorded 7 months post spill. At both sites, the density and diversity of infauna were extremely variable and no discernible pattern over time between the sites were observed. Ballou et al (1987) notes that the field study simulated a severe, worst-case spill of unweathered Prudoe Bay crude oil with dispersant application in nearshore waters of a slowly flushed, semi-enclosed bay which is not reflective of conditions associated with a Beehive LoWC (i.e., open ocean spraying of semi-weathered crude oil along predominantly open coastlines).	- **Vernon Islands** (Untreated – Dissolved: High probability up to 3%; Entrained – High, probability up to 24%. With Dispersant Use – Dissolved: High, probability up to 2%; Entrained – High, probability up to 24%); - **Berkeley River** (Untreated – Dissolved: High probability up to 92%; Entrained – High, probability up to 97%. With Dispersant Use – Dissolved: High, probability up to 91%; Entrained – High, probability up to 97%). Based upon modelling outcomes, some areas containing seagrass are predicted to encounter high levels of in-water hydrocarbon. and dissolved fractions that tend to result in the greatest impacts. The use of dispersant, however, does not significantly alter the potential for in-water exposure at these locations (i.e., exposure levels and probabilities are similar between mitigated and unmitigated cases). AAs identified by Ballou et al (1987) sub-tidal seagrasses affected by chemically treated in-water hydrocarbons may take 12 months to recover but will be protected from surface oil due to the presence of the overlying water. On this basis, the consequence to sub-tidal seagrass associated with dispersant use, based on the studies of Ballou et al (1987) is **moderate** (localised and short-term). Intertidal seagrasses are more likely to be affected by shoreline accumulations of oil; however, these affects would be reduced by dispersant application offshore. On this basis, the use of dispersant isassessed as **beneficial**.
Seabirds and shorebirds (described in Section 5.4.7 and Appendix 11, Section 11.3.7)	
The change in the risk profile for seabirds and shorebirds resulting from dispersant application is related primarily to the benefit gained from the reduced sea surface oiling. The greater proportion of oil becoming entrained and dissolved would increase exposure for diving birds in offshore/nearshore areas where the concentrations are high enough to have an adverse effect, and indirectly thorough hydrocarbon biomagnification through the food web. Prey fish species, such as sardines and other baitfish, exposed to entrained or dissolved oil may retain some hydrocarbons in their tissues which would then be taken up by the birds.	Given the depth at which most in-water hydrocarbon will suspend until it is biodegraded, together with the reduction in the exposure of birds in offshore, coastal and nearshore areas to floating oil and shoreline accumulations, the overall consequences to birds are considered limited to local effects on individual birds associated with possible decrease in the abundance of prey or bioaccumulation of hydrocarbons in the individual birds. As per previous assessments, increases in in-water hydrocarbons as a result of dispersant use is not significant when compared with the unmitigated spill

General impacts and risks	Beehive-1 specific impacts and risks
Sea surface slicks and shoreline accumulation effects on shorebirds, roosting seabirds and foraging birds in general will be reduced by dispersant application offshore. Diving seabirds/shorebirds may be exposed to increased concentrations for both dissolved and entrained but reduced exposure to surface oils.	scenario. Therefore the consequence associated with dispersant use to marine birds is assessed as **moderate**.
Marine reptiles (described in Appendix 11, Section 11.3.6)	
Marine reptiles, specifically turtles and sea snakes, are potentially directly impacted by the toxicity of in-water hydrocarbons through ingestion of floating oil and breathing of volatile hydrocarbons at the sea surface. Impacts to reptiles through physical oiling or in-waterhydrocarbon concentrations is provided in Table 8.34. Marine reptiles are also at risk of dispersant exposure where application is occurring, During the Macondo spill, the threats and damages from dispersant exposure are closely tied to the location and timing of the application of dispersant on slicks. Only 1 out of 68 heavily oiled turtles tested positive for the presence of chemicals found in dispersants; no other sampled turtles had detectable levels of dispersant based on available tests (Bailey *et al*., 2021). The492ffectt of dispersants on turtles is largely unknown, however dispersants have the potential to interfere with lung function, digestion and salt gland function (Shigenaka, 2003). In an exposure study investigating the effects of crude oil, dispersant and a crude/dispersant combination on loggerhead hatchlings, significant differences between treatment and non-exposed controls were detected in multiple blood chemistry parameters (Harms et al, 2014). Electrolyte imbalances and hydration challenges were worst in the combined oil/dispersant group and the failure to gain weight was noted in the dispersant and combined exposed hatchlings (Harms *et al*., 2014). Frasier et al (2020) surmises that since oil itself is generally toxic and can be lethal, dispersants may improve short-term survival of marine megafauna by reducing oil slick formation, decreasing the probability of heavy oiling and accelerating the initial degradation of the released oil.	Dispersant application will not be undertaken in marine parks or within 10 km of park boundaries, in WA and/or NT territorial waters or in waters less than 20 m deep (see Figure 9.2). Outside of these areas, dispersant will be applied to released oil with weathering up to 72 hours which limits the area of dispersant application. Important critical habitats for marine turtles are present within the EMBA. This includes the following: - Flatback turtle inter-nesting BIA within a 60 km radius of Cape Dommett/Lacrosse Island with movements confined to longshore movements in coastal waters; - Flatback inter-nesting area north of Daly River (NT) around the Cobourg Peninsula and Tiwi Islands; - Green turtle and olive ridley foraging BIA within the JBG; and - Flatback turtle and olive ridley foraging BIA which intersects the Oceanic Shoals AMP. The OSTM identified that the use of dispersant in a Beehive LoWC incident would have the following exposures on at these locations: - **Cape Domett/Lacrosse Island** (Untreated – Dissolved: High, probability up to 24%; Entrained – High, probability up to 67%. With Dispersant Use – Dissolved: High, probability up to 25%; Entrained – High, probability up to 67%) - **Daly River** ((Untreated – Dissolved: High, probability up to 5%; Entrained – High, probability up to 64%. With Dispersant Use – Dissolved: High, probability up to 3%; Entrained – High, probability up to 64%)

General impacts and risks	Beehive-1 specific impacts and risks
	- **Cobourg Peninsula** (Untreated – Dissolved: Low, probability up to 1%; Entrained – High, probability up to 6%. With Dispersant Use – Dissolved: Low, probability up to 1%; Entrained – High, probability up to 6%) - **Bathurst/Melville Island** (Untreated – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 19%. With Dispersant Use – Dissolved: Moderate, probability up to 3%; Entrained – High, probability up to 19%) - **JBG AMP** (Untreated – Dissolved: High, probability up to 89%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 92%; Entrained – High, probability up to 99%) - **Oceanic Shoals AMP** (Untreated – Dissolved: High, probability up to 2%; Entrained – High, probability up to 49%. With Dispersant Use – Dissolved: High, probability up to 2%; Entrained – High, probability up to 50%)) Individual marine reptiles may come into contact with moderate-high concentrations of in-water hydrocarbons in the offshore and near-shore areas of the JBG close to the areas of dispersant application, however the in-water concentrations and probability of exposure is not significant between the unmitigated and mitigated (dispersant) scenarios. Therefore dispersant use to mitigate shoreline oiling are not expected to have additional impacts over and above the level of impact assessed in Table 8.34. Impacts to Turtles associated with dispersant use are assessed as **minor**.
Marine mammals (described in Appendix 11, Section 11.3.5)	
Marine mammals can be exposed to chemically dispersed hydrocarbons through: • Internal exposure by consuming oil or contaminated prey; • External exposure, by swimming in oil and having oil directly on the skin and body; and • External transfer of contaminants to embryos (NRDA 2012). Physical impacts from ingested hydrocarbon with subsequent lethal or sub-lethal impacts are applicable to entrained and surface oil. However, the susceptibility of cetaceans varies with feeding habits. Baleen whales are likely to ingest surface oil as	Marine mammals with BIAs in the spill EMBA, and therefore at potential risk of encountering dispersant entrained hydrocarbons, are the pygmy blue whale, humpback whale, Australian humpback dolphin, Australian snubfin dolphin, Indo-Pacific spotted bottlenose dolphin and the dugong. Significant locations for these mammals include: - **Napier/Broome Bay** (significant habitat for Australian humpback dolphin, foraging/ breeding/ calving habitat for Australian snubfin dolphin); - **Vansittart Bay Anjo Peninsula** (significant habitat for Australian humpback dolphin, foraging/breeding/calving habitat for Australian snubfin dolphin);

General impacts and risks	Beehive-1 specific impacts and risks
they feed at the surface and in the water column. Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. As highly mobile species, in general it is very unlikely that these animals will be constantly exposed to elevated concentrations of hydrocarbons in the water column for continuous durations (e.g., >96 hours) that could lead to chronic effects. Many marine mammals also have liver enzymes that metabolise hydrocarbons and excrete them as polar derivatives (Ball & Truskewycz, 2013).	- **Bougainville Peninsula** (significant habitat for Australian humpback dolphin, foraging/breeding/ calving habitat for Australian snubfin dolphin); - **Cape Londonderry** (foraging habitat for Australian snubfin dolphin); - **Ord River** (foraging/breeding/calving habitat for Australian snubfin dolphin). The OSTM identified that the use of dispersant in a Beehive LoWC incident would have the following exposures on at these locations: - **Napier/Broome Bay** (Untreated - Dissolved: High, probability up to 19%; Entrained – High, probability up to 89%. With Dispersant Use – Dissolved: High, probability up to 19%; Entrained – High, probability up to 89%); - **Vansittart Bay Anjo Peninsula** (Untreated - Dissolved: High, probability up to 17%; Entrained – High, probability up to 88%. With Dispersant Use – Dissolved: High, probability up to 15%; Entrained – High, probability up to 89%); - **Bougainville Peninsula** (Untreated - Dissolved: High, probability up to 15%; Entrained – High, probability up to 86%. With Dispersant Use – Dissolved: High, probability up to 16%; Entrained – High, probability up to 86%); - **Cape Londonderry** (Untreated - Dissolved: High, probability up to 74%; Entrained – High, probability up to 94%. With Dispersant Use – Dissolved: High, probability up to 68%; Entrained – High, probability up to 95%); and - **Ord River** (Untreated – Dissolved: High, Probability up to 5%; Entrained – High, probability up to 64%. With Dispersant Use – Dissolved: High, probability up to 5%; Entrained – High, probability up to 65%). Based upon modelling outcomes, some areas containing important habitat for marine mammals are predicted to encounter high levels of in-water hydrocarbon and dissolved fractions. The use of dispersant, however, does not significantly alter the potential for in-water exposure at these locations (i.e., exposure levels and probabilities are similar between mitigated and unmitigated cases). While impacts as described in Table 8.33 may occur, based upon modelling results there will not be significant additional impacts to these locations as a result of dispersant use. On this basis, impacts to mammals from in-water concentrations of hydrocarbons in shoreline locations resulting from dispersant use is assessed as **minor**.

General impacts and risks	Beehive-1 specific impacts and risks
Corals (described in Appendix 11, Section 11.3.1)	
Field experiments undertaken to assess the effect of untreated crude and chemically dispersed oil on shallow water sub-tidal coral reefs (containing *Porites porites*, *Agaricia tenuifolia*, *Montastrea annular*is and *Acropora cervicornis*) identified the following (Ballou et al, 1987): - At the untreated crude site, there was a slight but statistically significant decrease in coral coverage over time. There was no change total organisms, total animals and total plants. - The percent coverage of coral reef substrate by epifauna and epifloral at the chemically treated site declines abruptly after treatment. The decline continued for 12 months post-spill after which the decline levelled off. The percent coverage by all assessment categories (total organisms, total animals, corals and total plants) declined during the study period. The effects of dispersed oil on *P.porites* was not great but a sight, significant reduction in 2 of 3 growth parameters was measures in the post-spill survey period. The coral species *Agaricia tenuifolia* showed clear signs of reduced growth rates. There were no significant changes in growth rates of *Montastrea annular*is and *Acropora cervicornis* at either the treated or untreated sites. The author notes that the field study simulated a severe, worst-case spill of unweathered Prudoe Bay crude oil in nearshore, shallow waters of a slowly flushed, semi-enclosed bay. Total hydrocarbon exposures at the coral sites were between 475-755ppm-hours, significantly higher than those expected from predictive modelling. Direct inter-tidal coral physical oiling impacts are described in Table 8.26.	Predictive modelling identified that the use of dispersant in a Beehive LoWC incident would have the following exposures on sub-tidal coral reef system locations identified in the EMBA (see Table 8.26): - **JBG AMP** (Untreated - Dissolved: High, probability up to 89%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 92%; Entrained – High, probability up to 99%); - **Ashmore Reef AMP** (Untreated - Dissolved: Low, probability up to 5%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 3%); - **Cartier Island AMP** (Untreated - Dissolved: Low, probability up to 4%; Entrained – High, probability up to 15%. With Dispersant Use – Dissolved: Low, probability up to 3%; Entrained – High, probability up to 15%); - **Mermaid Reef AMP** (Untreated - Dissolved: Moderate, probability up to 2%; Entrained – Low, probability up to 7%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – Low, probability up to 6%); - **Browse Island** (Untreated - Dissolved: High, probability up to 1%; Entrained – High, probability up to 46%. With Dispersant Use – Dissolved: Moderate, probability up to 7%; Entrained – High, probability up to 46%); - **Heywood Shoal** (Untreated - Dissolved: Moderate, probability up to 4%; Entrained – High, probability up to 21%. With Dispersant Use – Dissolved: Moderate, probability up to 5%; Entrained – High, probability up to 19%); - **Mermaid Reef** (Untreated - Dissolved: Moderate, probability up to 2%; Entrained – Low, probability up to 6%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – Low, probability up to 5%); - **Vulcan Shoal** (Untreated - Dissolved: Moderate, probability up to 3%; Entrained – Low, probability up to 13%. With Dispersant Use – Dissolved: Moderate, probability up to 4%; Entrained – Low, probability up to 12%); - **Scott Reef (North& South)** (Untreated – Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 3%. With Dispersant Use –

General impacts and risks	Beehive-1 specific impacts and risks
	Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 3%); - **Seringapatam Reef** (Untreated - Dissolved: Moderate probability up to 2%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 3%); - **Emu Reef** (NT) (Untreated - Dissolved: High, probability up to 35%; Entrained – High, probability up to 81%. With Dispersant Use – Dissolved: High, probability up to 38%; Entrained – High, probability up to 82%); and - **King Shoals** (WA) (Untreated – Dissolved: High, probability up to 92%; Entrained – High, probability up to 83%. With Dispersant Use – Dissolved: High, probability up to 91%; Entrained – High, probability up to 84%). Exposure comparisons between unmitigated and mitigated results indicates that exposure levels to both dissolved and entrained hydrocarbons at these location with only marginal changes to the likelihood of exposure. Using the impacts observed by Ballou et al (1987) for dispersed oil impacts to coral on a conservative basis (i.e., lower exposures), the consequence of dispersant use is over these subtidal coral systems is assessed as *moderate*. For emergent reef systems, dispersant use and the reduction of surface oiling is assessed as *beneficial.*
Mangroves (described in Appendix 11, Section 11.2.4)	
Field experiments undertaken to assess the effects of dispersants, untreated crude and chemically dispersed oil on mangroves identified that (Ballou *et al.*, 1987): - Areas of mangroves exposed to untreated crude showed visual contamination of roots immediately post spill and seen and black globules of oil were released from sediments during the remainder of the study (20 months). The effects on adult and juvenile mangroves were severe with mortality and defoliation evident 4 months after site treatment. Partial defoliation of living trees was evident throughout the site averaging 45%. Trees located on the outer fringe next to the water showed no observable effects possibly because they were rooted in sediments that were always under water thereby reducing exposure to oil. Tree snails at the site reduced by 50% following site treatment and remained at these levels for one year after exposure. No mortality in mangrove	Significant areas of mangrove lie along the JBG coastline. The nearest mangrove forests with the highest probability of moderate to high shoreline exposures are at Quoin Island (138 km southeast), Clump Island (141 km southeast) and the southern coastline of Dorcherty Island (97 km east). Modelling predicts with dispersant application, volumes of oil stranded along JBG shorelines is reduced. Predicted impacts at these representative locations at ecological levels are: - **Quoin Island**: Up to 49% probability of impact and 59.1 m^3 of oil (peak) without dispersant. With dispersant application – up to 41% probability of impact and 40.5 m^3 stranded oil (peak). In-water dissolved phase hydrocarbon remains at high exposure levels with a probability of up to 16% of impact without dispersant and 16% impact with dispersant. In-water entrained phase hydrocarbon remains at high exposure levels with a

General impacts and risks	Beehive-1 specific impacts and risks
oysters was observed despite the uptake of high levels of hydrocarbons. Tissue levels decreased to low levels after one year. - Areas exposed to dispersed oil exhibited a light coating of sheen on exposed sediments and prop roots but after 4 months it was difficult to detect the area had been oiled. There was no measurable impact on adult mangrove trees, however short-term survival and growth of juvenile mangroves were reduced compared with pre-spill levels. Tree snails at the site reduced by 50% following site treatment and recovery to pre-treatment levels occurred after one year. No mortality in mangrove oysters was observed. Tissue levels were high 3 days post-spill and declined over 12 months to very low levels. Note in this field study dispersants were applied in nearshore waters and the author notes that the field study simulated a severe, worst-case spill of unweathered Prudoe Bay crude oil in nearshore waters of a slowly flushed, semi-enclosed bay.	probability of up to 70% of impact without dispersant and 71% impact with dispersant - **Clump Island:** Up to 42% probability of impact and 20.6m^3 of oil (peak) without dispersant. With dispersant application – up to 30% probability of impact and 20.9m^3 stranded oil (peak). In-water dissolved phase hydrocarbon remains at high exposure levels with a probability of up to 18% of impact without dispersant and 18% impact with dispersant. In-water entrained phase hydrocarbon remains at high exposure levels with a probability of up to 70% of impact without dispersant and 70% impact with dispersant - **Dorcherty Island:** Up to 54% probability of impact and 134.8 m^3 of oil (peak) without dispersant. With dispersant application – up to 39% probability of impact and 90.2 m^3 stranded oil (peak). In-water dissolved phase hydrocarbon remains at high exposure levels with a probability of up to 30% of impact without dispersant and 33% impact with dispersant. In-water entrained phase hydrocarbon remains at high exposure levels with a probability of up to 79% of impact without dispersant and 80% impact with dispersant Mangrove areas therefore benefit from dispersant application by reducing the amount of shoreline oiling above ecological levels and not significantly increasing the in-water hydrocarbon exposure levels or probability of exposure. As per Ballou et al (1987), chemically treated oil in-water concentrations may have short-term impacts to juvenile mangroves, with no measurable impact to adult mangroves. Overall, the consequence of dispersant application to mangroves is assessed as **moderate.**

