Roc-2 Exploration & Appraisal Drilling Environment Plan Summary

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ACRONYMS

Abbreviation	Description
AFMA	Australian Fisheries Management Authority
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre Pty Ltd
AMSA	Australian Marine Safety Authority
AIMWTMF	Abrolhos Islands and Mid West Trawl Managed Fishery
AIS	Automatic Identification System
ASBTIA	Australian Southern Bluefin Tuna Association
BOP	Blow-out preventer
CFA	Commonwealth Fishing Association
CMR	Commonwealth Marine Reserve
DAH	Dissolved Aromatic Hydrocarbons
DMP	Department of Mines and Petroleum (State)
DoD	Department of Defence
DoE	(Australian) Department of the Environment
DoF	Department of Fisheries
DoT	Department of Transport
DPaW	Department of Parks and Wildlife
DPA	Dampier Port Authority
EMBA	Environment that May Be Affected
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ESD	Emergency Shut Down
HEV	High Environmental Values
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention
IMDG	International Maritime Dangerous Goods (Code)
IMS	Invasive of Marine Species
IUCN	International Union for Conservation of Nature
KEF	Key Ecological Feature
KPMF	Kimberley Prawn Managed Fishery
KGBF	The Kimberley Gillnet and Barramundi Managed Fishery
LCM	Lost Circulation Material
LMS	Listed Migratory Species

Abbreviation	Description
LTS	Listed Threatened Species
MC	Measurement Criteria
MMA	Marine Managed Areas
MNES	Matters of National Environmental Significance
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MOU	Memorandum of Understanding
MP	Marine Park
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NWS	Western Australia's North West Shelf
ODS	Ozone Depleting Substances
OIM	Offshore Installation Manager
OIW	Oil in Water
OPEP	Oil Pollution Emergency Plan
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OSRL	Oil Spill Response Limited
OSRT	Oiled Shoreline Response Team
OWA	Oiled Wildlife Advisors
PPA	Pearl Producers Association
RACON	Radar Transponder
ROV	Remotely operated vehicle
SOPEP	Shipboard Oil Pollution Emergency Plan
SRT	State Response Team
VRASS	Vessel Risk Assessment
VSP	Vertical Seismic Profiling
WA	West Australian
WAFIC	Western Australian Fishing Industry Council
WBM	Water Based Mud
WHA	World Heritage Area
WAOWRP	WA Oiled Wildlife Response Plan

1. INTRODUCTION

Quadrant Northwest Pty Ltd (Quadrant) is the registered operator for Petroleum Production Licence WA-437-P. Quadrant plan to further define the hydrocarbon resource of the Bedout Basin region in Commonwealth waters within permit area WA-437-P through drilling an exploration and appraisal well, Roc-2.

The Roc-1 well was the subject of another EP (Document reference: EA-00-RI-10117) accepted by NOPSEMA on 29/09/15, and the activities under this EP were completed in January 2016.

1.1 Titleholder

Quadrant Northwest Pty Ltd is the titleholder for petroleum activities covered under this EP within WA-437-P. For the purposes of this EP it will be referred to as Quadrant Energy.

Titleholder details are as follows:

Name: Quadrant Northwest Pty Ltd

Business address: Level 9, 100 St Georges Terrace, Perth WA 6000

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1.2 Compliance

The overall purpose of the *Roc-2 Environment Plan (EA-00-RI-10154)* (the EP) is to comply with statutory requirements of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations) and to ensure that the Activity is planned and conducted in line with Quadrant environmental policies and standards, including the corporate Environmental Policy. The EP was assessed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on the 26th May 2016. This EP summary has been prepared in accordance with the requirements of regulation 11 (4) of the OPGGS (E) Regulations.

1.3 Activity Duration and Timing

The time required to drill, test, appraise and plug and abandon the well is expected to be approximately 100 days. An additional 12 days[1] may be required to install and remove pre-lay anchors.

The timing of the activity is dependent on rig availability, operational efficiencies and weather conditions. This EP assumes the drilling activity will commence in June 2016. All activities will be completed by 31 December 2016 at the latest.

[1] 2-3 weeks prior to MODU arrival, pre-lay anchors may be installed over a period of 6 days. Following MODU demobilisation, the anchors will be removed over a period of approximately 6 days.

2. ACTIVITY LOCATION

The Operational Area is defined by a 1.5km radius around the proposed well location that represents the potential area within which anchors would be placed fixing the mobile offshore drilling unit (MODU) to the seafloor. A standby vessel mooring may be installed for the Activity, this would be located outside the anchor spread, within a 5km radius of the well location. The MODU will be located within permit area WA-437-P located within Commonwealth waters of the Bedout Sub-basin in the NW Shelf region of Western Australia (**Figure 2-1**). The Operational Area is approximately 80 km from the nearest shoreline (Bedout Island), 120 km north from the closest mainland point (Larrey Point), 157 km from Port Hedland, 290 km from Karratha and 363 km from Broome.

Table 2-1 summarises the proposed location and approximate water depth of the Roc-2 well. In the event of a re-spud, the MODU would kedge (skidding by increasing/decreasing tension of the anchor wires) up to 50 m from the original well location to re-drill the tophole. The anchors would not be repositioned to undertake a re-spud.