General impacts and risks	Beehive-1 specific impacts and risks
Aboriginal cultural heritage, sensitivities and values (described in Appendix 11, Section 11.5)	
There are 280 registered Aboriginal sites that fall within the spill EMBA. The majority of registered sites are located along the coastline between Derby-West Kimberley, Mitchell River, Wyndham-East Kimberley shoreline sectors.	Modelling predicts that moderate-high levels of both dissolved and entrained hydrocarbons will intersect NT and/or WA coastlines during a Beehive LoWC incident. As per previous assessments into habitats and species with respect to impacts associated with dispersant use, the OSTM has identified that in-water concentrations of hydrocarbons with dispersant use are not significantly different to in-water concentrations for unmitigated spill response and at most localised impacts may be realised (e.g., corals, birds, etc.) Dispersant use does have beneficial attributes in that the volume of oil ashore is reduced, thereby providing benefit to the shoreline Aboriginal sites. Visual impacts to seascapes are also reduced. From a cultural and sea scape values perspective, dispersant application is considered **beneficial.**
Native Title (described in Appendix 11, Section 11.5.4)	
Most Native Title determination areas within the spill EMBA occurs along shorelines, with some determinations (Bindunbur, Bardi and Jarwi, Mayala People, Warrwa Mawadjala Gadjidgar, Dambimangari, Uunguu Part A, Balanggarra, Larrakia and Croker Island) extending into coastal waters.	The use of dispersants will not affect the status of Native Title in nearshore waters, though it may temporarily affect the use and values of these waters (see row above). The likelihood of contact with the Native Title determinations along the coast of the spill EMBA is detailed in Table 5.17 of Appendix 11 of the EP, with associated mapping presented in Figure 5.59 of Appendix 11. The consequence of dispersant application to Native Title is assessed as **minor.**
Commercial fisheries (described in Appendix 11, Section 11.6.1)	
The NPF and North West Slope Trawl Fishery (in the Commonwealth sector) and the MMF, Northern Demersal Scale Managed Fishery, Kimberley Crab Managed Fishery, Kimberley Prawn Managed Fishery and the Kimberley Gillnet and Barramundi Fisheries (in the WA sector), are the key commercial fisheries in the spill EMBA. Effect pathways to benthic invertebrates (such as prawns and crabs) and finfish (such as snapper and barramundi) are predicted as described in earlier sections of this table.	The OSTM predicts no exposure to entrained or dissolved oil at concentrations that may cause harm at the seabed. Species such as prawns, targeted by the NPF, North West Slope Trawl Fishery and Kimberley Prawn Managed Fishery, are present through the spill EMBA at all times of the year. As such, dispersant application will result in localised areas of high to moderate dissolved and entrained hydrocarbons and dispersants if dispersant application takes place. Prawns move up and down the water column between day and night (diurnal movements), and as such, will spend at least half of each day in demersal waters, where concentrations of dispersed oil will be

General impacts and risks	Beehive-1 specific impacts and risks
No areas of commercial crabbing, scallop and rock lobster harvesting, or commercial invertebrate stocks are predicted to be affected by moderate–high concentrations of entrained or dissolved hydrocarbons or to increased oiled particle sedimentation.	lower than pelgaic and near-surface waters. The application of dispersants offshore is predicted to reduce the exposure of breeding and juvenile prawns in inshore areas to floating oil. The overall consequences to commercially important fisheries species are predicted to be short-term effects on local populations and are assessed as **moderate**.
Recreational fishing (described in Appendix 11, Section 11.6.2)	
As per 'fish' earlier in this table.	Areas of high productivity that attract aggregations of fish that are predicted to be impacted by entrained or dissolved hydrocarbons as follows, and are known or likely to be recreational fishing areas, are listed below: - **Ashmore Reef AMP** (Untreated – Dissolved: Low, probability up to 5%; Entrained – High, probability up to 3%. With Dispersant Use – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 3%); - **Cartier Island AMP** (Untreated – Dissolved: Low, probability up to 4%; Entrained – High, probability up to 15%. With Dispersant Use – Dissolved: Low, probability up to 3%; Entrained – High, probability up to 15%); - **Mermaid Reef AMP** (Untreated – Dissolved: Moderate, probability up to 2%; Entrained – Low, probability up to 7%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – Low, probability up to 6%); - **JBG AMP** (Untreated – Dissolved: High, probability up to 89%; Entrained – High, probability up to 100%. With Dispersant Use – Dissolved: High, probability up to 92%; Entrained – High, probability up to 99%); - **Kimberley AMP** (Untreated – Dissolved: High, probability up to 24%; Entrained – High, probability up to 88%. With Dispersant Use – Dissolved: High, probability up to 22%; Entrained – High, probability up to 88%); - **Oceanic Shoals AMP** (Untreated – Dissolved: High, probability up to 2%; Entrained – High, probability up to 49%. With Dispersant Use – Dissolved: High, probability up to 2%; Entrained – High, probability up to 50%); While the OSTM predicts that some AMPs may be affected by moderate to high levels of hydrocarbon exposure, increases in exposure levels and the associated probability of exposure do not vary significantly between the unmitigated and

General impacts and risks	Beehive-1 specific impacts and risks
	mitigated spills (i.e., dispersant used). On this basis, given the mobility of fish in open waters, that fish can metabolise PAHs and the limited exposures predicted, only a small increase in impact to pelagic fish could be expected due to dispersant use. The consequence is assigned as **minor.** Shallow inshore species are likely to be a greater target of recreational fishing than the offshore locations listed above. Given that dispersants will be applied close to the well site and not within WA/NT waters, AMPs or marine parks, the consequences to shallow water fish species will be limited to affected water inflows. The OSTM predicts the following in-water hydrocarbon water concentrations for inshore areas: - **Emu Reef** (NT) (Untreated – Dissolved: High, probability up to 35%; Entrained – High, probability up to 81%. With Dispersant Use – Dissolved: High, probability up to 38%; Entrained – High, probability up to 82%); - **King Shoals** (WA) (Untreated – Dissolved: High, probability up to 92%; Entrained – High, probability up to 83%. With Dispersant Use – Dissolved: High, probability up to 91%; Entrained – High, probability up to 84%); - **North Kimberley MP** (Untreated – Dissolved: High, probability up to 88%; Entrained – High, probability up to 97%. With Dispersant Use – Dissolved: High, probability up to 90%; Entrained – High, probability up to 97%); Shallow inshore species are less likely to be able to move away from in-water hydrocarbons and may be exposed for longer periods. As fish are most vulnerable to hydrocarbons during their embryonic, larval and juvenile life stages, nursery areas are more likely to suffer developmental effects, morbidity or mortality at lower concentrations. For shallow water areas, the use of dispersant does not significantly change exposure levels or probabilities of exposure between dispersed and non-dispersed scenarios. As per offshore areas, the consequence to inshore fish (and therefore recreational fishing) as a result of using dispersant is assessed as **minor,** given the predicted impacts associated with the unmitigated spill and the localised nature of the potential impact.

General impacts and risks	Beehive-1 specific impacts and risks
Traditional fishing (described in Appendix 11, Section 11.5.6)	
As per 'benthic invertebrates', 'fish' and 'marine reptiles' earlier in this table. Section 11.6.2 of Appendix 11 of the EP provides information about recreational fishing in the spill EMBA, noting that very little information is available.	Given the sparse nature of settlements along the majority of the coastline of the spill EMBA, recreational fishing is concentrated in the Darwin region. The risk of nearshore floating oil and in-water concentrations in the Darwin region is 1% (at the low threshold only and summer only). At the low threshold, there are no ecological impacts, so risks of toxicity (or tainting) to any fish caught by recreational fishers in this region will be low. Elsewhere, traditional Indonesian fishing at Seringapatam Reef may be impacted, as outlined below: - **Seringapatam/Scott reef complex KEF** (Untreated – Dissolved: Moderate, probability up to 2%; Entrained – High, probability up to 8%. With Dispersant Use – Dissolved: Moderate, probability up to 1%; Entrained – High, probability up to 8%). The consequence to traditional fishing as a result of using dispersant is assessed as **minor,** given the predicted impacts associated with the unmitigated spill and the localised nature of the potential impact.

9.3.7. Impact and Risk Assessment

Table 9.9 provides the impact and risk assessment for dispersant application.

Table 9.9. Impact and risk assessment for dispersant application

Summary		
Summary of risks	Disturbance to marine fauna from increased vessel and aerial activity. Potential toxicity effects to marine biota.	
Extent of risk	For potential toxicity impacts, the extent of consequence will be as widespread as the area of application (widespread).	
Duration of risk	May continue for a period (weeks to months) after the application of dispersant.	
Level of certainty of risk	HIGH – The impacts associated with vessel and aircraft disturbance are well understood, and controls are documented in legislation. MEDIUM – Some uncertainty associated with the use of dispersants.	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the geographical area, infrequent or non-standard activity, good practice not well defined or met by more than one option.
	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of the dispersant application response strategy must be greater than no response (i.e., “do nothing”).	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Plankton (increased toxicity)	Occasional	Minor	Low
Benthic invertebrates (increased toxicity)	Occasional	Moderate	Medium
Fish (increased toxicity)	Occasional	Minor	Low
Sub-tidal seagrass (increased toxicity)	Occasional	Moderate	Medium
Inter-tidal seagrass (oiling)	Likely	Beneficial	Beneficial
Seabirds/shorebirds (increased toxicity)	Occasional	Moderate	Medium
Marine turtles (increased toxicity)	Occasional	Minor	Low
Marine mammals (increased toxicity)	Occasional	Minor	Low
Sub-tidal corals (increased toxicity)	Occasional	Moderate	Medium
Inter-tidal corals (oiling)	Likely	Beneficial	Beneficial
Mangroves (increased toxicity)	Occasional	Moderate	Medium
Aboriginal cultural heritage/values	Likely	Beneficial	Beneficial

Commercial fisheries (increased toxicity)	Occasional	Moderate	Low
Recreational fisheries (increased toxicity)	Occasional	Moderate	Low
Traditional fisheries (increased toxicity)	Occasional	Moderate	Low
Fauna injury (dispersant application)	Occasional	Moderate	Medium

Assessment of Proposed Control Measures
The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP. The controls for each response strategy were assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness – all preparedness EPS are presented in Appendix B of the OPEP.		
Response		
Dispersant application is undertaken to reduce the probability or severity of contact with shoreline protection priorities.	**(RSK-11:EPS-01)** Only dispersants listed on the OSCA register (including transitional dispersants) are applied to a Beehive-1 LoWC oil spill.	Daily reports listing dispersants used verify they are OSCA registered or transition dispersants.
	(RSK-11:EPS-02) EOG shall initiate surface dispersant mobilisation following a LoWC within 2 hours of forming the DIMT.	Incident logs verify dispersant mobilisation was undertaken within 2 hours of the DIMT formation.
	(RSK-11:EPS-03) An in-situ dispersant efficacy test is undertaken, and dispersant is only applied if the test is deemed successful.	Incident logs.
	(RSK-11:EPS-04) Dispersant is applied only during daylight hours (in order to determine dispersion effectiveness).	Incident logs verify daytime only dispersant application was undertaken.
	(RSK-11:EPS-05) Dispersant is only applied to dispersible oil (i.e., oil that has not emulsified), with the window of opportunity for dispersant application to be determined based on field testing.	Incident logs verify that dispersant application takes place only on dispersible oil.
	(RSK-11:EPS-06) Dispersant is not applied within the: - JBG AMP or within 10 km of park boundaries (unless permission from the DNP has been sought and granted); or - North Kimberley Marine Park or within 10 km of park boundaries (unless permission from the NT DPWC has been sought and granted); - Within 1 km of the well site;	Incident logs verify no dispersant is applied within these areas.

	- In waters less than 20 m deep; or - In WA or NT coastal waters (unless permission from WA/NT agencies has been sought and granted).	
Dispersant application is monitored to ensure it is effective	**(RSK-11:EPS-07)** Operational monitoring is undertaken for the duration of dispersant application to verify the effectiveness of dispersant use: • Initial field effectiveness testing (Nat-DET) prior to dispersant application to determine hydrocarbon amenability to dispersant. • Test spray prior to broadscale application. • Visual assessment of dispersant operations by aerial observer in air attack aircraft. • Dispersant effectiveness via in-water testing (OSMP). • Volumes of dispersants applied will be visually assessed and recorded to determine that correct dosage rates have been applied. Dosage rates adjusted as needed. • OSTM daily reflecting dispersant application to identify potential impacts (OSMP). • OSTM on 3 day forecast model basis to assess and monitor for impacts and inform the IMT on the ongoing suitability of the response option (OSMP).	Incident logs verify that monitoring is undertaken in accordance with operational monitoring requirements within the OSMP.
	(RSK-11:EPS-08) Dispersant application is applied where effectiveness has been demonstrated via field test, test spray and NEBA.	Record of dispersant testing prior to dispersant application
	(RSK-11:EPS-09) EOG shall terminate dispersant application where efficacy test results indicate dispersant is not effective, or at the direction of Control Agency.	Sign-off reports verify that dispersant is no longer effective.
The dispersant is sprayed over the thickest areas of slick and not over wildlife	**(RSK-11:EPS-10)** FWADC is guided by aircraft with an onboard Air Attack Supervisor (to advise aircraft when the aircraft is on target to release dispersant) and trained aerial observer (to identify suitable slick thickness).	Incident log verifies the location and effectiveness of dispersant application by air attack supervisor
	(RSK-11:EPS-11) Visual observation is undertaken in accordance with OSMP (Marine Megafauna and Birds) and	Observer logs record marine fauna sightings during dispersant application and verifies fauna

	operations are directed such that wildlife is not sprayed.	were not exposed to dispersant application.
	(RSK-11:EPS-12) Sightings of EPBC-listed megafauna in the vicinity of dispersant application operations will trigger cessation of response until the animal has moved and not been sighted for 30 minutes.	Observer logs record marine fauna sightings and cessation of spraying.
Dispersant operations are risk assessed and controls adopted to prevent personnel exposure to dispersants	**(RSK-11:EPS-13)** A risk assessment is undertaken to identify controls to prevent human exposure to dispersant. Measures to be adopted include: • All marine vessels are located upwind during dispersant application. • Minimum buffer maintained between application sites and personnel areas (1 km vessel, 2 km aerial) (OSRL, 2011). • Exclusion of commercial fishing via AMSA RCC warnings and AHO Notice to Mariners. • Non-essential personnel inside accommodation with doors and windows secured during spraying operations.	Dispersant application records verify that location of dispersant application meets proximity distances to fixed and floating assets. AMSA RCC Auscoast warning. AHO Notice to Mariners issued.
Relevant persons are advised of pending dispersant application to allay concerns.	**(RSK-11:EPS-14)** EOG prepares a communications strategy for potentially affected relevant persons to advise on the background to the decision to use dispersants, OHS factors that need to be considered and operational exclusion requirements.	Records of communication regarding dispersant use are consistent with the communications strategy.
Aircraft maintain appropriate buffer distances from cetaceans and seabirds to prevent behavioural impacts	**(RSK-11:EPS-15)** Excepting for dispersant application activities, pilots to remain at a height of 300 m (fixed wing) above cetaceans in accordance with EPBC Regulations 2000 (Part 8).	Incident logs verify no breach of buffer distance during non-dispersant application activities.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Plankton (increased toxicity)	Rare	Minor	Negligible
Benthic invertebrates (increased toxicity)	Rare	Moderate	Low
Fish (increased toxicity)	Rare	Minor	Negligible
Sub-tidal seagrass (increased toxicity)	Rare	Moderate	Low
Inter-tidal seagrass (oiling)	Likely	Beneficial	Beneficial
Seabirds/shorebirds (increased toxicity)	Rare	Moderate	Low
Marine turtles (increased toxicity)	Rare	Minor	Negligible

Marine mammals (increased toxicity)	Rare	Minor	Negligible
Sub-tidal corals (increased toxicity)	Rare	Moderate	Low
Inter-tidal corals (oiling)	Likely	Beneficial	Beneficial
Mangroves (increased toxicity)	Rare	Moderate	Low
Aboriginal cultural heritage/values	Likely	Beneficial	Beneficial
Commercial fisheries (increased toxicity)	Remote	Moderate	Low
Recreational fisheries (increased toxicity)	Remote	Moderate	Low
Traditional fisheries (increased toxicity)	Remote	Moderate	Low
Fauna injury (dispersant application)	Rare	Moderate	Low

The risk of spill response activities to the identified receptors is assessed as negligible to low because:

- The control measures adopted are effective in reducing the risk to ALARP.

Demonstration of ALARP

A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.

Demonstration of Acceptability

Policy compliance	EOG's Safety and Environmental Policy objectives are met.	
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.	
External context	There have been no concerns raised from relevant persons regarding spill response activities.	

Legislative context	The EPS align with the requirements of:
	• *OPGGS Act* 2006 (Cth) and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• *EPBC Regulations* 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Marine Pollution Act* 1999 (NT).
	• *Waste Management & Pollution Control Act* 1998 (NT).	

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-11: all EPS)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.

	Exploration and Production (European Commission, 2019)	
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-11: all EPS)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS complement AMOSPlan.
	WA Oil Spill Contingency Plan (2015)	DoT will implement this plan in the event their resources are deployed. The EPS complement the WA Oil Spill Contingency Plan.
	NT Oil Spill Contingency Plan (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS complement the NT Oil Spill Contingency Plan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	Dispersant application	Oil spill response: Should you spray dispersant (IPIECA/IOGP, 2022).