Table 2-1: Summary of Roc-2 location

Well	Permit	Latitude	Longitude	Water depth (m)	Prop. Spud date
Roc-2	WA-437-P	18° 52’ 56.73”S	118° 52’ 15.65”E	100	October 2015

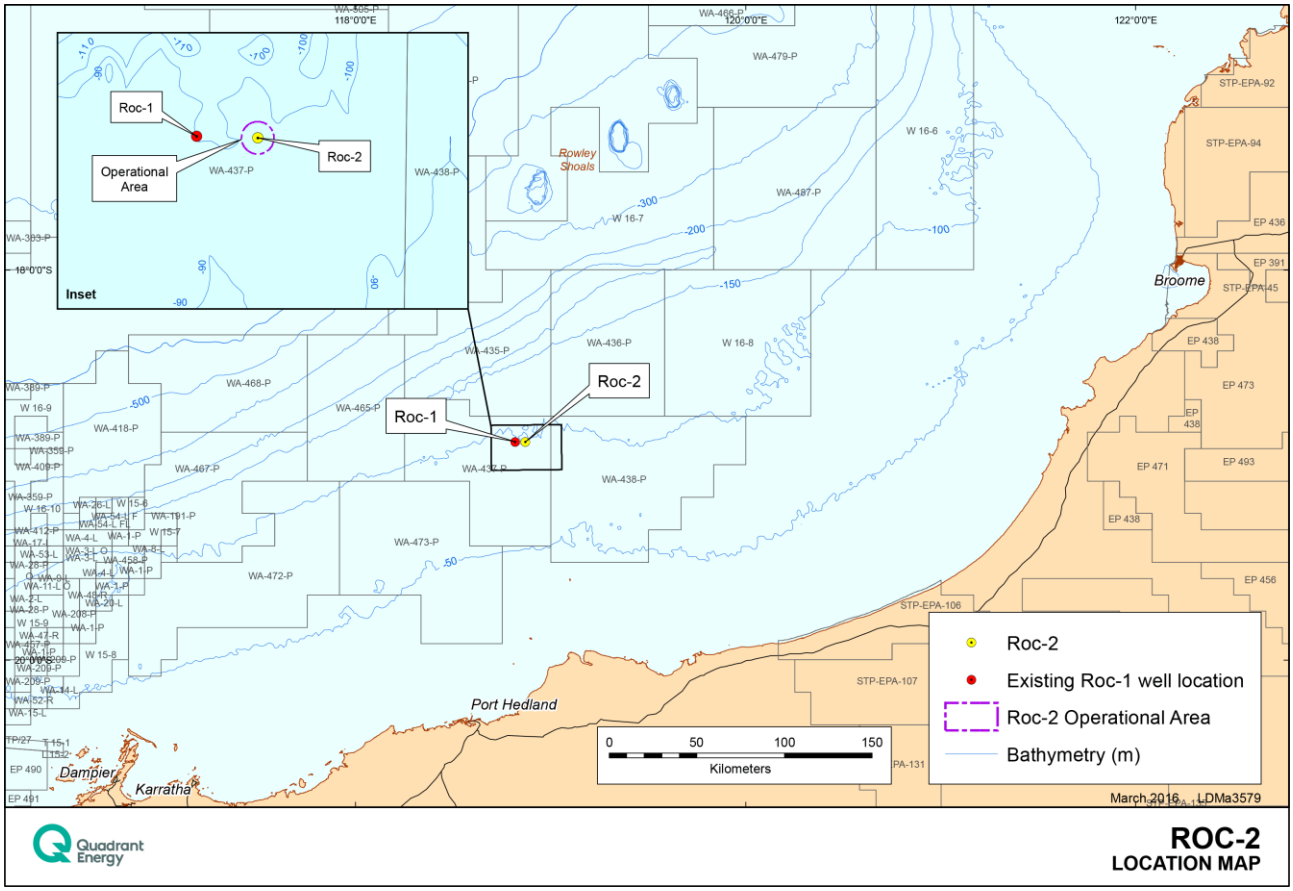

Figure 2-1: Operational Area showing proposed location of Roc-2 well

3. DESCRIPTION OF THE ACTIVITY

3.1.1 Activities

This EP covers drilling, evaluating, well testing, and abandonment activities related to exploration and appraisal drilling, and can include any/all of the following:

- Deployment and recovery of anchors
- Installing and cementing casing strings;
- Riserless drilling;
- Installation and operation of a blow-out preventer (BOP);
- Drilling using Water Based Muds (WBM);
- Contingency use of Lost Circulation Materials (LCM) as required;
- Use of chemicals for drilling, evaluation and abandoning activities;
- Well evaluation including, wireline logging, hydrocarbon sampling, Vertical Seismic Profiling (VSP) and coring;
- Plug and abandonment activities, including pulling casing strings and setting permanent cement barriers;
- MODU commissioning activities (e.g. equipment testing, tank flushing);
- Temporary placement of equipment on the seabed;
- Well testing (sampling, clean up, and flaring);
- Sidetrack drilling and re-spud drilling (contingent and unplanned activities); and
- Use of support vessels, helicopters, remotely operated vehicles (ROV).

3.1.2 MODUs

Drilling is proposed to be undertaken using a semi-submersible MODU which will remain at location (i.e. drilling site) for the duration of the drilling activity. The rig will hold station via a temporary mooring system with anchors. Vessels (anchor handling vessels) will assist with MODU anchoring by deploying an expected 8 anchors laid out to approximately 1.5 km distance from the rig. Prior to the MODU arriving, some or all of the anchors may be pre-laid using support vessels (approximately 2-3 weeks prior to MODU arrival), this activity is expected to take 6 days in total. An additional 6 days will be required to remove anchors once the MODU leaves site. Pre-laid anchors will be connected to the MODU's existing mooring lines on arrival at the location. Anchors will be retrieved upon completion of the activity and pre-laid anchors may be retrieved after the MODU has departed.