		Dispersants: surface application. Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015a).
		Dispersant logistics and supply planning (IPIECA, OGP, 2013a).
Environmental context	MNES	
	AMPs	Oil causing marine pollution are a threat identified in the North Marine Parks Network Management Plan 2018. Dispersant application will not be undertaken in AMPs and a buffer of 10km is in place to limit impacts to these sensitive areas. Associated vessel or aircraft-based monitoring activities (with controls) will have no significant impacts on the AMP.
	Ramsar wetlands	Dispersant application will not be undertaken near or in Ramsar wetlands.
	TECs	Dispersant application activities will not be undertaken in areas where TECs exist.
	NIWs	Dispersant application will not be undertaken in or near NIWs.
	Nationally threatened and migratory species	Some threatened and migratory species have the potential to be present in the dispersant application area, however only individuals may be at risk and with controls implemented, the risk is low and no impacts on threatened and migratory species at a population level is predicted.
	Other matters	
	State marine parks	The North Kimberley Marine Park Management Plan has the strategic *objective to protect and conserve biodiversity and ecological health*. Dispersant application supports this objective and does not conflict with the management objectives for the park in terms of cultural; natural; recreation, tourism and community; or commercial values detailed in the Management Plan. Dispersant application will assist in preserving the objectives detailed in the management plan. Dispersant application will not be undertaken in WA or NT waters by EOG unless under the direction of the WA or NT Control Agency after a NEBA assessment. Protection of the sensitive resources within these protected areas will be a key consideration in the NEBA such that there are no significant impacts on WA and/or NT marine parks or the management objectives of the parks' management plans.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to*

		recover habitats (e.g., nesting beaches, important foraging grounds, corals, seagrasses AND *manage anthropogenic activities to ensure that marine turtles are not displaced from habitat identified as critical to their survival*. Dispersant application activities supplement other oil spill response strategies (which prevent impacts to critical habitats) and dispersant application (no-go) zones protect critical inter-nesting areas. Dispersant application operations support identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific actions to address this. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. Dispersant application activities will assist in the removal of oil from the environment, thereby reducing the threat in support of the plan.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Statement of acceptability	EOG considers the risk associated with dispersant application activities to be acceptable because: • It will adhere to the company's Environment Policy. • The residual risk ratings are low-negligible. • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered and incorporated into the design of the activity. • The activity complies with relevant legislation and industry best practice. • Dispersant application will not have long-term or significant impacts on MNES. • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species. • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans. • Spill response activities are not inconsistent with ESD principles.	
Environmental Monitoring		
• As per Beehive-1 OPEP and OSMP requirements.		
Record Keeping		
• Contracts and agreements with third parties. • Equipment and service provider register. • Exercise drill reports. • Inspection/audit reports. • Incident and daily operations reports. • AUSCoast/NOTAM warnings. • Dispersant application records. • Induction records.		• Operational NEBA. • Briefing records. • Photos. • OSMP implementation records and reports. • IAP. • Stakeholder communications records. • Aerial observer logs. • Dispersant testing records.

9.4. Containment and Recovery

9.4.1 Background Information

Containment and recovery (CAR) typically involves the physical containment and mechanical removal of hydrocarbons via skimming operations from the marine environment. The objective of this response option is to remove free oil from the sea surface to minimise damage to fauna intersecting the sea surface and shoreline residue accumulation on adjacent shorelines.

CAR operations involve the deployment of booms and oil skimmers from vessels to collect oily water and transfer, store and dispose of oil and oily water recovered during operations. Typically, the oil/water mix is stored temporarily in support vessel tanks on the decks of vessels or in the internal storage tanks of vessels. To increase the endurance of CAR vessels, recovered seawater, collected with the oil, can be decanted back to sea, after sufficient separation time, to free up vessel storage and enable greater volumes of oil to be recovered without making the trip back to port (increasing the effectiveness of CAR). The decanting operation will occur in Commonwealth waters under approval by AMSA.

In offshore CAR operations, as opposed to nearshore protection booming (see Section 9.5), CAR typically recovers a low proportion of the original oil volume released (~10-15%) (ITOPF, 2022) largely due to limiting weather conditions (wind and wave height) for boom deployment.

Boom failures can occur when wind conditions > 20 knots and waves are > 1m (OSRL, 2017). Wind conditions in the JBG rarely exceed 20 knots (see Section 5.2.1) and wave heights are below 1 m for most of the year (see Section 5.2.2).

9.4.2 Scope of Activity

CAR operations typically involve the following:

- Strike teams each consisting of two vessels, booming and skimmers recovering oil/water to the vessel for storage/separation;
- Possible secondary vessel (spot hire tanker or barge) to collect oil residues and increase endurance of strike team vessels; and
- Aerial support to direct and coordinate strike teams to areas of suitable oil thickness away from any dispersant application. To maximise field presence and waste recovery of these vessels, an application to decant (discharge water collected through skimming operations to the marine environment) will be made to AMSA.

9.4.3 Hazards

CAR operations create the following hazards:

- The use of additional vessels increases the risk of interactions/strikes to megafauna, vessel collisions and routine discharges;
- Additional noise and air emissions from the use of aircraft;
- Waste handling hazards such as the accidental loss of oily wastes to the marine environment; and
- Contamination of surface waters due to the decanting of treated sea water.

9.4.4 Known and Potential Impacts and Risks

The potential environmental risks associated with CAR operations are:

- Planned noise, air and light emissions from aircraft;
- Planned liquid and solid discharges from vessels (as per Chapters 7 and 8).
- Unplanned events from vessels as per Chapter 8, noting that due to their slow speeds, the vessels used in CAR operations have a very low probability of collision;
- Interactions/strikes to marine fauna (as per Section 8.2);
- Interference with coral spawning slicks; and
- Loss of waste during generation, handling, transport or decanting treated seawater, noting that due to their slow speeds, the vessels used in CAR operations have a very low probability of collision (refer below).

9.4.5 Evaluation of Impacts and Risks

Waste Generation, Transport and Disposal

The following waste streams are expected during CAR activities and will require management and disposal else secondary contamination and effects on wildlife (ingestion, contact) may result:

- Recovered contaminated liquids (oil/water mixture);
- Semi-solids/solids (e.g., oily solids and contaminated boom); and
- Debris (e.g., seagrass/seaweed wrack, sand, wood, plastics).

All waste generated will be managed in accordance with AMSA approval requirements (treated seawater) and relevant WA and NT government agencies coordinating any nearshore response efforts (see Waste Management in Section 9.8 for risk assessment and controls).

Based upon vessel specifications for strike teams, the largest volume of oily water that could be spilled is 500 m^3 (combination of seawater and crude oil). The biological consequences of spilling this volume of weathered oil on open water sensitive receptors in an area impacted by a Level 3 oil spill is likely to be similar in magnitude to those associated with the unplanned release of hydrocarbons as a result of an MDO release (refer Section 8.6). In such a scenario, there would be localised consequences to marine megafauna (if present), plankton and fish populations (surface and water column) within the spill affected area.

Increased risk of Interaction/Collision with Marine Fauna

Typical booms used in CAR operations are designed to sit on the water surface, which allows fauna capable of diving (turtles, cetaceans) to avoid contact. Impacts to species that inhabit the water column, such as sharks and fish, are not expected. Additionally, fauna such as cetaceans are likely to detect and avoid the activity area.

Vessels involved in CAR operations will be moving slowly and present little risk to marine megafauna in the area with possibly only several individuals at risk. In addition, the noise of vessel motors may have a positive effect of scaring marine fauna away from the immediate area with consequent reduced exposure to the thickest patches of oil. The presence of extra vessels and booms may lead to effects

at an individual, most likely limited to behavioural effects with a very limited, short-term impact on fauna in any particular area (minor consequence).

Interference with Coral Spawning Slicks

Coral spawning occurs primarily during March-April within the Kimberley region and to a lesser extent in September-October (Cook *et al.*, 2017). Coral spawning slicks can often be confused for oil spill slicks and CAR operations may target these slicks instead of oil. This may lead to minor impacts to coral reproductive success (if CAR occurs during spawning period), given the small area of CAR operations relative to the large spawning area for coral. Inappropriate targeting also results in inefficiency in CAR oil recovery operations.

9.4.6 Impact and Risk Assessment

Table 9.10 presents the impact and risk assessment for CAR operations.

Table 9.10. Impact and risk assessment for CAR operations

Summary		
Summary of risks	Disturbance to marine and nearshore fauna from increased vessel and aerial activity. Waste handling incidents during collection, storage, transfer, or decanting activities.	
Extent of risk	Localised (immediately around vessel or aircraft).	
Duration of risk	Medium- to long-term (depending on spill volume, trajectory and shorelines affected).	
Level of certainty of risk	HIGH – The impacts associated with vessel operations and noise disturbance to fauna from vessels and helicopters are well understood, and controls are documented in legislation.	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the organisation or geographical area, infrequent or non-standard activity, good practice is well defined.
	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a CAR response strategy must be greater than no response.	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Rare	Minor	Negligible
Oily waste spills	Occasional	Moderate	Medium
Interference with coral spawn slicks	Occasional	Minor	Low

Assessment of Proposed Control Measures		
The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP. The controls for each response strategy were assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.		
Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness – all preparedness EPS are presented in Appendix B of the OPEP.		
Response		
CAR operations target oil slicks to maximise oil recovery.	**(RSK-12:EPS-01)** CAR operations are supported by trained aerial observers to position vessels in areas which contain oil in sufficient thicknesses for effective recovery.	Incident logs.
	(RSK-12:EPS-02) Oil volumes recovered are recorded.	Incident logs.
Waste decanting operations are undertaken in accordance with AMSA approval.	**(RSK-12:EPS-03)** Decanting in Commonwealth waters will only be undertaken following approval from AMSA.	Incident logs.
	(RSK-12:EPS-04) Treated water decanting operations adopt the following controls (per IPIECA, 2013b): • Undertaken in daylight hours. • Skimmer vessels store water in pollutant free tanks. • Minimum settling time of 60 minutes adopted to allow for oil/water separation. • Treated water discharged into apex of containment boom to recover free oil. • Continuous visual monitoring to confirm no oil release. • Records of discharge are retained.	Decanting records verify that all conditions were observed during decanting operations.
No spills overboard during oily waste transfer to dedicated waste storage vessel.	**(RSK-12:EPS-05)** A risk assessment of the transfer activity is undertaken prior to transfer and all identified controls implemented including, but not limited to: • Undertaken during daylight hours. • Continuous radio contact between vessels. • Continuous supervision by trained and competent crew. • Safe proximity distances established. • Weather boundaries of activity established. • Hoses and transfer equipment tested and fit-for purpose. • Available and tested vessel SMPEP.	Risk assessment record verifies controls required for transfer.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Remote	Minor	Negligible
Oily waste spills	Rare	Moderate	Low
Interference with coral spawn slicks	Rare	Minor	Negligible
The risk of spill response activities to the identified receptors is assessed as negligible to low because: • The control measures adopted are effective in reducing the risk to ALARP.			
Demonstration of ALARP			
A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.			
Demonstration of Acceptability			
Policy compliance	EOG's Safety and Environmental Policy objectives are met.		
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.		
External context	There have been no concerns raised from relevant persons regarding spill response activities.		

Legislative context	The EPS align with the requirements of:
	• *OPGGS Act* 2006 (Cth) and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• *EPBC Regulations* 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Marine Pollution Act* 1999 (NT)
	• *Waste Management & Pollution Control Act* 1998 (NT).		

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.		
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-12: all EPS)**.	
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.	
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-12: all EPS)**.	

	Development (World Bank Group, 2015)	
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS complement AMOSPlan.
	WA Oil Spill Contingency Plan (2015)	DoT will implement this plan in the event their resources are deployed. The EPS compliment the WA Oil Spill Contingency Plan.
	NT Oil Spill Contingency Plan (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS compliment the NT Oil Spill Contingency Plan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	Containment and recovery	The use of decanting during offshore oil spill recovery operations (IPIECA, OGP, 2013b).
		At-sea Containment & Recovery (IPIECA, 2016b).
		Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments (NOAA, 2001).
Environmental context	MNES	
	AMPs	Oil causing marine pollution are a threat identified in the North Marine Parks Network Management Plan 2018 (DNP, 2018).

		As this response removes oil from the environment, CAR operations minimise oil spill threats from AMP sensitivities. Vessel-based CAR activities, with all vessel-based controls implemented, will not have significant impacts on the AMP (and are designed to protect its values).
	Ramsar wetlands	CAR activities are not applicable to onshore Ramsar wetlands.
	TECs	CAR activities will not be undertaken in areas where TECs exist.
	NIWs	CAR activities will not be undertaken in NIWs.
	Nationally threatened and migratory species	Some threatened and migratory species have the potential to be present in areas of CAR operations, however impacts are predicted to affect individual animals only and not populations of threatened or migratory species.
	Other matters	
	State marine parks	The North Kimberley Marine Park Management Plan has the strategic *objective to protect and conserve biodiversity and ecological health*. CAR activities support this objective and do not conflict with the management objectives for the park in terms of cultural; natural; recreation, tourism and community; or commercial values detailed in the Management Plan. CAR will assist in preserving the objectives detailed in the management plan. CAR operations may be undertaken in coastal marine parks at the direction of the relevant State/Territory Control Agencies, given that parks are predicted to have shoreline oil loading above ecological limits. Offshore CAR activities, with controls implemented, are not expected to have significant impacts on these marine parks or the management objectives of the parks' management plans.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (e.g., nesting beaches, important foraging grounds, corals, seagrasses* AND *manage anthropogenic activities to ensure that marine turtles are not displaced from habitat identified as critical to their survival*. CAR activities supplement other oil spill response strategies (which prevent impacts to

		critical habitats). CAR supports identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific actions to address this. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. CAR activities will assist in the removal of oil from the environment, thereby reducing the threat in support of the plan.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Statement of acceptability	EOG considers the risk posed by CAR operations in the marine environment to be acceptable because: • It will adhere to the company's Environment Policy. • The residual risk ratings of additional hazards identified in CAR operations are low-negligible and ALARP. • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered. • Activity is compliant with relevant legislation and industry best practice. • Spill response activities will not have long-term or significant impacts on MNES. • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species. • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans. • Spill response activities are not inconsistent with ESD principles.	
Environmental Monitoring		
• As per Beehive-1 OPEP and OSMP requirements.		
Record Keeping		
• Contracts and agreements with third parties. • Equipment and service provider register. • Inspection/audit reports. • Incident and daily operations reports. • Waste Disposal Records. • Stakeholder Consultation Records.		• Operational NEBA. • Briefing records. • IAP. • Recovered Water Decanting Records. • Oil Transfer Risk Assessment/Procedure • Induction Records. • Oil recovery volumes.

9.5. Shoreline Protection & Deflection

9.5.1 Background Information

Shoreline protection involves deploying boom to deflect and protect coastal environmental sensitivities from the impacts of oil. This response will be activated onshore and in nearshore waters

where surveillance and tracking activities identify that priority protection areas (e.g., turtle nesting beaches, bird rookeries) are at risk from oiling or at the direction of the relevant CA.

This response option includes techniques such as:

- Deflection booming (deployed to divert oil away from sensitive receptors to a suitable collection point on the shoreline or at sea for subsequent removal); and
- Protection/exclusion booming (deployed to contain oil away from environmental sensitivities such as turtle nesting beaches, estuary areas containing mangroves, shorebird nesting sites to completely seals off sensitive receptor from oil).

Various anchoring methods are required depending on the boom and its location. For example, when used on the shoreline itself, boom skirts are replaced with water-filled chambers designed to allow the boom to settle on an exposed shoreline at low tide.

It is unlikely that shoreline protection activities will be undertaken in Commonwealth waters. As such, the WA DoT as the Control Agency in WA and NT DEPWS as the Control Agency in the NT will direct response operations to protect shoreline sensitivities. For Commonwealth areas such as Ashmore Reef and Cartier Island, EOG will be the Control Agency in consultation with the DNP.

All aspects of shoreline protection operations will be conducted in accordance with the requirements of theses Control Agencies after a shoreline assessment has been undertaken (see Section 9.6), NEBAs performed, IAPs developed and the permissions of relevant land managers obtained, with EOG supporting state/territory operations with resources as required.

Shoreline PPAs are those shorelines identified as being key coastal areas of importance in the spill EMBA (Table 9.11). Oil removal methods will be decided based on coastal access, nature of the weathered oil and sensitivity of the specific section of coastline. A summary of the minimum timeframes for a Level 3 LoWC where shoreline PPAs may be impacted by hydrocarbon residues (unmitigated) in excess of 10 g/m^2 (response time for surveys) and 100 g/m^2 (response time for equipment deployment) are provided in Table 9.11. This table also provides details on whether landside access to these locations is available.

EOG has prepared a series of maps illustrating the shoreline types (i.e., sandy beach, rocky shore, mangroves) within the parts of the spill EMBA predicted to have shoreline contact (Appendix 16). For the WA portion of the spill EMBA, the shoreline is mapped according to the fine-scale WAMOPRA DoT cells (which are also used in the OSTM report) so that in the event of a spill, EOG can communicate shoreline risks with the WA DoT by referencing their own data, which in turn can inform a better managed response. The locations noted in Table 9.11 are illustrated on the maps in Appendix 16. The exact geographic extent of each PPA is being determined by EOG in conjunction with OSRL. These are not yet finalised so are not marked as discreet areas within Appendix 16; this will be completed pre-drilling when the extents of the PPAs are finalised. These maps will assist in informing shoreline protection strategies in the event of a spill (e.g., deflecting spills from mangrove areas will be a higher priority than deflecting a spill from rocky shorelines).