3.1.3 Exploration and appraisal wells

Roc-2 will be drilled in up to three phases: surface, intermediate, and production. The top surface interval(s) will be drilled using seawater with viscous sweeps utilising bentonite or a viscosifying polymer with cuttings discharged directly at the seafloor.

The intermediate and production sections will be drilled with a riser and BOP installed following installation of a casing string cemented in place, which creates a closed circulating system for drilling fluids.

Cement will be used to form permanent barriers and fix casings in place prior to drilling the following interval in the well to form a seal between the casing and the formation.

After the BOP has been installed (and installation of a marine riser), recirculating muds will be used to drill the remainder of the well, with drill fluids and cuttings returned to the MODU for treatment prior to discharge. Only Water Based Muds (WBM) are planned to be used for the Roc-2 well. When WBM is used, the solids discharged from the shakers and centrifuges are discharged directly overboard at surface. On completion of the well, residual WBMs will be used on a subsequent well if possible, or discharged overboard. Leftover drilling fluids would be discharged in a single event.

3.1.4 Drilling Discharges

Drilling discharges account for:

- Drill solids or cuttings;
- Drilling fluids;
- Brines; and
- Cement (set or unset).

A heat exchanger/heater may also be used in well testing and heated water (i.e. fresh or seawater) will be discharged to sea.

3.1.5 Well evaluation and testing

Well testing and evaluation involves the collection of data on the well and surrounding formation. Wireline logging will be conducted during drilling activities and VSP will be used.

Well testing and associated flaring helps to ascertain the pressure, flow and composition of the reservoir products. Well testing involves the production of reservoir fluids back to the MODU via a temporary process and handling facility installed on the MODU. All production and reservoir parameters are recorded during this operation. During well testing, hydrocarbons (oil and/or gas) and potentially formation water will be produced from the reservoir. Hydrocarbons will be flared (combusted) using burners. Each test lasts up to 3 days, and up to 2 well tests are proposed during this activity.

During well testing formation water may be produced from the reservoir. Any formation water produced would be discharged to the marine environment following oil filtration.

3.1.6 Well abandonment

After final well operations, the Roc-2 well will be permanently abandoned by installing and testing down hole barriers (such as cement) prior to severing all casing strings below seabed.

3.1.7 Support Vessels

The MODU will be assisted by up to (at times) four support vessels that will transfer food, bulk drilling and cementing materials, diesel and equipment used in the drilling process.

At least one support vessel will remain on location at the well site during drilling for the duration of the activity for safety purposes (as per the approved Safety Case Revision for the rig) and to ensure the maintenance of 500 m exclusion zone around the MODU.

A support vessel standby mooring may be installed for the activity period, located outside the anchor spread, within a 5km radius of the well location.

3.1.8 Helicopters

Crew changes for personnel aboard the MODU will involve transfer by helicopter. These flights will occur several times a week dependent on the progress of the drilling program and logistical constraints.

3.1.9 ROV Operations

Remotely operated vehicle (ROV) operations and surveys may occur periodically throughout the Activity to determine the condition of subsea drilling-related infrastructure (including submerged parts of the MODU), monitor drilling operations, manipulate subsea equipment, and to conduct an as-left survey around the well location.

3.1.10 Waste

In addition to the drilling discharges (above), other operational waste streams from the MODU and support vessels are likely to include:

- Deck drainage;
- Putrescible waste and sewage;
- Oily water;
- Cooling water;
- Desalination plant effluent (brine) and backwash water discharge; and
- Ballast water.

3.1.11 Fuel and Chemical Handling

The main engines and equipment (e.g. pumps, cranes, winches, power packs, generators) used on MODUs and support vessels require diesel for fuel, hydraulic fluid and lubricating oils for operation and maintenance of moving parts. ROV's require hydraulic fluids for operations.

4. DESCRIPTION OF ENVIRONMENT

4.1 Environment that May Be Affected (EMBA)

Although most events and hazards associated with the activity may only affect the environment within a few hundred metres around the MODU (as identified in each relevant aspect description in Section 6), the worst case potential environmental impact is linked to unplanned hydrocarbon spills and may extend substantially beyond a few hundred metres. The largest predicted impact area is linked to the loss of containment scenario (**Table 4-1**) and it was used to define the Environment that May Be Affected (EMBA) (**Figure 2-1)**. The combined EMBA was used to complete a search of the Matters of National Environmental Significance (MNES) data base, which in turn identified the environmental values and sensitivities within the existing environment.

Table 4-1 Summary of largest credible hydrocarbon spill events considered

Scenario	Hydrocarbon Type	Maximum Credible Volume	Comment
Minor hydrocarbon spills	Various	0.16 m^3	Maximum loss of hydraulic fluid during transfer from a support vessel
Hydrocarbon spill (diesel) during refuelling	Diesel	20 m^3	Maximum credible volume based on 15 minutes of flow (from refuelling hose) at a pumping rate of approximately 1.25 m^3/min.
Hydrocarbon spill (diesel) from vessel collision – vessel tank		250 m^3	Maximum credible volume based on the holding capacity of largest flank fuel tank on support vessel.
Hydrocarbon spill from a loss of containment scenario – **surface** release	Crude	322,627 m^3 (<4190 m^3/d average over 11 weeks)	Highest flow potential derived by combining the most optimistic reservoir parameters for the well design
Hydrocarbon spill from a loss of containment scenario – **seabed** release		321,650 m^3 (<4177 m^3/d average over 11 weeks)	

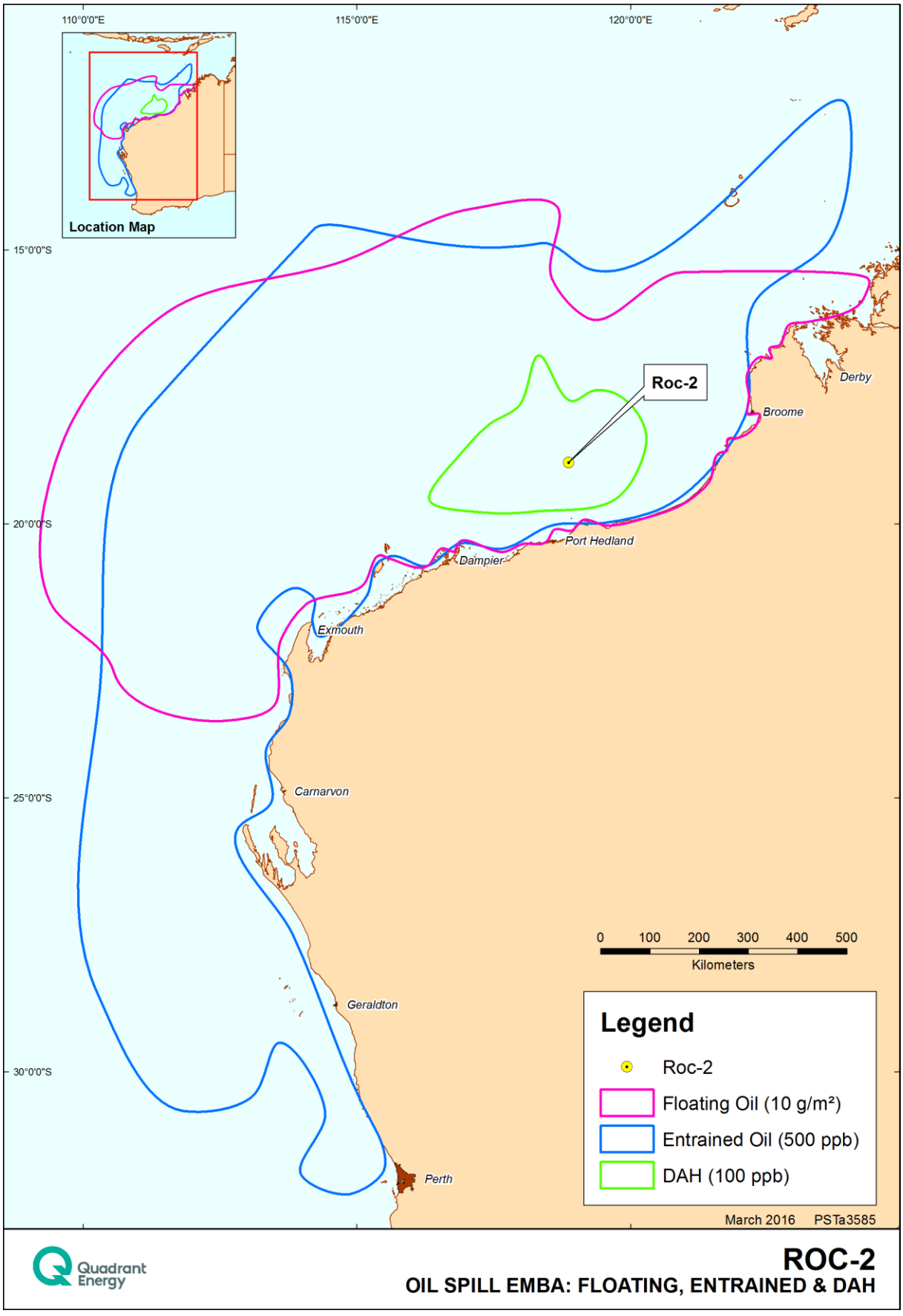

Figure 4-1 Environment that May be Affected (EMBA) from Floating oil, Entrained oil and Dissolved Aromatic Hydrocarbons (DAHs)

4.1.1 Physical environment and habitats

Physical environment

North West Shelf (NWS) waters are usually thermally stratified with a marked change in water density at approximately 20 m (SSE, 1993). Surface temperatures vary annually, being warmest in March (32˚C) and coolest in August (19˚C). During summer (October–March), the prevailing non-storm winds are from the southwest, west and northwest at an average speed of less than 10 knots, peak average speeds of 15–25 knots, and maximum speeds of 30 knots. Non-storm winds prevail from the north-east through to south-east at average speeds of 5–6 knots, peak average speeds of 10–15 knots, and maximum speeds of 20 knots. The wave climate is generally composed of locally generated wind waves (seas) and swells that are propagated from distant area (WNI, 1995; 1996). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed (Holloway and Nye, 1985).

Tidal and wind-forcing are the dominant contributions to local sea surface currents. The tides of the NWS have a strong semi-diurnal signal with four tide changes per day (Holloway and Nye, 1985) and a spring tidal range of 1.9 m and a highest astronomical tide of 2.9 m (Chevron Australia, 2010). The dominant sea surface offshore current (typically seaward of the 200 m isobath) is the Leeuwin Current, which carries warm tropical water south along the edge of WA's continental shelf, reaching its peak strength in winter and becoming weaker and more variable in summer. The current is described as a sea surface current, extending in depth to 150 m (BHPB, 2005; Woodside, 2005). Closer to the coast, the Ningaloo Current flows in a northerly direction, in the opposite direction to the Leeuwin Current, along the outside of the Ningaloo Reef and across the inner shelf from September to mid-April (BHPB, 2005; Woodside, 2005). The Indonesian Throughflow is the other important current influencing the upper 200 m of the outer NWS (Woodside, 2005). This current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago.