Table 9.11. Minimum time to shore above 10 g/m² and 100 g/m² for priority protection areas (unmitigated)

Location	Habitat present	Sensitive fauna present	Landfall timeframe for 10 g/m² (Days (d))	Landfall timeframe for 100 g/m² (Days (d))	Landside access possible?
NT					
Darwin	NIW, mangroves, saltmarsh, seagrass	Turtles (critical), seabirds, shorebirds	**48.1d(S),** N/A(T), N/A(W)	**51.7d (S),** N/A (T), N/A (W)	Yes (limited access to estuary)
Peron Islands	Mangroves, Saltmarsh, Tidal Flats	Turtles, IBA	**18d(S),** 92d(T), N/A(W)	**21.6d(S),** 92.5d (T), N/A (W)	No
Daly River Estuary	NIW, mangroves, saltmarsh	Turtles, IBA	**18.3d(S),** 63.5d(T), 53d(W)	**25.8d (S),** 93.1 (T), 71d (W)	No
Moyle River Estuary	NIW, mangroves, saltmarsh	IBA	**11.6d(S),** 15.6d(T), 31.7d(W)	**14.5d (S),** 22.8d (T), 37.2d (W)	Yes (limited minor roads)
Victoria River Estuary	Mangroves, inter-tidal mudflats	-	14.8d (S), 12.3d (T), **14d (W)**	19.1d (S), 15.8d (T), **14.5d (W)**	No
Forsyth Creek*	Seafarms Group Ltd (seawater intake for prawn aquaculture facility under construction)				
Keep River Estuary/Turtle Point	Mangroves, inter-tidal mudflats, sand beach	Turtles, IBA	18.6d(S), 22.7d(T), **13.9d(W)**	24.1d (S), 24.6d (T), **15d (W)**	No
WA					
Cape Domett (DoT Cells 1&2)	Mangroves, saltmarsh, sand beach	Turtles (critical), shorebirds	**21d(S),** 24.9d(T), 33.7d(W)	**22.6d (S),** 30.3d (T), 50.4d (W)	No
Cambridge Gulf/Lacrosse Island (DoT Cell 3)	Ramsar wetland, NIW, mangroves, saltmarsh, inter-tidal mudflats	Turtles (Critical), IBA	16.5d (S), **11.8d(T),** 15.7d(W)	17.4d (S), **12.8d (T),** 26.9d (W)	No (only via Wyndham port)
Berkeley River (DoT Cell 10)	Seagrass, exposed tidal mudflats, sand beach	Turtles, shorebirds	20.4d (S), 17d(T), **11.7d (W)**	28.3d(S), 21.2d (T), **12.5d (W)**	No (nearby airstrip available)
King George River (DoT Cell 13)	Mangroves, seagrass, corals	Turtles, shorebirds	24.7 (S), 18.1d (T), **12.5d (W)**	27.3d (S), 21.3d (T), **16.8d (W)**	No
Drysdale River/Napier Broome Bay (DoT Cells 16 & 17)	NIW, mangroves, saltmarsh, inter-tidal flats, sand beach	Turtles (critical), shorebirds	25.5d (S), 27.9 (T), **21.7d (W)**	35.5d (S), 37.6d (T), **26.3d (W)**	Yes (limited – Kalumbaru & Warrender only)

Location	Habitat present	Sensitive fauna present	Landfall timeframe for 10 g/m^2 (Days (d))	Landfall timeframe for 100 g/m^2 (Days (d))	Landside access possible?
Sir Graham Moore Island (DoT Cell 17)	Sand Beach, Corals, rocky shoreline	Turtles (critical)	36d(S), 27.9d (T), **21.7d(W)**	49d (S), 37.6 (T). **26.3d (W)**	No
West Governor island (DoT Cell 17)	Sand beach, rocky shoreline, mangroves, tidal flats	Turtle (critical), shorebirds	36d(S), 27.9d (T), **21.7d(W)**	49d (S), 37.6 (T), **26.3d (W)**	No
Cassini Island (DoT Cells 22 & 23)	Sand Beach, rocky cliffs	Turtle (critical), shorebirds	40d(S), 33.6d (T), **23.3d(W)**	40d(S), 35.8 (T), **30.2 (W)**	No
Maret Island & Coronation Islands (DoT Cells 30 & 31)	Sand beaches, mangroves, rocky shoreline	Turtle (critical)	55.6d(S), 46.9d (T), **35.4d (W)**	61.8d(S), 53.2 (T), **39.1d (W)**	No
Commonwealth					
Ashmore Reef	Ramsar wetland, coral reefs (sub-tidal, inter-tidal, seagrass	Turtle (critical), shorebirds, seabirds	N/A (S), N/A (T), **70d (W)**	N/A (S), N/A (T), **80.9d (W)**	No

* *Modelling results aren't available for Forsyth Creek. Results shown are the lowest for either Keep River or Victoria River.*

LEGEND: S - Summer T - Transitional W - Winter

XXd – target days in which to deploy SCAT response

XXd – target days in which to deploy shoreline response

TRP pre-preparation

9.5.2 Scope of Activity

Shoreline protection may be applied to shoreline, shallow water habitats and estuarine environments in the path of the spill. Shoreline protection activities will be preceded by a Shoreline Clean-up and Assessment Technique (SCAT) survey to assess the local environmental sensitivities and the feasibility/location for boom installation and identify controls to prevent/limit impacts to identified sensitivities.

A summary of the expected types of booming to be employed in the event of a significant oil spill is provided in Table 9.12. The shoreline protection methods outlined are not suitable to the exposed rocky shorelines/cliffs within the spill EMBA as this shoreline type is self-cleaning due to wave action against the rocks. The methods provided in this table are limited to other shorelines such as sandy beaches, mangroves, wetlands and man-made structures (e.g., jetties and harbours).

Given the remoteness and inaccessibility of much of the coastline by land, shoreline protection and deflection is expected to be accessed either entirely or predominantly by marine-side resources (see Table 9.11).

Deployment of shoreline protection measures are limited to calm, low-energy environments (current, waves, winds) that allow booms to operate effectively. The techniques need to be adapted to local conditions and consider site constraints and metocean conditions at the time. Note that deployed booming requires ongoing supervision and maintenance (tidal changes require booming reconfiguration, oil recovery, etc).

Table 9.12. Potential shoreline protection measures

Technique	Description	Limitations	Possible environmental impacts
Nearshore			
Exclusion/ containment	Boom is deployed across of around sensitive areas and anchored in place. Approaching oil is deflected or contained within boom	Cannot operate in: • Currents > 1 knot (varies according to boom angle) • Breaking waves >50 cm • Water depth >20 m	Minor disturbance to seabed substrate or shoreline anchor points. Waste collection and disposal.
Redirection towards shoreline	Single or multiple booms are deployed from shoreline in path of approaching slick and anchored/held in place using a vessel suitable for the activity. Oil diverted to sacrificial shoreline for recovery.	Cannot operate in: • Currents >2 knots • Breaking waves >50 cm	Minor disturbance to seabed/shoreline substrates due to anchoring. Sacrificial shoreline oiling & clean-up. Waste collection and disposal. Disturbance to beaches. Vessel environmental hazards.
Redirection away from shoreline	Single or multiple booms deployed from the shoreline at an angle away from the shore and anchored/held in place using a vessel	Cannot operate in: • Currents >2 knots • Breaking waves >50 cm	Minor disturbance to seabed/shoreline substrates due to anchoring. Waste collection and disposal. Vessel environmental hazards.

	suitable for the activity. Oil deflected away from the shoreline for recovery.		
Onshore			
Inter-tidal/Shoreline Boom	Boom can be deployed across or along shore, on beach or in water to contain oil. Suitable where water levels fluctuate. Waterfilled chambers provide a seal as boom grounds. Can prevent remobilisation of stranded oil.	Cannot operate in: • Currents > 1 knot (varies on angle of boom) • Breaking waves >50 cm	Minor disturbance to substrate at anchor points. Can cause heavy oiling if boom fails. Disturbance to beach and shoreline from vehicle and foot access. Waste collection and disposal.
Beach barriers, berms	Berm constructed along high water mark. Berm covered with plastic to minimise erosion, oil penetration or burial.	Cannot operate in: • Strong currents • Breaking waves >35 cm • Areas where turtle nesting or hatching is active	Disturbs upper 50-60cm of foreshore zone. Disturbance to beaches from vehicle and foot access. Barrier to nesting turtles. Waste collection and disposal.

9.5.3 Hazards

Hazards associated with shoreline protection include:

- Additional vessel activity (including anchoring);
- Boom deployment and management (including human presence impacts); and
- Waste collection and disposal (see Section 9.8).

9.5.4 Known and Potential Impacts and Risks

The potential environmental impacts and risks from shoreline protection operations are:

- For nearshore vessel operations:
  - Planned discharges and emissions as per Sections 7.1 to 7.11.
  - Unplanned events as per Section 8.1 to 8.6.
- Damage to nearshore habitats/sea country from inshore shallow draught vessels (noise, turbulence and turbidity, outboard spills, anchoring) and boom anchoring (damage to seagrass, marine muds, sand, etc);
- Disturbance to native fauna breeding or entrapment (e.g., turtles);
- Damage to shoreline environments from vehicle and foot access and associated land use (e.g., waste storage, equipment cleaning); and
- Temporary restricted access to shoreline/waterway users.

9.5.5 Evaluation of Impacts and Risks

The known and potential impacts associated with routine and non-routine nearshore vessel operations are assessed through Sections 7.1 to 8.6.

Shoreline TRPs (including booming strategy) are being prepared for environmentally sensitive protection priorities (see Table 9.11). Other protection priority areas will be assessed at the time of the spill, given the time available to develop TRPs. In addition, EOG in consultation with relevant WA and NT authorities will undertake an operational NEBA at the time of the spill to confirm the net benefits of the implementation of a shoreline protection response strategy.

The following impacts may eventuate in the event of deploying a shoreline protection response strategy, noting that the nature of disturbance to shoreline environments will be dependent on the location and scale of activities in any given area.

Inshore Shallow Draught Vessel Operation

Small vessels required to anchor booms in inshore areas will operate intermittently and will contain small volumes of fuel (limiting spill potential). Given the size constraints of these vessels, noise impacts within inshore areas are expected to be similar to recreational fishing vessels that operate in nearshore waters (intermittent and localised).

Vessel & Boom Anchoring: Benthic Disturbance/Indigenous Sea Country

Damage to nearshore habitats (such as seagrass meadows, mangroves, estuaries, corals) from inshore shallow draught vessel activities and boom anchoring may disturb localised areas of seabed habitats and alter the dynamics of local ecosystems.

Sandy seabed habitats are generally able to quickly self-repair due to tidal sand movements. Localised physical damage to estuarine environments (i.e., subsurface marine muds) is also expected to recover quickly due to tidal water movements.

Seabed disturbance is a key contributor to the physical degradation in seagrass ecosystem function and can persist in sites for 5+ years after the disturbance (Bourque *et al*., 2015). Physical damage to coral from disturbance activities can take a several decades to recover (Pearson, 1981).

Damage to Shoreline Environments

Damage to shoreline environments from vehicle and foot access and associated land-use (staging areas, etc) may disturb First Nation's cultural heritage areas (such as shell middens), and disturb nesting turtles and shoreline/wetland bird feeding, nesting, roosting, or breeding activities, in turn temporarily impacting on local population dynamics. Physical damage to vegetation as a result of gaining access to sites may result in localised mortality within estuarine environments (i.e., mangroves), however mangrove forests are generally able to recover with time (NOAA, 2014). Shoreline access may also result in localised soil compaction and erosion, which may result in poor vegetation growth and regeneration.

Secondary Contamination

Secondary contamination to shorelines not originally oiled may occur through access (vehicle, equipment and foot), equipment cleaning activities or waste management/storage activities. This may expose more habitat, flora and fauna to oiling than the area impacted by the spill itself, with oil smothering creating larger impact areas.

Secondary contamination risk from waste storage and handling activities will be managed by EOG's waste management contractor who will ensure that all waste storages are appropriately stored in

impervious bunds, removed from site promptly and transported/disposed in accordance with all State/Territory legislation (see Section 9.8).

Access Restrictions – Recreational and Indigenous

Shoreline protection booms may prevent indigenous people from accessing waterways for recreation and food collection (fishing). Alternate food gathering areas to those impacted from a Level 3 spill will need to be sought by indigenous people and recreational fishers.

Cultural Heritage Impacts

The movement of SCAT survey personnel, responders, vehicles and equipment through backshore areas may disturb or damage cultural heritage artefacts or sites. Adverse effects are expected to be localised to the area of disturbance, and for important sites – artefacts can be relocated or protected by exclusion zones. Disturbance to culturally significant artefacts may also affect spiritual associations and management and mitigation would be coordinated with local indigenous custodians (as appropriate).

Disturbance to Fauna (Turtle Nesting/Internesting, megafauna interaction with boom)

Use of barriers on shorelines during nesting periods or hatchling emergence can affect turtles by preventing females from reaching nesting beaches or blocking the movement of hatchlings or adults into the water. For hatchlings, barrier entrapment can increase predation risk and can also cause disorientation, dehydration or otherwise expend vital energy reserves causing mortality.

Booms, designed to protect sensitive resources on one side of deployment, can potentially increase turtle exposure to oil on the alternate side, whether the animals are trapped or not. Use of shoreline protection methods in turtle nesting areas require careful consideration and boom deployment is likely not recommended when females are nesting (NOAA, 2021), however this will be a key consideration during the operational NEBA. Boom use during hatchling emergence requires rigorous mitigation through regular monitoring of nests to ensure clear egress of hatchlings to sea (NOAA, 2021).

9.5.6 Impact and Risk Assessment

Table 9.13 presents the impact and risk assessment for shoreline protection and deflection.

Table 9.13. Impact and risk assessment for shoreline protection and deflection

Summary		
Summary of risks	Disturbance to nearshore benthic and shoreline fauna/habitat from increased vessel and human activity. Waste handling incidents during collection, storage, and transfer activities	
Extent of risk	Localised (immediately around vessel or shoreline protection area)	
Duration of risk	Short to medium-term (depending on length of spill response).	
Level of certainty of risk	HIGH – The impacts associated with boom deployment, vessel operations, habitat and fauna disturbance from vessels and human interference are well understood, however an operational NEBA undertaken at the time of a spill will determine the suitability of the response	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the organisation or geographical area, infrequent or non-standard activity, good practice is well defined.

	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a shoreline protection response strategy must be greater than no response.	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Rare	Severe	High
Oily waste spills	Occasional	Moderate	Medium
Damage to benthic habitats	Occasional	Moderate	Medium
Interference with coral spawn slicks	Occasional	Minor	Low
Cultural Heritage Impacts	Occasional	Moderate	Medium
Interference to shoreline access for First Nations people	Occasional	Moderate	Medium

Assessment of Proposed Control Measures

The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP.

The controls for each response strategy were assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
GENERAL SHORELINE OPERATIONS (applicable to all shoreline activities)		
Preparedness - all preparedness EPS are presented in Appendix B of the OPEP.		
Activity Controls		
There is no increase in environmental harm from oil spill response activities.	**(RSK-13:EPS-01)** The response strategy is only undertaken if a WA and/or NT Control Agency operational NEBA determines it is likely to have a net environmental benefit and it is safe to do so.	Operational NEBA is prepared.
	(RSK-13:EPS-02) A Control Agency NEBA is undertaken during each operational period to determine if the response strategy is continuing to have a net environmental benefit.	Operational NEBAs are prepared.
	(RSK-13:EPS-03) DIMT confirms protection priorities in consultation with WA DoT and/or NT IC (CA) as appropriate prior to deployment of SCAT.	IAP is in place. Incident logs verify DIMT has consulted with the Control Agencies.

	(RSK-13:EPS-04) Environmental briefings are conducted for shoreline monitoring crews to identify site-specific risks and suitable controls.	Briefing records are available.
	(RSK-13:EPS-05) SCAT crews are inducted into the TRPs so that environmental, cultural heritage and socio-economic sensitivities are known and can be appropriately managed during survey.	Incident logs verify inductions took place.
Access and onshore activity is undertaken in accordance with Traditional Owner requirements.	**(RSK-13:EPS-06)** Traditional Owner permission (with conditions, if required) is sought and granted to access shorelines for this response (where required).	Incident logs verify permission was granted. Tradition Owner permits (if relevant) are available.
	(RSK-13:EPS-07) Traditional Owners are invited to participate in the activity to ensure that cultural heritage values are protected.	Incident logs verify invite to Traditional Owners was issued.
As recommended by Operational NEBA, undertake shoreline response in accordance with OPEP (appropriate to the nature and scale of the spill)	**(RSK-13:EPS-08)** Where monitoring and evaluation indicates that shoreline contact could occur within the next 3 days, SCAT teams will be deployed within 24 hours of that forecast.	Incident logs verify that SCAT resources have been mobilised in suitable timeframe.
	(RSK-13:EPS-09) SCAT verify shoreline and nearshore sensitivities (environmental, cultural), determine 'no-go' zones (turtle nesting, shoreline bird habitats, etc), least impact zones and any limitations associated with shoreline response to inform the WA and/or NT operational NEBA and IAP for the predicted shoreline contact area.	IAP records.
	(RSK-13:EPS-10) TRPs are reviewed and updated based upon SCAT outcomes to become site-specific TRPs and to reflect outcomes of the operational NEBA.	Site-specific TRPs available.
	(RSK-13:EPS-11) During periods of important ecological sensitivity (e.g., coral spawning, turtle nesting/inter-nesting and hatching season), EOG will provide input into WA and/or NT operational NEBA regarding these sensitivities and will assist with providing input into operational constraints.	Operational NEBA verifies that sensitivities have been considered and operational controls developed.
No secondary contamination to the environment from	**(RSK-13:EPS-12)** Decontamination zones are setup and implemented to ensure that responders do not cause secondary contamination.	Incident logs verify decontamination zones and waste facilities have been set up and is supervised.

shoreline response activities	**(RSK-13:EPS-13)** Waste collection facilities are set out in accordance with TRPs, which provides for waste storage tanks and hoses to be located in a contained, impervious area.	Incident logs verify waste storage facility has been set-up and is supervised.
	(RSK-13:EPS-14) Spill kits are available at oil recovery areas, which are under supervision and secured from public access.	Audit/Inspection records verify waste storage facility has spill kits
	(RSK-13:EPS-15) Waste is collected, transported, and disposed in accordance with WA and/or NT waste management requirements	Waste Transport Certificates verify waste disposal location.
Impacts from shoreline activities to shoreline fauna, native vegetation and habitats are prevented.	**(RSK-13:EPS-16)** Access to shoreline habitats is via established tracks. Access outside existing tracks is determined in consultation with the WA and/or NT Cas and local land managers.	Incident records verify that consultation has occurred and controls implemented.
SHORELINE PROTECTION & DEFLECTION		
Response		
As recommended by Operational NEBA, undertake shoreline protection in accordance with OPEP appropriate to the nature and scale of the spill.	**(RSK-13:EPS-17)** Site-specific TRPs are reviewed and revised based upon SCAT and monitoring and evaluation outcomes.	Revised site-specific TRPs.
	(RSK-13:EPS-18) Where the WA and/or NT Control Agencies request shoreline protection resources, EOG will provide them within the requested timeframes.	Incident log verifies resource deployment within requested timeframes.
Activity Controls		
Shoreline protection equipment does not lead to wildlife entrapment.	**(RSK-13:EPS-19)** Monitoring teams are deployed to monitor and maintain the operability of shoreline booms (including oiled wildlife surveillance and management).	Incident logs verify maintenance and wildlife entrapment incidents.
Shoreline protection operations do not harm sensitive benthic habitats (seagrass, emergent reefs).	**(RSK-13; EPS-20)** Vessel and boom anchoring will not occur in areas of fragile/sensitive habitat (reefs, seagrass, sponge).	Incident logs verify adoption of this control.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Fauna disturbance	Remote	Severe	Medium
Oily waste spills	Rare	Moderate	Low
Damage to benthic habitat	Remote	Moderate	Low
Coral spawn slicks	Remote	Minor	Negligible

Cultural heritage impacts	Rare	Moderate	Low
Interference to shoreline access for First Nations people	Rare	Moderate	Low

The risk of spill response activities to the identified receptors is assessed as negligible to low because:

- The control measures adopted are effective in reducing the risk to ALARP.

Demonstration of ALARP

A detailed demonstration of ALARP for shoreline protection is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.

Demonstration of Acceptability

Policy compliance	EOG's Safety and Environmental Policy objectives are met.	
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.	
External context	There have been no concerns raised from relevant persons regarding spill response activities.	

Legislative context	The EPS align with the requirements of:
	• *OPGGS Act* 2006 (Cth) and OPGGS€:
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• *EPBC Regulations* 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Protection of Marine Waters (prevention of Pollution from Ships) Act* 1987 (WA).
	• *Emergency Management Act* 1986 (WA).
	• *Contaminated Sites Act* 2003 (WA).
	• *Waste Management & Pollution Control Act* 1998 (NT).
	• *Environment Protection Act* 2019 (NT).	

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(OPEP)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.

	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(OPEP)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS listed in this table complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS listed in this table complement AMOSPlan.
	WA OSCP (2015)	DoT will implement this plan in the event their resources are deployed. The EPS listed in this table compliment the WA Oil Spill Contingency Plan.
	NT OSCP (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS listed in this table compliment the NT Oil Spill Contingency Plan.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS listed in this table are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	Shoreline protection and deflection	Use of booms in oil pollution response, Technical Information, Paper 3 (ITOPF, 2011c).
		Shoreline Response Programme Guidance (IPIECA, 2020).
		Characteristics of Response Strategies: A Guide for Spill Response Planning in Marine Environments (NOAA, 2001).

Environmental context	MNES	
	AMPs	Oil causing marine pollution are a threat identified in the North Marine Parks Network Management Plan 2018. Removal of oil through spill response activities possibly in areas such as Ashmore Reef, Cartier Island will assist in the protection of values in AMPs. Shoreline protection, with all controls implemented, is not inconsistent with maintaining AMP values.
	Ramsar wetlands	Shoreline protection activities may be undertaken on the perimeter of onshore Ramsar wetlands (e.g., Cambridge Gulf). Protection controls developed for implementing shoreline protection aim to protect the wetlands from damage and improve environmental outcomes resulting from any spills. Impacts to Ramsar wetlands are not expected.
	TECs	Shoreline protection activities will not be undertaken in areas where TECs exist.
	NIWs	Shoreline protection activities may be undertaken on the perimeter of NIWs (Moyle River Estuary, Daly River Estuary, Darwin Estuary). Protection controls developed for implementing shoreline protection aim to protect the wetlands from damage and improve environmental outcomes resulting from any spills.
	Nationally threatened and migratory species	Some threatened and migratory species have the potential to be present in shoreline protection operations, however impacts are predicted to affect individual species only and not populations of threatened or migratory species. Protection controls developed for implementing shoreline protection aim to protect threatened and migratory species from damage and improve environmental outcomes resulting from any spills
	Other matters	

	State marine parks	The North Kimberley Marine Park Management Plan has the strategic *objective to protect and conserve biodiversity and ecological health*. CAR activities support this objective and do not conflict with the management objectives for the park in terms of cultural; natural; recreation, tourism and community; or commercial values detailed in the Management Plan. Shoreline protection and deflection will assist in preserving the objectives detailed in the management plan. Shoreline protection and deflection operations may be undertaken in coastal marine parks at the direction of the relevant WA and/or NT CAs, given that parks are predicted to have shoreline oil loading above ecological limits. With controls implemented, shoreline protection and deflection activities are not expected to have significant impacts on these marine parks or the management objectives of the parks' management plans.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (e.g., nesting beaches, important foraging grounds, corals, seagrasses* AND *manage anthropogenic activities to ensure that marine turtles are not displaced from habitat identified as critical to their survival*. Shoreline protection activities, with controls implemented, will prevent impacts to critical habitats. Shoreline protection supports identified priority actions within this management plan.
		The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. Shoreline protection activities will assist in the removal of oil from the environment and isolation of species from oiled areas, thereby reducing the threat in support of the plan.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Statement of acceptability	EOG considers the risk posed by shoreline protection operations in the marine environment to be acceptable because: • It will adhere to the company's Environment Policy. • The residual risk ratings of additional hazards identified in shoreline protection operations are negligible to medium and ALARP. • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered. • Activity is compliant with relevant legislation and industry best practice. • Spill response activities will not have long-term or significant impacts on MNES. • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species. • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans. • Spill response activities are not inconsistent with ESD principles.
Environmental Monitoring	
• As per Beehive-1 OPEP and OSMP requirements.	
Record Keeping	
• Contracts and agreements with third parties. • Equipment and service provider register. • Inspection/audit reports. • Incident and daily operations reports. • OSMP Records (SCAT) • Stakeholder Consultation Records	• Operational NEBA. • Briefing records. • IAP. • Shoreline TRPs (including revised TRPs) • Induction Records

9.6. Shoreline Clean-up

9.6.1 Background Information

As per the Level 3 LoWC OSTM results, the first shoreline contact with coastlines associated with a LoWC is 11.6 days at 10 g/m^2 (Moyle River Estuary, Lacrosse Island, Cambridge Gulf and Berkeley River) in the absence of any on-water response efforts. Shoreline impacts at ecological harm levels (100 g/m^2) is 12.5 to 12.8 days (Cambridge Gulf, Lacrosse island, Cape Domett, Berkeley River).

The objective of shoreline clean-up is to reduce the volume of oil on the shoreline, reduce the likelihood/consequence of impacts to shoreline sensitivities and promote increased speed to the natural recovery of the shoreline to its pre-oiled state.

Any shoreline response activities will be preceded by a SCAT survey. The objective of SCAT is to systematically collect data about the location, nature and degree of shoreline oiling and at risk/impacted wildlife to inform shoreline treatment and oiled wildlife response planning.

Shoreline response activities including SCAT come under the control of the relevant WA and NT Control Agencies. Control Agencies may choose to conduct the SCAT activity, including provision of SCAT specialists, wildlife specialists, local government rangers and Aboriginal heritage advisors/rangers. The Control Agency may also request EOG to provide specialist support personnel including SCAT and OWR experts and logistical support for remote and/or larger SCAT operations.

Two shoreline locations that fall under Commonwealth jurisdiction (rather than WA or the NT) are Ashmore Reef and Cartier Island. In the event of a spill reaching these two locations, EOG would be the Control Agency. Under this scenario, the SCAT team would consist of SCAT specialists and wildlife response specialists provided by industry mutual aid, supported by a Parks Australia ranger (or equivalent). No Aboriginal heritage advisors are required at this location. Note that an unexploded ordinances risk is present on Cartier Island and in waters within a 10 km radius. Landing or anchoring anywhere within the Cartier Island AMP is strictly prohibited. Therefore, SCAT surveys will be conducted by fixed wing, helicopter or drone in this location. Due to the sensitivities of these shoreline receptors and the safety issues associated with UXO, the merits of shoreline clean-up at Cartier Island will be discussed in consultation with the DNP.

Shoreline types within the LoWC EMBA are described in Section 11.2 of Appendix 11 of this EP, and include :

- Rocky shorelines of the Bonaparte Archipelago;
- Fine sands, silts, clays, muds of sheltered and highly tidal mangrove/saltmarsh and salt flat systems of the Kimberley and NT maintain shorelines; and
- Coarse sandy/gravel beaches, on offshore islands, the Kimberley coastline and some areas of the NT coastline.

9.6.2 Scope of Activity

Any clean-up response will be preceded by a SCAT survey. NOAA (2013b) describes this process as the systematic approach to collecting data on shoreline oiling conditions using the following steps:

- Conduct reconnaissance survey;
- Segment the shore;
- Assign teams and conduct shoreline surveys;
- Develop clean-up guidelines and endpoints;
- Submit reports and sketches to Planning Section in DIMT;
- Monitor effectiveness of clean-up;
- Conduct post-clean-up inspections; and
- Undertake a final evaluation of clean-up activities.

A trained SCAT team will be deployed prior to shoreline stranding (informed by surveillance and tracking) to provide feedback on the best methods for clean-up (as appropriate).

Shoreline clean-up activities will be controlled by the relevant WA and/or NT Control Agencies. Feedback from SCAT teams into a WA and/or NT-controlled NEBA will determine whether shoreline intervention offers net benefits. Techniques that may be considered in the NEBA are provided in Table 9.14, which lists techniques generally in order of least impact to highest impact.

The deployment of all types of shoreline clean-up material and associated staging facilities such as waste reception and responder amenities (shelter, ablutions) requires a large, coordinated logistics effort and access to large numbers of on-ground responders.

Given the remoteness and lack of land access to many parts of the EMBA coastline, shoreline clean-up operations are expected to be undertaken mostly by marine-side resources.

Table 9.14. Description of key shoreline clean-up techniques (ITOPF 2011d, 2012)

Technique	Description	Suitable shorelines
1. Natural Cleaning	For most shorelines, oil will clean and degrade naturally over time, the rate determined by the oil type (low or high viscosity) and coastline feature (low/high energy). Natural cleaning encompasses photo oxidation, biodegradation, abrasion, clay/oil flocculation and/or mineral-oil aggregation. In high energy environments (e.g., surf beaches, sheer cliffs) oil is likely to be removed within a seasonal cycle (except areas above the high tide mark which may take several years). In low energy environments (mangroves, salt marshes), degradation can take many years as oil is incorporated into fine anaerobic muds where the absence of oxygen precludes bacterial degradation. **Jabiru crude**, *a persistent Type II crude oil, is expected to take a substantial period of time to weather naturally on coastal shorelines and may infiltrate the underlying substrate.* **MDO** *evaporates within hours to days and spreads to very thin layers rapidly. MDO is not sticky or viscous and when stranded on the shoreline the hydrocarbon will tend to penetrate the porous sediments quickly but be washed by waves and tidal action. While MDO is considered persistent (5% by mass), MDO is readily and completely degraded by naturally occurring microbes in timeframes of 1-2 months (NOAA, 2020). Natural cleaning is feasible for MDO spills on any shoreline type found in the EMBA.*	Sub-tidal macroalgae & seagrass Social infrastructure & cultural values (low level oiling only) All shorelines (dependent on oiling level)
2. Flushing	Flushing uses high volumes of low-pressure water to wash stranded or buried oil from shorelines. Floating booms can be used in conjunction with this process to contain any oil released with recovery of oil through skimming. Within sediments: Oil can become mixed with substrate (sand, pebbles, rocks) through natural seepage, burial under clean sediment deposited by tidal movements or after storms, or as a result of clean-up activities. Flushing oil from sediment reduces the amount of waste compared with substrate removal. Seawater is drawn by portable pumps through screens/hose to lances or nozzles. Water is injected into sediment to provide agitation, dislodging oil. When dislodgement is above the waterline released oil can be channelled to pits, trenches or to Sea where it is contained for recovery. Sensitive/inaccessible areas: Flooding shorelines with water may flush oil and oiled debris from sensitive areas such as mangroves. Low-pressure flushing reduces the potential for physical damage to the shoreline, habitat and fauna compared with other techniques. The oil flushed out can be contained and recovered from the sea surface (since these shorelines are usually in calm, sheltered waters). *Technique suitable for both crude oil and MDO spills where material is still fluid. Not feasible for muddy or sandy substrates.*	Social infrastructure & cultural values Fine to coarse grained sand/gravel beaches Exposed tidal flats (low pressure only) Sheltered, solid man-made structures, riprap Sheltered tidal flats (low pressure only)
3. Ploughing/ Harrowing	After bulk oil removal from sand beaches, light contamination usually remains where oil has been mixed into the sand by clean-up traffic. Agricultural ploughs/harrows can be used repeatedly to the lightly oiled sediments during low tide to remove the remaining contamination. Breaking up oiled sediments increases surface areas exposed to weathering processes and facilitates sediment aeration enhancing microorganism degradation. Small	Fine to coarse grained sand/gravel beaches

Technique	Description	Suitable shorelines
	amounts of oil that may be released during high tide can be recovered using sorbents. *This technique is suitable for both crude oil and MDO hydrocarbon residues on accessible shorelines*.	
4. Adsorbents	Adsorption refers to the process whereby oil is preferentially attracted to the surface of the material and incorporated into the body of the material. Once recovered, oiled material needs to be stored in enclosed storage facilities to prevent oil leaching (secondary contamination) until disposal. Adsorbents are best used in nearshore and onshore clean-up operations, but large-scale use is discouraged due to the excessive volumes of oiled waste. Adsorbent use should be restricted to situations where other techniques aren't likely to be feasible or effective and is best employed to capture run-off from high-pressure washing, capture oil mobilised on successive tides in mangrove areas or to clean rockpools. *Technique is feasible for both crude oil and MDO spills on accessible shores where oil is free-floating close to shore or stranded onshore.*	Sub-tidal macroalgae & seagrass, shoreline fauna (in conjunction with protect and deflect activities) Social infrastructure & cultural values (low level oiling only) Coarse grained beaches sheltered, solid man-made structures, riprap Sheltered tidal flats (where damage to vegetation and substrate is limited)
5. Manual Collection	Manual collection of oil is a suitable technique that can be employed for most shoreline types except those deemed too dangerous, such as sheer cliffs, rock walls and jetties. A workforce using shovels, rakes and buckets is more selective than mechanical methods of cleaning (e.g., bulldozers) as the amount of underlying clean material collected can be minimised. While manual clean-up is labour intensive, it generally leads to more rapid shoreline recovery as a result of less disturbance to substrate. Manual clean-up is particularly effective for high viscous or emulsified oils where it can be directly transferred using shovels and buckets/plastic bags into a centralised waste storage area. *Suitable for crude oil. MDO rapidly percolates into substrates and surface collection is not feasible.*	Social infrastructure & cultural values Shoreline Fauna Coarse grained beaches Exposed tidal flats sheltered, solid man-made structures, riprap Sheltered tidal flats (where damage to vegetation and substrate is limited)
6. Sand blasting/steam cleaning	High-pressure washing can be used on hard substrates (cliffs, rock platforms and man-made objects such as piers and rock walls) once bulk oil is removed. This method is generally applied when further natural cleaning is insufficient or too slow for recreational, amenity or aesthetic reasons and may occur with hot or cold water. This method damages fauna such as limpets, mussels or lichen and may damage the substrate surface itself. Oil released by pressure washing can be collected with adsorbent materials at the base of the surface to be cleaned or contained and recovered in booms. *Technique suitable for both crude oil and MDO but not feasible on soft substrates, vegetation, or loose substrates such as sand.*	Sheltered, solid man-made structures, riprap
7. Mechanical collection	Oil-in-water emulsions may be lifted directly from the sea surface in excavator buckets into trucks and skips. Skilled operators are required to minimise the volume of water collected with the oil. On sandy beaches, if there is adequate access, front-end loaders can be used to collect and remove stranded oil and contaminated material, though care must be exercised to ensure that oil is not	Social infrastructure & cultural values Fine grained sand/gravel beaches

Technique	Description	Suitable shorelines
	mixed with clean sediment through the actions of the mechanical equipment. Oiled material must be temporarily stored prior to removal from site. *Technique is suitable for crude oils but not feasible on shorelines that cannot support heavy equipment and sensitive habitats (seagrass, corals, soft substrates – saltmarsh, mangrove, inter-tidal flats). Technique is not suitable for MDO residues which spread rapidly to sheens and percolate into sand sediments.* Floating oil accumulated in calm waters against shorelines accessible by vehicles can be recovered by vacuum pumps and/or skimmers after being concentrated by recovery booms. Similarly, trenches can be dug in sandy beaches to collect through flushing with the oil collected by vacuum trucks or temporarily stored.	
8. Chemical dispersants (shoreline application)	Dispersants are sometimes used as cleaning agents to remove remaining oil from hard surfaces such as man-made structures, rocks and boulders. Dispersed oil cannot be recovered and in instances where its application is approved, it is generally applicable to areas of low environmental sensitivity but high amenity value. It is very unlikely that chemical dispersants will be used in shoreline clean-up operations. *Technique is suitable for crude oil residues. MDO residues quickly evaporate and percolate into sediments*.	Sheltered, solid man-made structures, riprap (where residue does not pose risk)
9. Vegetation Removal	In rare circumstances, vegetation may require removal to remove oil from the environment. This is likely where viscous oil has adhered to vegetation such as mangroves and saltmarsh and cannot be otherwise removed, or possibly where secondary contamination has occurred through sand dune vegetation as a result of clean-up activities. *Technique is feasible for habitats composed of vegetation – wetlands, seagrass beds and kelp beds containing emergent vegetation.*	Emergent macroalgae & seagrass Social infrastructure & cultural values Coarse grained beaches Exposed tidal flats Sheltered tidal flats & mangroves (where damage to vegetation and substrate is limited)

Note the following:

- Cliffs/Rocky Coves (Bonaparte Archipelago): IPIECA-IOGP (2015d) identify that the base of cliff faces can be accessed only with great difficulty and can present an extremely hazardous working environment. Typically, cliffs and inaccessible rocky coves are highly exposed and best left to self-clean naturally unless there are over-riding reasons to intervene. Unless the oil has been thrown up to extreme heights by exceptional weather conditions and is not under the influence of normal sea conditions, residual staining would be expected to diminish over 2-3 seasonal cycles. Given the extreme tidal regime of the Kimberley coastline, together with the recommendations of IPIECA-IOGP (2015d), planning for cleaning of remote rocky cliffs/shorelines is not considered appropriate.
- Wetlands/mudflats: In general, oil deposited on mudflats does not penetrate into the substrate because the water table is sufficiently high to provide a barrier against the downwards migration of oil. It is most likely that the oil will re-float and migrate elsewhere, however this does not apply when there are open stemmed plants, animal burrows,

wormholes, etc., or if oil is present in a storm which suspends sediment, oil can attach to the sediment and be deposited in the mudflat (IPIECA-IOGP, 2015d). Erecting barriers across major inlets allowing water exchange but preventing oil ingress is the best strategy paying attention to the tidal currents that the barriers need to withstand (IPIECA-IOGP, 2015d).

- Sandy beaches: It is anticipated that the typical response strategy for sandy beaches will be small remote response teams conducting manual clean-up (i.e., rakes, shovels, lined bulk bags) with limited likelihood for use of any machinery-assisted cleaning except for small, tracked vehicles that may be used for collection and transport of small volumes of oily waste to collection points/landing barges. The high tidal regime will result in enhanced natural surf washing/flushing, a recognised rehabilitation technique within IPIECA-IOGP (2015d). If relatively close to the surface, oil may be mobilised through harrowing/ploughing or by using flushing lances to release the oil and flush it to the waters' edge where it can be recovered by skimmers or sorbents. This technique would need to be recommended by the relevant CA.

9.6.3 Hazards

The hazards associated with SCAT surveys and shoreline clean-up are:

- Additional human activity on shorelines;
- Mechanical access to, and activity on beaches;
- Loss of shoreline sediment; and
- Waste collection and transport (see Section 9.8).