Offshore drift currents are represented as a series of interconnected eddies and connecting flows that can generate relatively fast (1–2 knots) and complex water movement. These offshore drift currents also tend to persist longer (days to weeks) than tidal current flows (hours between reversals) and thus will have greater influence upon the trajectory of slicks over time scales exceeding a few hours (APASA, 2014).

4.1.2 Habitats

The operational area is located in water depth of 100 m; depths which are unlikely to receive significant concentrations of light (Burke *et al*., 2001) and are therefore unlikely to sustain light-dependant benthic organisms such as hard corals or algae. The operational area is approximately 80 km from the nearest shallow water environment (Bedout Island) and approximately 120 km from the nearest mainland coast (Larrey Point), and therefore no coastal or shallow marine environments are included within or in close proximity to the operational area.

Survey footage at the Roc-1 location (5.6 km to the West of Roc-2) shows the area to be predominantly smooth and featureless with a few zones of low height sand ripples and no evidence of rock outcropping or coral reef development within the survey area. Sediment samples taken at the Roc-1 location featured fine to medium sands with shell and coral fragments over cemented materials as expected to occur in the region (Fugro, 2016). The seabed is likely to be the same at the Roc-2 location given that the benthic environment surrounding the operational area is described as a ‘featureless plain’ on the western flank of the middle NWS slope that consist of sands and gravels (Baker *et al*., 2008).

Table 4-2: Environmental values and sensitivities – Habitats

Category	Receptor	Operational Area presence	Southwest Bioregion	Central Bioregion				Northwest Bioregion				
			Southwest Shelf transition	Central Western Shelf Transition	Central Western Transition	Central Western Shelf Province	Central Western Province	Northwest Province	Northwest Transition	Northwest Shelf Province	Northwest Shelf Transition	Timor Province
High Environmental Area	**Outer Abrolhos Islands - Shoals Abrolhos Is. Wallabi Gp Abrolhos Is. Pelsaert Gp Abrolhost West Abrolhos Is. Easter Gp Geraldton - Jurien Bay Jurien CMR Jurien Bay - Yanchep Two Rocks CMR Perth Nth Coast Kalbarri - Geraldton Perth Canyon CMR**			**Ningaloo Coast Nth Ningaloo Coast Sth Outer Ningaloo Coast Nth**	**Outer Ningaloo Coast Nth Outer NW Ningaloo**	**Carnarvon - Inner Shark bay Outer Shark Bay Coast Ningaloo Coast South Zuytdorp Cliffs - Kalbarri Kalbarri - Geraldton**	**Outer Abrolhos Islands - Shoals Abrolhost West Perth Canyon CMR**	**Outer NW Ningaloo Outer Ningaloo Coast Nth**	**Mermaid Reef CMR Clerke Reef MP Imperieuse Reef MP**	**Broome –Roebuck Eighty mile beach Kimberley CMR Dampier Archipelago Lowendal Is. Montebello Is. Barrow Is. Barrow- Montebellow Surrounds Muiron Is. Nigaloo Nth Coast Exmouth Gulf Coast**	**Kimberley CMR Kimberley Coast PMZ Camden Sound Sth Coast**	**Ashmore Reef Outer Johnson Bank Cartier Is. CMR Scott Reef Nth Scott Reef Sth Kimberley CMR**
Benthic habitats	*Coral Reefs*	*None present*	• *Houtman Abrolhos Islands* • *Rottnest Island*	*Ningaloo Reef*	*Not Present*	• *Shark Bay* • *Bernier, Dorre and Dirk Hartog Islands*	*Not present*	*Present but no significant areas*	*Rowley Shoals (Imperieuse Reef, Clerke Reef, Mermaid Reef)*	• *Dampier Archipelago* • *Montebello, Lowendal and Barrow Islands*	• *Adele Islands* • *Long Islands* • *Heyward Islands group* • *Bonaparte archipelago* • *Cape Voltaire and Bougainville* • *Montgomery reef* • *Browse island*	• *Ashmore Reef, Cartier Island, Hibernia, Scott and Seringapatam reefs*
	Seagrasses	*None present*	• *Houtman Abrolhos Islands* • *Perth Region*	*Ningaloo Reef*	*Not Present*	*Shark Bay*	*Not present*	*None present*	*Rowley Shoals*	• *Roebuck Bay* • *Dampier Archipelago, Regnard Islands* • *Mary Anne Reef* • *Onslow* • *Montebello and Barrow Islands*	*Southern Kimberly islands*	*Ashmore Reef, Scott Reef, Seringapatam reefs*
	Macroalgae	*None present*	*Houtman Abrolhos Islands*	*Ningaloo Reef*	*Not Present*	*Shark Bay*	*Not present*	*Present but no significant areas*	*Present but no significant areas*	• *Shallow offshore waters of the Pilbara – Montebello, Lowendal and Barrow Islands* • *Dampier Archipelago/ Regnard Islands* • *Thevenard, Serrurier, Airlie Islands*	*Present but no significant areas*	*Ashmore Reef, Scott Reef, Seringapatam reefs*
	Non Coral Benthic Invertebrates	*Present but no significant areas*	*Present but no significant areas*	*Present but no significant areas*	*Present but no significant areas*	*Shark Bay* *Hamelin Pool*	*Perth Canyon*	*Present but no significant areas*	*Rowley Shoals*	• *Dampier to Port Hedland* • *Barrow Island*	*Echuca Shoals*	*Ashmore Reef*