9.6.4 Known and Potential Impacts and Risks

The known and potential environmental risks of shoreline clean-up include:

- Ground disturbance due to manual raking, turnover of sand beaches or tidal flats to remove oil could affect sediment infauna,
- Damage to First Nations cultural heritage sites (e.g., shell middens);
- Damage to habitat (i.e., loss of inter-tidal or supratidal flora/fauna species habitat);
- Disturbance to shoreline fauna from human presence – noise, air, light emissions from response activities (such as pumps, vehicles, staging areas) affecting behaviours (e.g., shorebird and seabird foraging and nesting, turtle nesting) with potential for secondary contamination of foreshore and backshore areas;
- Vegetation cutting and compression in preparing storage areas, vehicle access tracks and accommodation areas;
- Vertical infiltration/secondary contamination of oil into shoreline sediments;
- Increased demand for what may be limited resources in small, isolated coastal towns (such as accommodation, fuel, hire vehicles, PPE); and
- Temporary exclusion of residents and tourists from amenity beaches.

Note that the risks relating to waste handling and management are assessed in Section 9.5 and with waste transport and disposal are addressed in Section 9.8.

9.6.5 Evaluation of Impacts and Risks

Shoreline clean-up plans can only be finalised once the fate and trajectory of the spilled oil, the oil type and volume have been verified. Damage or loss of habitat from oil spill response techniques is expected, in most cases, to be localised to the area in which the technique is employed but may have secondary impacts to features further along shorelines.

Oil spill modelling indicates that in the case of a LoWC, the probability of accumulation on any shoreline is 100% and the greatest volume of oil ashore is 705m^3. The maximum length of shoreline exposed to accumulations of oil at actionable concentrations (> 100 g/m^2), it is approximately 129 km (in summer). This is expected to be the maximum length of shoreline subjected to clean-up and to the extent of possible effects of response activities. It is important to note this is the maximum predicted length of shoreline affected, with the actual length of shoreline impacted lower with areas not amenable or suitable for clean-up activities. Modelling also assumes that once oil accumulates on a shoreline, it remains at the location until removed. In reality, the loading will be temporary removed by natural processes with diminishing concentrations.

The risks described in this section assume independence of response measures and are based on the unmitigated spill outcome without any nearshore containment or deflection booming which would reduce impacts under real conditions.

Damage to Shoreline Habitat

Damage to shoreline habitats can be caused by high pressure washing (detaching intertidal rock biota such as limpets, mussels and algae), compression/compaction of shoreline sediments from vehicles and human responders, removal of oiled biota and collection of oiled sediments and wrack from beaches leading to loss of sandy habitats and sediment infauna.

Damage to intertidal shoreline habitats and communities may have indirect effects on food chains affecting the macrofauna communities they support. In addition, removal of habitat (e.g., sand from beaches) may also make the beaches more vulnerable to ongoing erosion. Affected sites are predicted to recover though beach replenishment due to natural sediment transport processes and recolonisation by beach biota within the medium term (1-3 years).

Cultural Heritage

Cultural heritage assessment has been undertaken in Section 9.5 (Shoreline Protection & Deflection).

Disturbance to Shoreline Fauna

The noise, light and general disturbance created by shoreline clean-up activities is likely to disturb the feeding, breeding, nesting or resting activities of resident or migratory fauna species present in the affected area. This includes beach-nesting turtles and shoreline birds whereby eggs may be damaged; incubating adult birds may abandon nests; eggs may not be protected against adverse weather conditions or chicks may be disturbed leading to starvation. Compression due to machinery may also damage turtle nests. Any erosion caused by responder access to sandy beaches, or the removal of sand, may also bury nests. For critical turtle breeding areas such as Cape Domett and Lacrosse Island (flatback turtle nesting areas), this may have impacts at the population level. Note that shoreline response activities occur during daylight hours only.

Damage to Vegetation

Localised damage to vegetation may occur from shoreline clean-up activities, vehicle and foot traffic to access shorelines, and associated vegetation clearing for land-use (staging areas, etc). In

addition, shoreline access may also cause soil compaction and erosion, which may result in poor vegetation growth and regeneration.

Impacts to sensitive vegetation areas, such as mangroves and saltmarsh may lead to long-term damage. The use of heavy equipment, poorly supervised manpower and removal of oiled sediment have led to long-term damage due to trampling, damage to root systems and consequent erosion in saltmarshes (IPIECA-IOGP, 2015d).

Damage to Sediment/Infiltration of Oil

Vertical infiltration of oil into shoreline sediments is possible by machinery/ equipment movement thereby exposing fauna to oil that would not otherwise be exposed. This affects the base of the foodweb to contamination that may bioaccumulate up through the food chain. It can also result is the need to increase removal of the affected substrate, which in turn will exacerbate the risk of beach erosion. Untreated, secondary contamination of the environment from human/equipment movement from oil-exposed areas into clean areas can also have the same impact causing chronic toxicity impacts to flora/fauna directly contacted. Habitat degradation or loss may occur as a result of soil pollution. The degree of impact is a function of the volume of oil spilled and how long it remains in the environment before being cleaned (if at all).

Ground/Topography Disturbance

The collection of oil from sandy beaches may also result in significant volumes of clean sand removed from beaches, resulting in temporary loss of shoreline habitat and associated macrofauna and meiofauna. The reduced sand profile of sandy beaches may also make them more vulnerable to damage (such as additional sand loss, erosion of dunes, etc.) caused by spring tides and storm surges. This risk is temporary as tides replenish the lost sand over the following weeks/months.

Temporary Exclusion of Residents/Tourists

The presence of stranded oil and clean-up operations will necessitate temporary beach closures, with ground disturbance also requiring beach closures. During shoreline clean-up operations, it is expected that the entire beach would be closed.

As described in Appendix 11 (Sections 11.5 & 11.6), there are indigenous, recreational and tourism activities linked to the coastal region. The exclusion of tourist is likely to be result in impacts to local tourism businesses. Given that coastal exclusions may be in place for the majority of the release duration and for extended clean-up once the well is killed, there is potential for a prolonged impact to tourism and local residents (~1 year).

Influx of shoreline personnel to area

The influx of clean-up personnel to a given region, if landside access is available, will place increased demand on the resources of small and remote coastal towns in the EMBA such as accommodation, meals, vehicle hire, fuel groceries and other day-to-day consumables (where these are available, noting the remoteness of most of the shoreline in the EMBA). Sudden and temporary influxes of workers to small Australian towns can often be fraught with social unrest as the demand for goods and services can negatively impact on the provision of services to residents and tourists. This is likely to be temporary and localised. For a response to a Beehive LoWC, these impacts are not likely to materialise given that it is likely that most shoreline clean-up personnel will be accommodated in offshore accommodation vessels.

9.6.6 Impact and Risk Assessment

Table 9.15 presents the impact and risk assessment for shoreline clean-up operations.

Table 9.15. Impact and risk assessment for shoreline clean-up operations

Summary		
Summary of risks	Damage to shoreline habitats and cultural heritage. Damage to sediment/topography. Damage to sediment. Disturbance to shoreline fauna. Exclusion of residents/tourists to coastal areas. Influx of population to remote areas.	
Extent of risk	Immediate area of works along relevant shorelines.	
Duration of risk	Medium-term (depending on spill volume, trajectory and shorelines affected, potential for months of clean-up).	
Level of certainty of risk	MEDIUM – The impacts associated with SCAT and shoreline clean-up are well understood, however an operational NEBA undertaken at the time of spill will confirm the suitability of activity.	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the organisation or geographical area, infrequent or non-standard activity, good practice not well defined or met by more than one option.
	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a spill response strategy must be greater than no response.	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Damage to shoreline habitat	Likely	Moderate	Medium
Cultural heritage impacts	Occasional	Moderate	Medium
Sediment contamination (including secondary contamination)	Occasional	Moderate	Medium
Disturbance to shoreline fauna	Occasional	Moderate	Medium
	Occasional	Severe (based on presence of nesting/hatching turtles and/or birds)	High
Damage to vegetation	Likely	Moderate	Medium

Ground/topography disturbance	Occasional	Moderate	Medium
Exclusion of residents/tourists	Likely	Moderate	Medium
Influx of population to remote area	Likely	Minor	Low

Assessment of Proposed Control Measures
The suitability of response techniques to a hydrocarbon spill from Beehive-1 drilling activities are based on a strategic (or *a-priori*) NEBA, which is presented in Appendix B (BOD) of the OPEP. A strategic NEBA is based on theory and experience from other global hydrocarbon spill incidents, but not on experience for this well, this oil type (which is speculative) and this location. An operational (*a-posteriori*) NEBA will be undertaken at the time of the spill once key facts about the spill are established (nature of the oil, flow rate, trajectory of movement, etc).

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness - all preparedness EPS are presented in Appendix B of the OPEP.		
Response		
Implement shoreline clean-up response as recommended by an operational	**(RSK-14:EPS-01)** For Ashmore Reef and Cartier Island, DIMT to confirm protection priorities in consultation with the DNP together with the deployment of SCAT teams to gather information.	Incident logs verify DIMT consulted with the DNP about protection priorities at these locations.
NEBA so there is no increase in environmental harm from oil spill response activities.	**(RSK-14:EPS-02)** For Ashmore Reef and Cartier Island, shoreline response strategies will be implemented in consultation with the DNP after an operational NEBA determines a net benefit.	Incident logs verify operational NEBA was undertaken.
	(RSK-14:EPS-03) Unless directed otherwise by the Control Agency, a Heritage Advisor and/or Traditional Owner and/or Aboriginal Ranger is consulted if shoreline operations overlap with areas of cultural significance.	Incident logs verify these experts were consulted on shoreline operations.
	(RSK-14:EPS-04) The establishment of forward staging areas and decontamination areas on shorelines is undertaken only under the direction of or in consultation with the WA DoT and/or NT DEPWS.	Outcomes of consultation with WA/NT agencies regarding forward staging areas is documented in IAP and incident logs.
	(RSK-14: EPS-05) Clean-up teams are mobilised to undertake shoreline clean-up activities in accordance with the timeframes in the OPEP.	Incident logs verify clean-up crews were deployed in the assigned timeframes.

	(RSK-14: EPS-06) Shoreline decontamination areas are set up at each shoreline response location to ensure secondary oiling impacts are prevented.	Incident logs verify that decontamination areas were established.
	(RSK-14: EPS-07) No vehicle access or machinery to be used in sensitive vegetation (mangroves, saltmarsh and other sensitive habitat).	Incident logs verify no vehicle or machinery access into sensitive coastal vegetation.
	(RSK-14:EPS-08) Deploy accommodation vessel/s to remote areas to provide accommodation for shoreline teams where onshore accommodation is not available or feasible to rapidly establish.	Incident logs verify accommodation vessel/s has been deployed.
	(RSK-13:EPS-09) TRPs are reviewed and updated based upon SCAT outcomes to become site-specific TRPs and to reflect outcomes of the operational NEBA.	Site-specific TRPs available.
	(RSK-14:EPS-10) SCAT response continues to provide feedback on the effectiveness of the shoreline response until termination criteria are met, as outlined within the OPEP.	Incident logs verify effectiveness of SCAT response.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Damage to shoreline habitat	Rare	Moderate	Low
Damage to cultural heritage	Rare	Moderate	Low
Sediment contamination	Rare	Moderate	Low
Disturbance to shoreline fauna	Remote	Moderate	Medium
	Remote	Severe (based on presence of nesting/hatching turtles and/or birds)	Medium
Damage to vegetation	Remote	Moderate	Low
Ground/topography disturbance	Rare	Moderate	Low
Exclusion of residents/tourists	Likely	Moderate	Medium
Influx of population to remote area	Likely	Negligible	Negligible

The residual risk of SCAT and shoreline clean-up response activities to the identified receptors is assessed as negligible to medium and is considered to be ALARP on the following basis:

- The control measures adopted are effective in reducing the risk. Further controls will be developed based upon the area impacted through the NEBA process.
- The shoreline response will not proceed unless there is a net benefit. This will include the assessment of impacts against seasonal turtle critical habitats to determine whether clean-up activities should proceed.
- The response option has been assessed on a conservative basis utilising the worst case shoreline oil loading and independent of other response options which, if implemented will reduce the likelihood and severity of impacts along the shoreline.

Demonstration of ALARP
A detailed demonstration of ALARP for shoreline clean-up is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.

Demonstration of Acceptability		
Policy compliance	EOG's Safety and Environmental Policy objectives are met.	
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.	
External context	There have been no concerns raised from relevant persons regarding spill response activities.	

Legislative context	The EPS align with the requirements of:
	• OPGGS Act and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (risk assessment undertaken to demonstrate ALARP).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Protection of Marine Waters (prevention of Pollution from Ships) Act* 1987 (WA).
	• *Emergency Management Act* 1986 (WA).
	• *Contaminated Sites Act* 2003 (WA).
	• *Waste Management & Pollution Control Act* 1998 (NT).
	• *Environment Protection Act* 2019 (NT).	

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-14: all EPS)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.

	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-14: all EPS)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS listed in this table complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS listed in this table complement AMOSPlan.
	WA OSCP (2015)	DoT will implement this plan in the event their resources are deployed. The EPS listed in this table complement the WA OSCP.
	NT OSCP (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS listed in this table complement the NT OSCP.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	SCAT/Shoreline Clean-up	A guide to oiled shoreline assessment (SCAT) surveys (IPIECA/IOGP, 2014f).
		A guide to oiled shoreline clean-up techniques (IPIECA/IOGP, 2015d).
		Shoreline Response Program Guidance – A technical support document to accompany the IPIECA-IOGP guidance on oiled shoreline assessment and shoreline clean-up techniques (IPIECA-IOGP, 2020b).

		Characteristic Coastal Habitats: Choosing Spill Response Alternatives (NOAA, 2013b).
Environmental context	MNES	
	AMPs	Oil causing marine pollution is a threat identified in the North & North-West Marine Parks Network Management Plans 2018. Any spill response activity considered for AMPs such as Ashmore Reef and Cartier Island will be undertaken in consultation with the Commonwealth DNP. Any intervention would proceed after a NEBA identifying a positive benefit and identifying controls to bring any risks to ALARP.
	Ramsar wetlands	As above.
	TECs	Shoreline clean-up will not be undertaken in areas where TECs exist.
	NIWs	Any spill response activity considered for NIWs will be under the control of WA and/or NT CAs and would proceed only after a NEBA identified a positive benefit and identifying controls to be implemented to bring any risks to ALARP.
	Nationally threatened and migratory species	Any spill response activity considered for areas where nationally threatened and migratory species are present will be under the control of WA/NT CAs and would proceed only after a NEBA identified a positive benefit and identifying controls to be implemented to bring any risks to ALARP.
	Other matters	
	State marine parks	The North Kimberley Marine Park Management Plan (coastline is part of park) has the strategic objective *to protect and conserve biodiversity and ecological health*. Shoreline clean-up activities do not conflict with the management objectives for the park in terms of cultural, natural, recreation, tourism and community, or commercial values detailed in the management plan. Shoreline clean-up, if undertaken, will assist in preserving the objectives detailed in the management plan.

	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (e.g. nesting beaches, important foraging grounds, corals, seagrasses* AND *manage anthropogenic activities to ensure that marine turtles are not displaced from identified habitat critical to their survival.* Shoreline clean-up activities will consider turtles within the NEBA performed by the WA or/or NT CAs and will only be undertaken if there are net benefits with controls implemented. Shoreline clean-up supports the identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. Shoreline protection activities will assist in the removal of oil from the environment and isolation of species from oiled areas, thereby reducing the threat in support of the plan.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	
Statement of acceptability	EOG considers the risk of a hydrocarbon release to be acceptable because: • It will adhere to the company's Environment Policy; • The residual risk ratings are ALARP; • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered and incorporated into the design of the activity; • Relevant legislation and industry best practice will be complied with; • Spill response activities will not have long-term or significant impacts on MNES; • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species; • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans; and • Spill response activities are not inconsistent with ESD principles.	
Environmental Monitoring		
• As per Beehive-1 OPEP and OSMP requirements.		

Record Keeping	
• Contracts and agreements with third parties. • Equipment and service provider register. • Exercise drill reports. • Inspection/audit reports. • Incident and daily operations reports.	• Operational NEBA. • Briefing records. • Photos. • OSMP implementation records and reports. • IAP. • Stakeholder Consultation Records • Shoreline TRPs • Induction Records

9.7. Oiled Wildlife Response

9.7.1 Background Information

Oiled wildlife response (OWR) may be required in the event of a significant spill incident, at sea (especially nearshore), on island shorelines, and/or at the WA/NT mainland shores. A description of the coastlines with key fauna sensitivities within the EMBA is provided in Sections 11.2 & 11.3 of Appendix 11 and summarised in the environmental sensitivity matrix for the spill EMBA (see Appendix B of the OPEP).

The objective of OWR is to minimise the impacts of an oil spill on wildlife by both prevention of oiling where possible or mitigate the impacts of individuals when oiling has taken place (IPIECA-IOGP, 2014c).

OWR will be implemented for a Level 2/3 crude oil spill or Level 2 MDO spill. The response will be activated and undertaken in accordance with the WA and/or NT oiled wildlife plans by trained personnel, prioritised according to net benefits based on a WA and/or NT operational NEBA, and informed via monitoring and SCAT activities. OWR response activities are typically under the control of the relevant WA and/or NT CA. Control agencies may choose to deploy their own OWR team leads and support personnel or the CA may request EOG to provide specialist support personnel including OWR team leads, additional OWR personnel and labour hire, OWR equipment, logistical and service support (water, waste) for remote and/or larger OWR operations.

As per shoreline clean-up, the only two locations in the region that do not have a WA or NT CA are Ashmore Reef and Cartier Island, both of which are under Commonwealth control. In the event of a spill reaching these locations, EOG will be the CA. In this scenario, SCAT teams would survey with team membership consisting of SCAT and wildlife response specialists provided by mutual aid, and as recommended by the DNP, possibly a Parks Australia person with local knowledge. No Aboriginal heritage advisers are required at these two locations.

In the event of a spill, modelling indicates that an extensive area of coastline may be exposed to shoreline accumulations of hydrocarbons. Based upon sensitivity of receptors and maximum shoreline loadings, there are a large number of locations – specifically birds and turtles, which have the potential to be oiled. Table 9.11 provides details of the environmentally sensitive shoreline fauna locations predicted to be heavily impacted by oil and the time for contact at 10 g/m^2 (survey implementation timeframes) and 100 g/m^2 (OWR resource response timeframe).

9.7.2 Scope of Activity

Broadly, OWR involves the following three-tiered approach:

1. Primary Response
    a. Undertaking surveillance to determine location and extent of wildlife injuries or death (situational awareness possibly using drones).
    b. Deflecting oil away from areas of high sensitivity where practicable.
2. Secondary Response
    a. Hazing (scaring animals away for impacted or potentially impacted areas).
    b. Pre-emptive capture and exclusion activities.
3. Tertiary Response:
    a. Capture and stabilisation of oiled wildlife (on vessels or on the beach).
    b. Transport to treatment facilities
    c. Treatment of affected animals.
    d. Rehabilitation and release of affected animals.