Category	Receptor	Operational Area presence	Southwest Bioregion	Central Bioregion				Northwest Bioregion				
			Southwest Shelf transition	Central Western Shelf Transition	Central Western Transition	Central Western Shelf Province	Central Western Province	Northwest Province	Northwest Transition	Northwest Shelf Province	Northwest Shelf Transition	Timor Province
High Environmental Area	**Outer Abrolhos Islands - Shoals Abrolhos Is. Wallabi Gp Abrolhos Is. Pelsaert Gp Abrolhost West Abrolhos Is. Easter Gp Geraldton - Jurien Bay Jurien CMR Jurien Bay - Yanchep Two Rocks CMR Perth Nth Coast Kalbarri - Geraldton Perth Canyon CMR**			**Ningaloo Coast Nth Ningaloo Coast Sth Outer Ningaloo Coast Nth**	**Outer Ningaloo Coast Nth Outer NW Ningaloo**	**Carnarvon - Inner Shark bay Outer Shark Bay Coast Ningaloo Coast South Zuytdorp Cliffs - Kalbarri Kalbarri - Geraldton**	**Outer Abrolhos Islands - Shoals Abrolhost West Perth Canyon CMR**	**Outer NW Ningaloo Outer Ningaloo Coast Nth**	**Mermaid Reef CMR Clerke Reef MP Imperieuse Reef MP**	**Broome –Roebuck Eighty mile beach Kimberley CMR Dampier Archipelago Lowendal Is. Montebello Is. Barrow Is. Barrow- Montebellow Surrounds Muiron Is. Nigaloo Nth Coast Exmouth Gulf Coast**	**Kimberley CMR Kimberley Coast PMZ Camden Sound Sth Coast**	**Ashmore Reef Outer Johnson Bank Cartier Is. CMR Scott Reef Nth Scott Reef Sth Kimberley CMR**
Shoreline habitats	Mangroves	*None present*	*Present but no significant areas*	*Mangrove Bay*	*None Present*	*Shark Bay*	*Not present*	*None present*	*Present but no significant areas*	• *Exmouth Gulf* • *Montebello, Barrow and Lowendal Islands* • *Port Hedland*	• *Prince Frederick Harbour* • *Cambridge Gulf*	*None present*
	Intertidal mud / sand flats	*None present*	*Present but no significant areas*	*Present but no significant areas*	*None Present*	*Shark Bay*	*Not present*	*None present*	*None present*	• *Roebuck Bay* • *Eighty Mile beach*	• *Colllier Bay* • *Walcott inlet* • *Prince Frederick harbour* • *Mitchell River* • *Cambridge Gulf*	*None present*
	Intertidal platforms	*None present*	*Present but no significant areas*	*Ningaloo Coast*	*None Present*	*Ningaloo Coast North-West cape*	*Not present*	*None present*	*Present but no significant areas*	*Present but no significant areas*	*Present across region*	*None present*
	Sandy beaches	*None present*	*Houtman Abrolhos Islands*	*Present but no significant areas*	*None Present*	*Present but no significant areas*	*Not present*	*None present*	*Present but no significant areas*	*Eighty Mile Beach*	*Camden marine Park*	*None present*
	Rocky shorelines	*None present*	*Present but no significant areas*	*Present but no significant areas*	*None Present*	*Ningaloo Coast North-West Cape*	*Not present*	*None present*	*None present*	*Present but no significant areas*	*Present but no significant areas*	*None present*