Site-specific wildlife reconnaissance is undertaken by SCAT teams where possible to optimise response resources.

Hazing, to deter wildlife from entering contaminated areas or move wildlife away from areas likely to be affected by the spill, includes the following techniques:

- Human disturbance (simple process of humans in the wildlife habitat);
- Vehicular disturbance (e.g., terrestrial vehicles, boats and aircraft);
- Visual disturbance (e.g., lights, reflectors, flags, effigies, etc.);
- Auditory disturbance (e.g., noise generators); and
- Physical structures (e.g., fences) to prevent wildlife from entering site.

Animals often quickly become habituated to the deterrent stimulus, at which point efficacy will decrease markedly and the deterrent should be changed.

Both the WA DoT and NT DEWPS have OWR plans for their respective states: the WA Oiled Wildlife Response Plan (WAOWRP) and the NT Oiled Wildlife Response Plan (NTOWRP).

Given the remoteness and poor land access to much of the affected coastline within the spill EMBA, EOG anticipates that a significant portion of the OWR will be supported by marine resources (transport, accommodation, and treatment of affected animals). Therefore, both landside and marine activities are anticipated.

9.7.3 Hazards

OWR involves reconnaissance from vessels, aircraft, drones and shoreline surveys as well as capture, transport, rehabilitation of oiled wildlife.

In addition to vessel, aircraft and shoreline survey/activity hazards previously identified in this EP, additional hazards associated with wildlife response include:

- Hazing activities;

- Pre-emptive capture and capturing of oiled wildlife;
- Relocation of unoiled wildlife;
- Transporting wildlife;
- Stabilising wildlife;
- Cleaning and rinsing oiled wildlife;
- Rehabilitation (e.g., diet, cage size, housing density) activities; and
- Release of wildlife.

9.7.4 Known and Potential Impacts and Risks

At sea, the known and potential environmental risks of OWR activity are:

- Planned noise, air and light emissions from vessels (accommodation and activity support) and aircraft (reconnaissance) as per Section 7.1 to Section 7.11 and Section 9.2;
- Planned liquid and solid discharges from vessels as per Sections 7.3, 7.4, 7.5, 7.8 to 7.11; and
- Unplanned events from vessels as per Sections 8.1 to 8.4.

Onshore, the potential environmental impacts and risks are generally limited to:

- Vegetation clearing required for the establishment of OWR facilities (directed by the relevant WA and/or NT CA);
- Use of drones in surveillance activities;
- Provision of water and other services (generators, hot water);
- The generation of waste materials (oil and detergents washed off animals, oiled carcasses, oiled PPE, transport boxes, used medical supplies); and
- Domestic wastes (e.g., food and kitchen waste, sewage, etc.,) generated by responders.

Additional wildlife-related specific risks associated with OWR include:

- Hazing activities
  - Disturbance to target and non-target biota with potential for behavioural impacts (i.e., to resting, feeding, breeding) and stress-related responses.
  - Exclusion facilities (e.g., drift fences around sensitive habitats such as turtle hatchling areas to prevent hatchlings from entering an oiled area) may deter non-target animals from their normal resting, feeding, breeding and other behaviours.
- Pre-emptive capture and capturing of oiled wildlife
  - Inefficient capture techniques (e.g., due to inadequate training) have the potential to cause stress, exhaustion, or injury to wildlife.
  - Pre-emptive capture/translocation could cause undue wildlife impacts when oiling is not certain.
- Transporting wildlife
  - Inefficient transport techniques have the potential to cause injury, stress and thermoregulation pressures to wildlife.

- Stabilising wildlife
  - Inefficient stabilisation of wildlife has the potential to cause injury to wildlife and thermoregulation stress, in addition to potential mortality during the triage process.
  - Euthanasia of affected animals that cannot be treated or have no chance of rehabilitation.
- Cleaning and rinsing oiled wildlife
  - Inefficient cleaning and rinsing techniques have the potential to cause injury, stress and exhaustion of wildlife (e.g., removing the natural water-proofing on feathers).
- Rehabilitation (e.g., diet, cage size, housing density) activities
  - Inefficient rehabilitation techniques have the potential to cause injury or thermoregulation stress.
- Release of treated wildlife
  - Potential to stress wildlife if released in an unfamiliar site.
  - Potential for rehabilitated wildlife to return to the oiled area of capture.
  - Potential for stress when adjusting to the release site.

9.7.5 Evaluation of Impacts and Risks

The evaluation of environmental impacts and risks associated with OWR are:

- Planned noise, air and light emissions from vessels and aircraft as per Sections 7.3, 7.4 and 7.5;
- Planned liquid and solid discharges from vessels as per Sections 7.8 through 7.11;
- Unplanned events from vessels as per Sections 8.1 to 8.6;
- Aircraft impacts as per Section 7.4 and 7.5 and Section 9.2;
- Shoreline vegetation clearing as per Section 9.6; and
- Waste generation, handling, treatment and disposal as per Section 9.8.

Other identified impacts and risks include:

Unnecessary Wildlife Impacts

It is preferable to have oil-affected animals that have no prospect of surviving or being successfully rehabilitated and released back to their environment, humanely euthanized rather than allow for prolonged suffering. The removal of these individuals from the environment has additional benefits in so far as they are not consumed by predators/scavengers, avoiding secondary contamination of the food chain.

Hazing is best undertaken by trained and experienced expert personnel as there are many factors to be considered, both before and during hazing. Considerations include having available geographic area to relocate species to and understanding specific species response to the specific deterrent.

Hazing and exclusion of wildlife from known congregation, resting, feeding, breeding or nesting areas may have a short or long-term impact on survival if access to result in the prevention of species accessing their preferred resources (affecting both target and non-target species). For example, drift-fences set up on beaches to capture emergent turtle hatchlings before they entered

an inter-tidal oiled zone may prevent them from reaching the sea and will require relocation/ release to an area well away from the slick (informed by modelling).

This approach may also result in additional localised disturbance/handling stress without any benefit as many species (e.g., birds) return to sites from which they have been moved. This can result in reduced healing capacity, reduced reproduction and species recruitment, as well as reduced energy stored for migratory animals.

Untrained personnel capturing and handling native fauna may cause distress, injury and death of fauna. To prevent these impacts only trained oiled wildlife responders will approach and handle fauna. This will reduce the potential for distress, injury or death of individual wildlife and prevent injury to the responders.

Fauna casualties from OWR activities have the potential to result in incremental impacts on fauna populations (though oiling is expected to pose a greater risk). However, there is still the potential for OWR to result in local degradation of the environment or effects on individuals as opposed to population level effects.

Wildlife behavioural impacts due to use of drones

While drones are being used increasingly in wildlife studies, there are few scientifically justified guidelines that provide minimum distances at which wildlife can be approached to minimise visual and auditory disturbance. Bevan at al (2018) identified that sea turtles in nearshore waters off nesting beaches or in foraging habitats exhibited no evasive behaviours (e.g. rapid diving) in response to a drone at or above 20-30m altitude, and at or above 10m altitude for juvenile green and hawksbill turtles foraging on shallow, algae covered reefs. Adult female flatback sea turtles were not deterred by drones flying forward or stationary at 10m altitude when crawling up the beach to nest or digging a body pit or gg chamber. In contrast, flyovers elicited a range of behaviours from crocodiles including minor lateral head movements, fleeing or complete submergence when a drone was present below 50m altitude. Similarly, a colony of crested terns resting on a sandbank displayed disturbance behaviours (e.g. flight response) when a drone was flown below 60m altitude.

Within the Bevan et al (2018) study, it was concluded that behavioural disturbance thresholds for diverse species should be considered when establishing operating conditions for drones. Current evidence shows that negative effects on bird species are reduced when drones are flown at altitudes ≥60 m depending on the characteristics of the target species. The Wildlife Conservation Plan for Seabirds (CoA, 2020) recommends that altitude thresholds for target species should be determined prior to initiating studies.

Hampton et al (2022) also identifies that the proximity of take-off and landing locations have behavioural effects on wildlife with Mulero-Pazmany et al (2017) suggesting that control stations are 100-300m away from the study area.

Drone surveys also present a risk of mid-air wildlife (bird) collision resulting in injuries or fatalities to individuals. Mulero-Pazmany et al (2017) recommends, to minimise disturbance and collision risk that drones are operated only by experienced pilots; drones with a low noise profile are utilised, survey missions should be as short as possible; manoeuvres above animals be avoided; minimise flights over sensitive species or during breeding periods; avoid drones with silhouettes that resemble predator shapes and favour indirect approaches.

Onshore OWR Facility Impacts

Given the remote locations where oil spill impacts may occur, most OWR activity (triage, etc.,) is likely to be marine-based on vessels with appropriate pollution treatment and control for vessel

discharges. Marine-based operations (accommodation, triage, treatment and support) would utilise offshore barges with all wastes contained on-board as per assessed vessel operations (see Section 7.8, 7.9, 7.10 and 7.11)

During oiled wildlife cleaning, it is expected that up to 1000 litres of fresh water may be required to wash and rinse one wildlife casualty. Additional water is required for rehabilitation pools, general cleaning, etc. Freshwater and oily water waste storage is therefore a key consideration. For those areas where onshore access is available, OWR centres will preferentially avoid locations which require vegetation clearing (leading to loss of habitat, reduction in local species biodiversity and abundance). Facilities such as portable toilets, kitchen facilities, oily residue management will be established to deal with the day-to-day requirements of responders so wastes are not discharged to the environment.

Waste Collection, Treatment and Disposal

OWR activities undertaken offshore will manage OWR waste residues on-board vessels in inboard tanks or on deck mounted liquid waste storage tanks and avoid discharge to the marine environment. These wastes will then be collected at the FOB (expected to be Port of Darwin) for treatment and disposal by EOG's waste management contractor (see Section 9.8).

Onshore, OWR facilities will be supplied with facilities for the collection and/or treatment of oily water and detergents associated with the treatment of oiled wildlife to prevent discharge to the environment. A licenced waste management contractor will coordinate the supply of waste facilities and regular removal of wastes (including carcases) to licenced facilities for disposal and/or treatment. Further details are provided in Section 9.8.

9.7.6 Impact and Risk Assessment

Table 9.16 presents the impact and risk assessment for OWR operations.

Table 9.16. Impact and risk assessment for OWR operations

Summary		
Summary of risks	Disturbance, injury or death of wildlife through inappropriate handling and treatment Hazing of target fauna may result in disruption to feeding, resting, breeding activities of non-target species. Onshore response centres set-up and operation (possible vegetation clearing, disturbance to shorelines, cultural heritage impacts) Waste generation and disposal (refer Section 9.8 for assessment)	
Extent of risk	Localised. OWR limited to shoreline areas where hydrocarbon loadings may have ecological impacts.	
Duration of risk	Long-term – weeks to months at any one location.	
Level of certainty of risk	HIGH – The impacts associated with OWR are well understood, with trained personnel available through the WA and NT OWR Plans to manage the activity. However, and operational NEBA undertaken at the time of the spill will determine the suitability of the response.	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the organisation or geographical area, infrequent or non-standard activity, good practice is well defined.

	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a spill response strategy must be greater than no response.	

Risk Assessment (inherent)			
Hazard	Likelihood	Consequence	Risk rating
Wildlife injury or death through inappropriate handling and treatment	Occasional	Moderate	Medium
Wildlife injury or death through inappropriate handling and treatment to fauna of cultural significance to First Nations people (e.g., turtles, dugong)	Occasional	Moderate	Medium
Hazing disturbance to non-target species	Likely	Moderate	Medium
Fauna Disturbance due to drone activity	Likely	Moderate	Medium
Onshore response centre set-up and operation (vegetation clearing)	Likely	Moderate	Medium

Assessment of Proposed Control Measures

The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic (or *a-priori*) NEBA, which is presented in Appendix B (BOD) of the OPEP.

A strategic NEBA is based on theory and experience from other global LoWC incidents, but not on experience for this well, this oil type (which is speculative) and this location. An operational (*a-posteriori*) NEBA will be undertaken at the time of the spill once key facts about the spill are established (nature of the oil, flow rate, trajectory of movement, etc).

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness - all preparedness EPS are presented in Appendix B of the OPEP.		
Response		
Humanely treat, house, and release oiled fauna wherever possible. Euthanise fauna where treatment and release is not a humane option.	**(RSK-15:EPS-01)** Integration of WA and/or NT-based OWR liaison representatives in the DIMT is undertaken prior to the spill reaching coastal waters to facilitate planning and implementation of OWR response.	Incident logs verify integration of state-based agency OWR personnel into the DIMT prior to the spill reaching state waters.
	(RSK-15:EPS-02) Mobilisation of OWR resources and trained resources will take place in accordance with the timeframes outlined in the OPEP.	Incident logs verify mobilisation within timeframes.
	(RSK-15:EPS-03) Capture and treatment of oiled wildlife is undertaken only by trained personnel.	Incident logs noting names of wildlife capture and treatment personnel.

	(RSK-15:EPS-04) Personnel provided by EOG are inducted into OWR handling restrictions.	Induction records.
	(RSK-15:EPS-05) Wildlife surveys by drones are undertaken by experienced drone pilots flying at the highest altitude possible to avoid disturbance to the target species if known. Disturbance altitude should be established for each target species. If altitude is not known, 60 m should be utilised for bird species and 10 m for nesting turtles.	Incident logs capture fly-over altitudes for target species.
	(RSK-15:EPS-06) OWR response continues until termination criteria are met, as outlined within the OPEP.	Incident logs.

Risk Assessment (residual)			
Hazard	Likelihood	Consequence	Risk rating
Wildlife injury or death through inappropriate handling and treatment	Remote	Moderate	Low
Wildlife injury or death through inappropriate handling and treatment to fauna of cultural significance to First Nations people (e.g., turtles, dugong)	Remote	Moderate	Low
Hazing disturbance to non-target species	Remote	Moderate	Low
Fauna Disturbance due to drone activity	Remote	Moderate	Low
Onshore response centre set-up and operation (vegetation clearing)	Remote	Moderate	Low

The risk of spill response activities to the identified receptors is assessed as low because:

- The control measures adopted are effective in reducing the risk to ALARP.

Demonstration of ALARP
A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.

Demonstration of Acceptability	
Policy compliance	EOG's Safety and Environmental Policy objectives are met.
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.
External context	There have been no concerns raised from relevant persons regarding spill response activities.

Legislative context	The EPS align with the requirements of:
	• OPGGS Act 2006 and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).

	• EPBC Regulations 2000 (Cth): ○ Part 8 (Interacting with cetaceans and whale watching). • *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA). • *Protection of Marine Waters (prevention of Pollution from Ships)* Act 1987 (WA). • *Emergency Management Act* 1986 (WA). • *Contaminated Sites Act* 2003 (WA). • *Waste Management & Pollution Control Act* 1998 (NT). • *Environment Protection Act* 2019 (NT) • *Parks and Wildlife Commission Act* 2013 (NT) • *Territory Parks and Wildlife Conservation Act* 2014 (NT)	
Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for offshore activities with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-15: all EPS)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(RSK-15: all EPS)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk associated with any oil spill response option from any unplanned release of material into the marine environment to ALARP and to an acceptable level.
	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS complement AMOSPlan.
	WA OSCP (2015)	DoT will implement this plan in the event their resources are deployed. The EPS complement the WA OSCP.
	WA OWRP (2021)	WA OWRP is a subplan to the WestPlan-MOP and is the responsibility of DBCA) who provides advice

		to the CA with respect to OWR. The EPS complement the WA OWRP.
	NT OSCP (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS complement the NT OSCP.
	NT OWRP (2019)	PWC is the lead agency for OWR in the NT and will liaise with the CA on oiled wildlife matters in the event of a hydrocarbon spill. This plan will be implemented according to the nature and scale of the spill. The EPS complement the WA OWRP.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	OWR	Key principles for the protection, care and rehabilitation of oiled wildlife (IPIECA, IOGP, 2017)
		Wildlife response preparedness (IPIECA/IOGP, 2014c).
		A guide to oiled wildlife response planning (IPIECA, 2014).
Environmental context	MNES	
	AMPs	Oil causing marine pollution are a threat identified in the North Marine Parks Network Management Plan 2018. Removal of oil impacts through spill response activities such as OWR will assist in the protection and rehabilitation of fauna species vulnerable to oil in AMPs. OWR activities, with controls adopted, will not have any impacts on AMPs.
	Ramsar wetlands	OWR activities will not be undertaken in Ramsar wetlands given the sensitivity of the habitat, hence no impacts predicted. OWR assists in protecting and rehabilitating Ramsar-associated wildlife.
	TECs	OWR activities will not be undertaken in areas where TECs exist. No impacts predicted.

	NIWs	OWR activities will not be undertaken in NIWs given the sensitivity of the habitat, hence no impacts predicted. OWR assists in protecting and rehabilitating NIW-associated wildlife.
	Nationally threatened and migratory species	OWR activities prevent oil spill impacts to, or rehabilitate (where possible), nationally threatened and migratory species from oiling impacts. As such, OWR activities do not conflict with nationally threatened/migratory species management plan requirements.
	Other matters	
	State marine parks	The North Kimberley Marine Park Management Plan has the strategic objective *to protect and conserve biodiversity and ecological health*. OWR activities do not conflict with the management objectives for the park in terms of cultural; natural; recreation, tourism and community; or commercial values detailed in the Management Plan. OWR will assist in preserving the objectives detailed in the management plan.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (e.g. nesting beaches, important foraging grounds, corals, seagrasses* AND *manage anthropogenic activities to ensure that marine turtles are not displaces from identified habitat critical to their survival.* OWR activities supplement other oil spill response strategies (which prevent impacts to critical habitats) and mitigate any impacts to the species assist with their recovery. OWR supports the identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. OWR does not propose to target whales, dolphins or dugongs for rehabilitation due to their size. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. OWR activities will mitigate impacts on bird species thereby reducing the threat in support of the plan.

ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).
Statement of acceptability	EOG considers the risk associated with OWR activities resulting from a hydrocarbon release to be acceptable because: • It will adhere to the company's Environment Policy; • The residual risk ratings are low and ALARP; • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered and incorporated into the design of the activity; • Relevant legislation and industry best practice will be complied with; • Spill response activities will not have long-term or significant impacts on MNES; • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species; • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans; and • Spill response activities are not inconsistent with ESD principles.
Environmental Monitoring	
• As per Beehive-1 OPEP and OSMP requirements.	
Record Keeping	
• Contracts and agreements with third parties. • Equipment and service provider register. • Exercise drill reports. • Inspection/audit reports. • Incident and daily operations reports. • OWR Strategy • Shoreline TRPs.	• Operational NEBA. • Briefing records. • Photos. • OSMP implementation records and reports. • IAP. • Stakeholder Consultation Records • Induction Records

9.8. Waste Management (Support Activity)

9.8.1. Background Information

Waste removal and management is a support activity relevant to almost all the oil spill response strategies detailed throughout Chapter 9. The minimisation of waste generation and recovery of waste is a key consideration in assessing benefits of the oil spill response strategies, especially in the context of logistics in a remote environment and that oil spill response results in the rapid generation and accumulation of large quantities of oily waste (IPIECA-IOGP, 2014d). Table 9.17 summarises the types of waste typically generated by each response strategy.