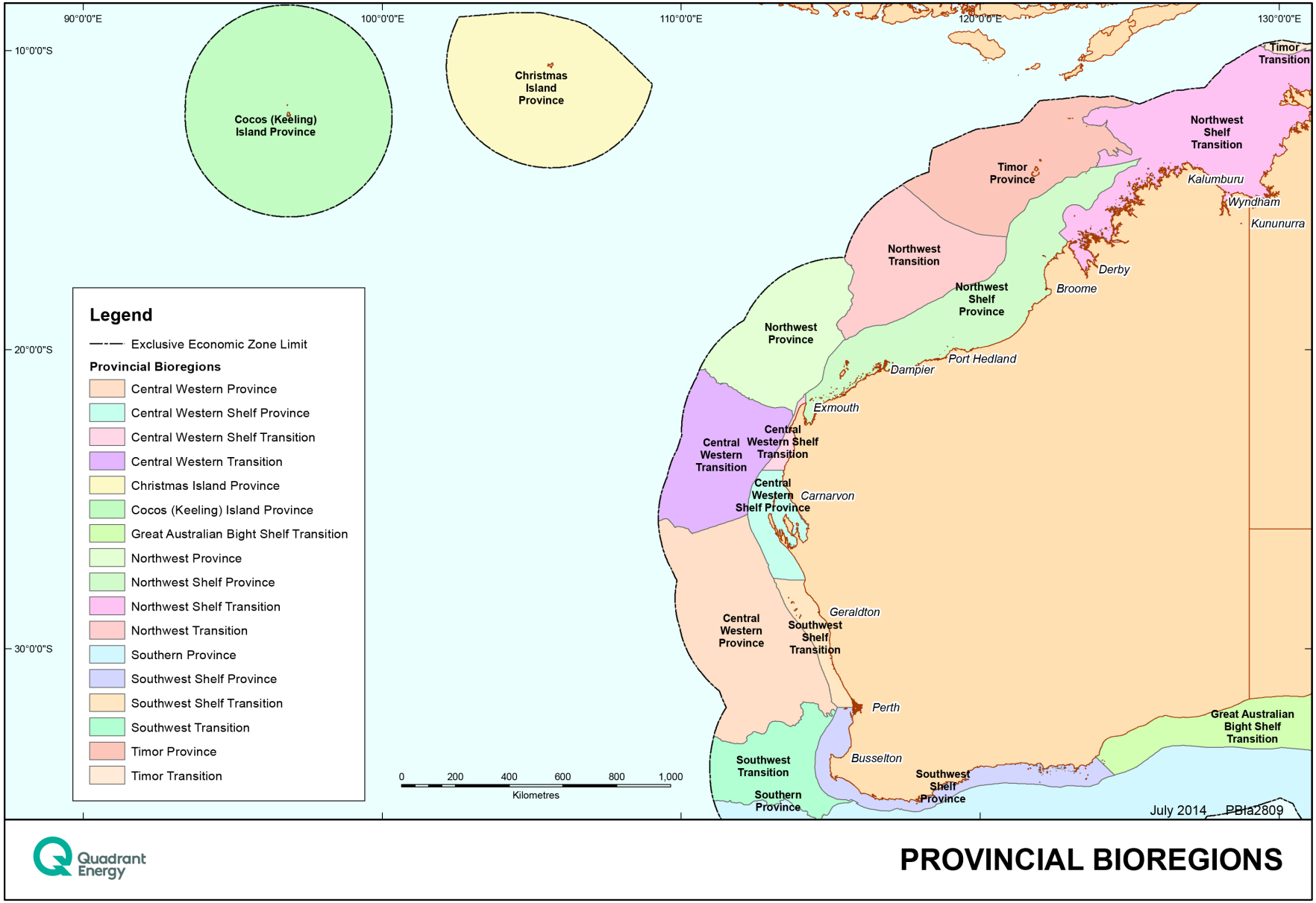

Figure 4-2 Provincial Bio-regions

4.1.3 Protected and Significant Areas

Commonwealth Marine Reserves (refer **Figure 4-4**) , State Marine Parks, Marine Management Areas, World Heritage Areas, Wetlands of International Importance, Commonwealth or National Heritage Places and Key Ecological Features (refer **Figure 4-3**) present within the EMBA are listed in **Table 4-3.** None of these areas were identified within, or nearby, the Operational Area for the Activity, with the exception of the 125m Ancient Coastline. Further description of those protected or significant areas within the vicinity of the operational area are provided below.

Ancient coastline at 125 m depth contour

The shelf of the North-west Marine Region contains several terraces and steps which reflect changes in sea level that occurred over the last 100,000 years. The most prominent of these features occurs at a depth of 125 m as an escarpment along the North West Shelf and Sahul Shelf (DSEWPaC 2012). Where the ancient submerged coastline provides areas of hard substrate it may contribute to higher biological diversity. Little detailed knowledge is available, but the hard substrate of the escarpment is likely to support sponges, corals, crinoids, molluscs, echinoderms (DSEWPaC 2012).

Parts of the ancient coastline are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column providing a relatively nutrient-rich environment for species present on the escarpment (DSEWPaC 2012).

Table 4-3: Environmental values and sensitivities –protected/significant areas

Value/Sensitivity	Distance from Operational Area (km)	EMBA presence
Commonwealth Marine Reserves (CMR)	1,060	Abrolhos Commonwealth Marine Reserve
	124	Argo-Rowley Terrace Commonwealth Marine Reserve
	850	Ashmore Reef Commonwealth Marine Reserve
	916	Carnarvon Canyon Commonwealth Marine Reserve
	855	Cartier Island Commonwealth Marine Reserve
	210	Dampier Commonwealth Marine Reserve
	67	Eighty Mile Beach Commonwealth Marine Reserve
	571	Gascoyne Commonwealth Marine Reserve
	1,312	Jurien Commonwealth Marine Reserve
	305	Kimberley Commonwealth Marine Reserve
	196	Mermaid Reef Commonwealth Marine Reserve
	328	Montebello Commonwealth Marine Reserve
	573	Ningaloo Commonwealth Marine Reserve
	1,029	Oceanic Shoals Commonwealth Marine Reserve
	1,480	Perth Canyon Commonwealth Marine Reserve
	337	Roebuck Commonwealth Marine Reserve
	844	Shark Bay Commonwealth Marine Reserve
	1,436	Two Rocks Commonwealth Marine Reserve
State Marine Parks (MP) and Marine Management Areas (MMA)	584	Lalang garram/Camden Sound MP
	128	Rowley Shoals MP
	855	Shark Bay MP
	1,299	Jurien Bay MP
	1,456	Marmion MP