Table 9.17. Waste typically generated by each response strategy

Response strategy	Waste generated	
Relief well drilling	Routine and unplanned emissions and discharges (see Chapters 7 and 8)	
Monitor and evaluate	Routine vessel discharges and emissions (refer Section 9.2)	
Dispersant application	Empty dispersant containers	PPE
Offshore CAR	Recovered weather oil Oily water	Oiled PPE Oiled sorbent materials

	Oiled equipment (booms skimmers) Oiled vessels	Oiled flotsam & jetsam Animal carcasses
Shoreline protection & deflection Shoreline clean-up	Recovered weather oil Oily water Oiled equipment (booms skimmers) Oiled vessels Oiled storage facilities (temporary tanks, pit liners, barrels, sacks, skips, bins)	Oiled PPE Oiled sorbent materials Oiled flotsam & jetsam Animal carcasses Oiled vegetation Oiled beach material (sand, wrack materials) General domestic wastes
OWR	Animal carcasses Animal capture materials (nets, slings, stretchers, transport boxes) Veterinary wastes Oil absorbent materials	Oiled equipment (booms, skimmers) Oiled vessels Oily water (from washing) Oiled PPE General domestic wastes

9.8.2. Scope of Activity

Once oil and associated waste are contained and recovered, residues must be carefully removed and managed (transferred, stored and disposed) to avoid further contamination of the environment. Waste management will be implemented for a Level 2 or 3 spill event when safe to do so and as directed by WA and/or NT Control Agencies in WA/NT waters.

Waste management is a key consideration for many of the response options outlined in this chapter. As part of the implementation of response options, a waste management plan will be developed in consultation with AMOSC and EOG's waste management contractor, prior to the commencement of the activity. This plan will take into account the unique logistics required for the spill EMBA coastline and put provisions in place to rapidly mobilise waste management personnel and equipment to various locations along the affected coastline. The waste management plan will deal with the following:

- Establishment of temporary waste depots;
- Waste storage;
- Waste transfer (offshore to onshore, nearshore to shore, shoreline to road/marine support);
- Waste transport (temporary facilities to permanent facilities); and
- Waste disposal or treatment.

EOG will adhere to, and implement strategies to support the waste minimisation hierarchy when dealing with waste (IPIECA-IOGP, 2014d):

1. Avoid/eliminate – consider actions which will eliminate or avoid the production of waste (e.g., removal of shoreline wrack prior to oiling);
2. Reduce – techniques to reduce waste generated (e.g., in-situ treatment of oiled material such as offshore decanting of water collected in CAR activities and careful control of consumables such as sorbent materials);
3. Reuse – implement programs to reuse resources where possible during clean-up (e.g., reusing oiled equipment and PPE where possible);

4. Recycle – implement programs to reuse wastes such as waste oil recovery into refinery streams or road building;
5. Recovery – utilise waste oil as a fuel for power or heat generation; and
6. Disposal – wastes that cannot be dealt with by the above techniques are disposed of through options such as incineration, landfill or composting in accordance with the relevant WA and/or NT legislative requirements.

EOG has assessed the waste management requirements for a Level 3 LoWC incident. Anticipated waste volumes to be collected, treated and disposed based on a LoWC (Level 3) incident are provided in Appendix B of the OPEP. All wastes generated from response options described in this section have been treated independently (i.e., it assumes that dispersant application cannot be implemented and therefore does not reduce the impact on shoreline loading volumes). Waste management arrangements are therefore seen as being conservative.

9.8.3. Hazards

The hazards associated with waste management activities include the following:

- Increased vessel and marine activity;
- Waste management handling, transfer, storage, transport and disposal;
- Establishment of shoreline waste transfer areas; and
- Offshore decanting and transfer activities.

9.8.4. Known and Potential Impacts and Risks

For both onshore and offshore waste management activities, response activities may be delayed/ constrained by limited access to temporary waste storage, transport and disposal.

Offshore, the known and potential environmental risks of waste management activity are:

- Planned noise, air and light emissions from vessels (accommodation and activity support) as per Section 7.3 to 7.5;
- Planned liquid and solid discharges from vessels as per Sections 7.8 to 7.11;
- Unplanned events from vessels as per Sections 8.1 to 8.6;
- Contain and recover vessel decanting activities leading to a return of oil to the offshore environment (as per Section 9.4); and
- Oil transfer from CAR vessels to support marine storage vessels leading to oil spills offshore (as per Section 9.4).

Onshore, the potential environmental impacts and risks associated with waste management activities are generally limited to:

- Vegetation clearing required for the establishment of waste collection facilities (directed by the relevant WA and/or NT CA) as per Section 9.7 (OWR).
- Secondary contamination of the environment (i.e., spreading of oil to otherwise unpolluted areas via response activities associated with people, equipment and vehicles) such as:
    - Air pollution (incineration disposal techniques).
    - Groundwater contamination (failure of temporary coastal storage, transfer spills, transport spills, inappropriate landfill disposal).

- Habitat damage and fauna injury/death (failure of temporary coastal storage, transfer spills, transport spills, inappropriate landfill disposal).

Health and safety risks to response personnel are not addressed here, these will be specifically dealt with in the spill-specific waste management plan.

9.8.5. Evaluation of Impacts and Risks

Impacts and risks associated with increased marine vessel activity offshore is contained in Sections 7.3 to 7.5, Sections 7.8 to 7.11 and Sections 8.1 to 8.6, along with Section 9.5 (shoreline vessels).

Impacts and risks associated with vegetation clearing associated with onshore waste holding and transfer facilities are described in Section 9.5 (Shoreline Protection).

Constrained Waste Management

EOG has assessed waste management requirements on a conservative basis to understand the level of support required to provide effective and non-constrained waste management support. EOG will engage a waste management contractor with a national footprint, experienced in emergency response and has access to waste storage equipment, transport and resources to support a Level 3 LoWC Beehive oil spill response to ensure waste collection and disposal (and therefore spill clean-up response) is not constrained by inadequate waste removal.

In the event of a Level 3 spill, a Waste Management Contractor Coordinator will operate within the EOG DIMT and assist in the development of a spill-specific waste management plan.

Offshore, waste collection activities may be constrained by available oil/water storage capacity. To increase capacity, CAR vessels will utilise oil/water decanting techniques (see below) as approved by AMSA to maximise the vessels' oil storage capacity. In addition and as required, an additional support vessel (tanker or barge) may be engaged as an 'oil reception vessel' to receive waste oil from CAR vessels thereby increasing the endurance of the CAR strike vessels.

Secondary Contamination

Secondary contamination of the environment can occur through overfilling oil containment, transfer spills or utilising inappropriate treatment/disposal techniques/locations. EOG's waste management plan supported by EOG's waste contractor facilities will ensure that all wastes are appropriately segregated, stored in covered containers in storage areas with impervious bunds to collect spills, transported via appropriately permitted vehicles and disposed to licenced waste treatment/disposal facilities in accordance with all WA and/or NT waste legislation to prevent secondary contamination.

9.8.6. Impact and Risk Assessment

Table 9.18 presents the impact and risk assessment for waste management operations.

Table 9.18. Impact and risk assessment for waste management operations

Summary	
Summary of risks	Offshore oil spills due to decanting or oil transfer with associated toxicity effects to marine fauna. Increased vessel activity. Secondary oil contamination (leaking containers, transfer spills, incorrect disposal location).

Extent of risk	Shoreline (localised) – waste management activities contained to sandy beaches, near-shore activities shoreline, accessed by vessel vehicles and on foot (where possible and safe to do so). Offshore (localised) – surrounding contain and recover vessels, oil storage tanker.	
Duration of risk	Mid to long-term (~100 days for LoWC incident)	
Level of certainty of risk	HIGH – The impacts associated with spill response waste management are well understood, with trained personnel available through EOG Contractor(s). However, an operational NEBA undertaken at the time of the spill will determine the suitability of the response and the location of waste management to reduce impacts to ALARP.	
Risk decision framework context	Decision type	B – good industry practice required with engineering risk-based tools applied.
	Activity	New to the organisation or geographical area, infrequent or non-standard activity, good practice not well defined or met by more than one option.
	Risk & uncertainty	Amenable to assessment using well-established data and methods, some uncertainty.
	Stakeholder influence	No conflict with company values, some partner interest, some persons may object, may attract local media attention.
Defined acceptable level	The net environmental benefit of a spill response strategy must be greater than no response.	

Risk Assessment (inherent)			
Waste strategy	Likelihood	Consequence	Risk rating
Secondary contamination (spills on transfer, incorrect disposal)	Occasional	Moderate	Medium
Delays in waste removal constraining response activities	Likely	Moderate	Medium

Assessment of Proposed Control Measures
The suitability of response techniques to a spill of crude oil from a Beehive-1 LoWC are based on a strategic NEBA, which is presented in Appendix B of the OPEP. The controls for each response strategy were assessed to ALARP in Appendix B of the OPEP. EPOs, EPSs and measurement criteria for response strategy preparedness are also presented in Appendix B of the OPEP.

Environmental Controls and Performance Measurement		
EPO	EPS	Measurement criteria
Preparedness - all preparedness EPS are presented in Appendix B of the OPEP.		

Waste from oil spill recovery activities will be managed to prevent additional environmental impacts and ensure clean-up operations are not constrained by waste handling issues.	**(RSK-16:EPS-01)** TRPs for PPAs are prepared ahead of drilling, factoring in shoreline type and safe access for waste management purposes.	Shoreline PPA TRPs are available prior to the well spud.
Response		
Waste management resources are sufficient to allow for uninterrupted response implementation as a result of waste collection and disposal	**(RSK-16:EPS-02)** Waste contractor is called out and mobilised within 48 hrs after notification of a LoWC to assist with the development of a spill-specific waste management plan.	Incident logs verify contact is made with the waste contractor in the required time.
	(RSK-16:EPS-03) Waste management personnel and equipment are deployed (if safe to do so, depending on shoreline type) to areas at least 48 hours prior to predicted shoreline stranding to minimise waste where possible (e.g., relocate shoreline wrack).	Incident logs verify personnel and equipment are deployed in the required time.
	(RSK-16:EPS-04) Waste collection facilities are set out in accordance with spill-specific TRPs/waste management plan, which provides for waste storage tanks and hoses to be located in a contained, impervious area.	Incident logs verify waste storage facility has been set-up and is supervised.
	(RSK-16:EPS-05) Waste storage areas are under supervision and secured from public access.	Audit records verify waste storage facility is secured and supervised
	(RSK-16:EPS-06) Wastes are treated and/or disposed of in accordance with the spill specific waste management plan, which documents all regulatory requirements.	Waste transport, disposal and/or destruction certificates verify regulatory compliance.
	(RSK-16:EPS-07) Waste management response continues until termination criteria are met, as outlined within the OPEP.	Incident logs.

Risk Assessment (residual)			
Response strategy	Likelihood	Consequence	Risk rating
Secondary contamination (spills on transfer, incorrect disposal)	Rare	Moderate	Low
Delays in waste removal constraining response activities	Rare	Moderate	Low

The risk of spill response activities to the identified receptors is assessed as negligible to low because:

- The control measures adopted are effective in reducing the risk to ALARP.

Demonstration of ALARP		
A detailed demonstration of ALARP is presented in Appendix B of the OPEP. This also considers the availability, functionality, reliability, survivability and independence/capability of each control measure.		
Demonstration of Acceptability		
Policy compliance	EOG's Safety and Environmental Policy objectives are met.	
EMS compliance	Chapter 10 describes the EP implementation strategy to be employed for this activity.	
External context	There have been no concerns raised from relevant persons regarding spill response activities.	

Legislative context	The EPS align with the requirements of:
	• OPGGS Act 2006 and OPGGS(E):
	  ○ Part 6.2 – directs the polluter to take actions in response to an incident and to clean up and monitor impacts.
	  ○ Regulation 21(5) (Risk assessment undertaken to demonstrate ALARP).
	• EPBC Regulations 2000 (Cth):
	  ○ Part 8 (Interacting with cetaceans and whale watching).
	• *Pollution of Waters by Oil and Noxious Substances Act* 1987 (WA).
	• *Protection of marine Waters (Prevention of Pollution from Ships) Act* 1987 (WA).
	• *Emergency Management Act* 1986 (WA).
	• *Contaminated Sites Act* 2003 (WA).
	• *Waste Management & Pollution Control Act* 1998 (NT).
	• *Environment Protection Act* 2019 (NT).	

Industry practice	The consideration and alignment of EPS, listed in this table and in the OPEP BoD, with the mitigation measures outlined in the below-listed codes of practice and guidelines demonstrates that BPEM will be implemented for this activity.	
	Environmental management in the upstream oil and gas industry (IOGP-IPIECA, 2020)	The EPS meet the relevant mitigation measures listed for waste management with regard to: • Emergency preparedness and response – spill preparedness and emergency response measures are in place **(RSK-16: all EPS)**.
	Best Available Techniques Guidance Document on Upstream Hydrocarbon Exploration and Production (European Commission, 2019)	No guidance is provided regarding oil spill response activities, other than having a spill contingency plan in place. An OPEP is in place for the activity.
	Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development (World Bank Group, 2015)	Guidelines met with regard to: • Sections 76-79 (Spill response planning): A spill response plan should be prepared **(OPEP)**.
	AEP CoEP (APPEA 2008)	The EPS meet the following offshore development and production objectives: • To reduce the risk of any unplanned release of material into the marine environment to ALARP and to an acceptable level.

	Hydrocarbon spill-specific guidelines	
	NatPlan (AMSA, 2020)	AMSA will implement this plan in the event their resources are deployed. The EPS complement the NatPlan.
	AMOSPlan (2017)	AMOSC (on behalf of EOG) will implement this plan in the event their resources are required. The EPS complement AMOSPlan.
	WA OSCP (2015)	DoT will implement this plan in the event their resources are deployed. The EPS complement the WA OSCP.
	NT OSCP (2014)	The NT IC will implement this plan in the event their resources are deployed. The EPS complement the NT OSCP.
	Contingency planning for oil spills on water – Good practice guidelines for incident management and emergency response personnel (IPIECA/IOGP, 2015b)	The EPS are prepared cognisant of these guidelines, which discuss oil spill scenarios, various response techniques and the requirements for contingency plan preparation.
	Oil spill training - Good practice guidelines on the development of training programmes for incident management and emergency response personnel (IPIECA/IOGP, 2014b)	The EPS are prepared cognisant of these guidelines, in so far as training of EOG and contractor personnel in oil spill preparedness and response takes place and is overseen by an emergency response specialist.
	Response-specific guidance	
	Waste management	Oil spill waste minimisation and management (IPIECA, IOGP, 2014).
Environmental context	MNES	
	AMPs	Oil causing marine pollution are a threat identified in the North Marine Parks Network Management Plan 2018 (DNP, 2018). Removal of oil through spill response activities supported by waste management will assist in the protection and rehabilitation of fauna species vulnerable to oil in AMPs. Waste management activities, with controls implemented, will not have any impacts on AMPs.
	Ramsar wetlands	Waste management activities will not be undertaken in Ramsar wetlands given the sensitivity of the habitat. No impacts are predicted.
	TECs	Waste management activities will not be undertaken in areas where TECs exist. No impacts are predicted.

	NIWs	Waste management activities will not be undertaken in areas classified as NIW given the sensitivity of the habitat. No impacts are predicted.
	Nationally threatened and migratory species	Waste management activities remove oil from the environment and will prevent or minimise impacts to nationally threatened or migratory species. As such, waste management activities do not conflict with nationally threatened/migratory species management plan requirements.
	Other matters	
	State marine parks	The North Kimberley Marine Park Management Plan has the strategic objective *to protect and conserve biodiversity and ecological health*. Waste management support activities do not conflict with the management objectives for the park in terms of cultural; natural; recreation, tourism, and community; or commercial values detailed in the Management Plan. Waste removal will assist in preserving the objectives detailed in the management plan.
	Species Conservation Advice/ Recovery Plans/ Threat Abatement Plans	Marine (oil) pollution is a threat identified in the Recovery Plan for Marine Turtles in Australia 2017-2027 (DoEE, 2017c) with priority actions requiring that *spill risk strategies and response programs include management for turtles and their habitats particularly in reference to slow to recover habitats (e.g. nesting beaches, important foraging grounds, corals, seagrasses* AND *manage anthropogenic activities to ensure that marine turtles are not displaces from identified habitat critical to their survival.* Waste management activities support other oil spill response strategies (which prevent impacts to critical habitats) and mitigate any impacts to the species assist with their recovery. Waste management supports the identified priority actions within this management plan. The conservation advice and management plans for blue, humpback, sei and fin whales identify hydrocarbon spill as threats, though there are no specific aims to address this. The Wildlife Conservation Plan for Seabirds (CoA, 2020) identifies oil pollution as a threat to seabirds although no specific actions are defined to manage the threat. Waste removal activities will mitigate impacts on bird species thereby reducing the threat in support of the plan.
ESD principles	The EIA presented throughout this EP demonstrates that ESD principles (a), (b), (c) and (d) are met (noting that principle (e) is not relevant).	

Statement of acceptability	EOG considers the risk to be acceptable because: • It will adhere to the company's Environment Policy; • The residual risk ratings are low and ALARP; • An Implementation Strategy (described in Chapter 10) is in place to ensure the EPS are achieved. • Input from engagement with relevant persons and stakeholders has been considered and incorporated into the design of the activity; • Relevant legislation and industry best practice will be complied with; • Spill response activities will not have long-term or significant impacts on MNES; • Spill response activities are not inconsistent with the aims of recovery plans/conservation plans/advice that are in force for EPBC Act-listed threatened and migratory species; • Spill response activities are not inconsistent with the aims of relevant marine reserve management plans; and • Spill response activities are not inconsistent with ESD principles.
Environmental Monitoring	
• As per Beehive-1 OPEP and OSMP requirements.	
Record Keeping	
• Contracts and agreements with waste contractor. • Equipment and service provider register. • Shoreline TRPs. • Inspection/audit reports. • Incident and daily operations reports. • Waste transport certificates	• Operational NEBA. • Briefing records. • Photos. • OSMP implementation records and reports. • IAP. • Stakeholder consultation records • Induction records