Value/Sensitivity	Distance from Operational Area (km)	EMBA presence
	418	Barrow Island MP
	389	Barrow Island MMA
	375	Montebello Islands MP
	572	Ningaloo MP
	551	Muiron Islands MMA
	132	Eighty Mile Beach MP
	246	Proposed Dampier Archipelago MP
	308	Proposed Regnard MMA
	333	Proposed Roebuck Bay MP
World Heritage Area (WHA)	551	The Ningaloo coast
	855	Shark Bay
Wetlands of International Importance (Ramsar)	348	Roebuck Bay
	147	Eighty Mile Beach
National Heritage Places	1,129	HMAS Sydney II and HSK Kormoran Shipwreck Sites
	301	The West Kimberley
	551	The Ningaloo Coast (see World Heritage)
	267	Dampier Archipelago (including Burrup peninsula)
	1,177	Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos
	947	Dirk Hartog Landing Site 1616 – Cape Inscription Area
	855	Shark Bay (see World Heritage)
Commonwealth Heritage Places	608	Scott reef and Surrounds
	663	Seringapatam Reef and Surrounds
	850	Ashmore Reef National Nature Reserve (see Commonwealth Marine Reserves)
	204	Mermaid Reef - Rowley Shoals (see Commonwealth Marine Reserves)
	573	Ningaloo Marine Area - Commonwealth Waters (see Commonwealth Marine Reserves)
Threatened Ecological Communities	855	Subtropical and Temperate Coastal Saltmarsh
	363	Monsoon vine thickets on the coastal dunes of Dampier Peninsula
Key ecological feature (KEF)	11	Ancient coastline at 125 m depth contour
	1,125	Ancient Coastline at 90m-120m depth
	527	Canyons linking the Cuvier Abyssal Plain with the Cape Range Peninsula
	1,147	Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)
	1,125	Commonwealth marine environment within and adjacent to the west coast inshore lagoons
	573	Commonwealth waters adjacent to Ningaloo Reef
	324	Continental slope demersal fish communities
	474	Exmouth Plateau
	223	Glomar Shoals

Value/Sensitivity	Distance from Operational Area (km)	EMBA presence
	119	Mermaid Reef and Commonwealth waters surrounding Rowley Shoals
	1,189	Perth Canyon and adjacent shelf break, and other west-coast canyons
	596	Seringapatam Reef and Commonwealth waters in the Scott Reef complex
	1,074	Wallaby Saddle
	1,000	Western Demersal slope and associated fish communities (of the Central Western Province)
	1,091	Western rock lobster

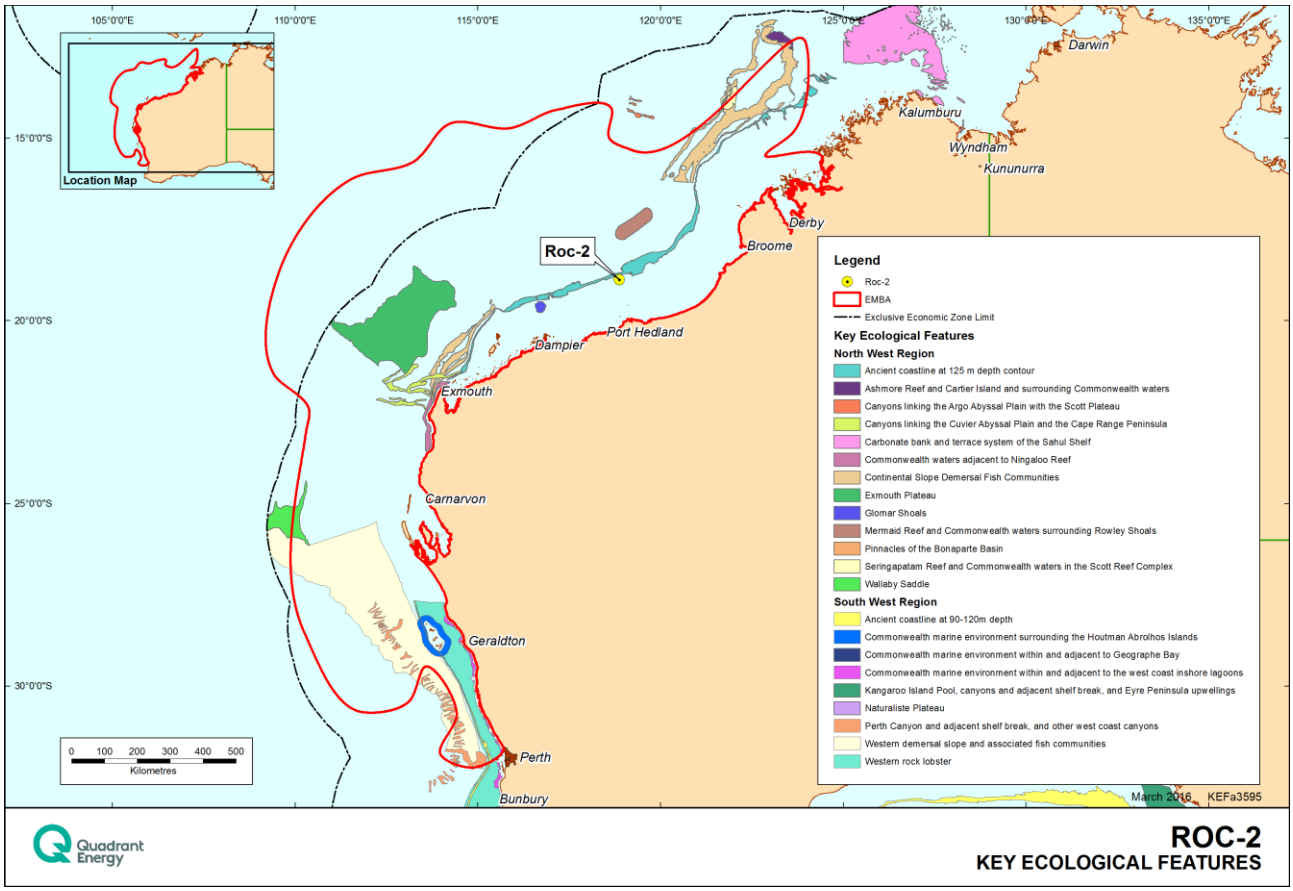

Figure 4-3: Protected/significant areas (Key Ecological Features) that occur within the EMBA

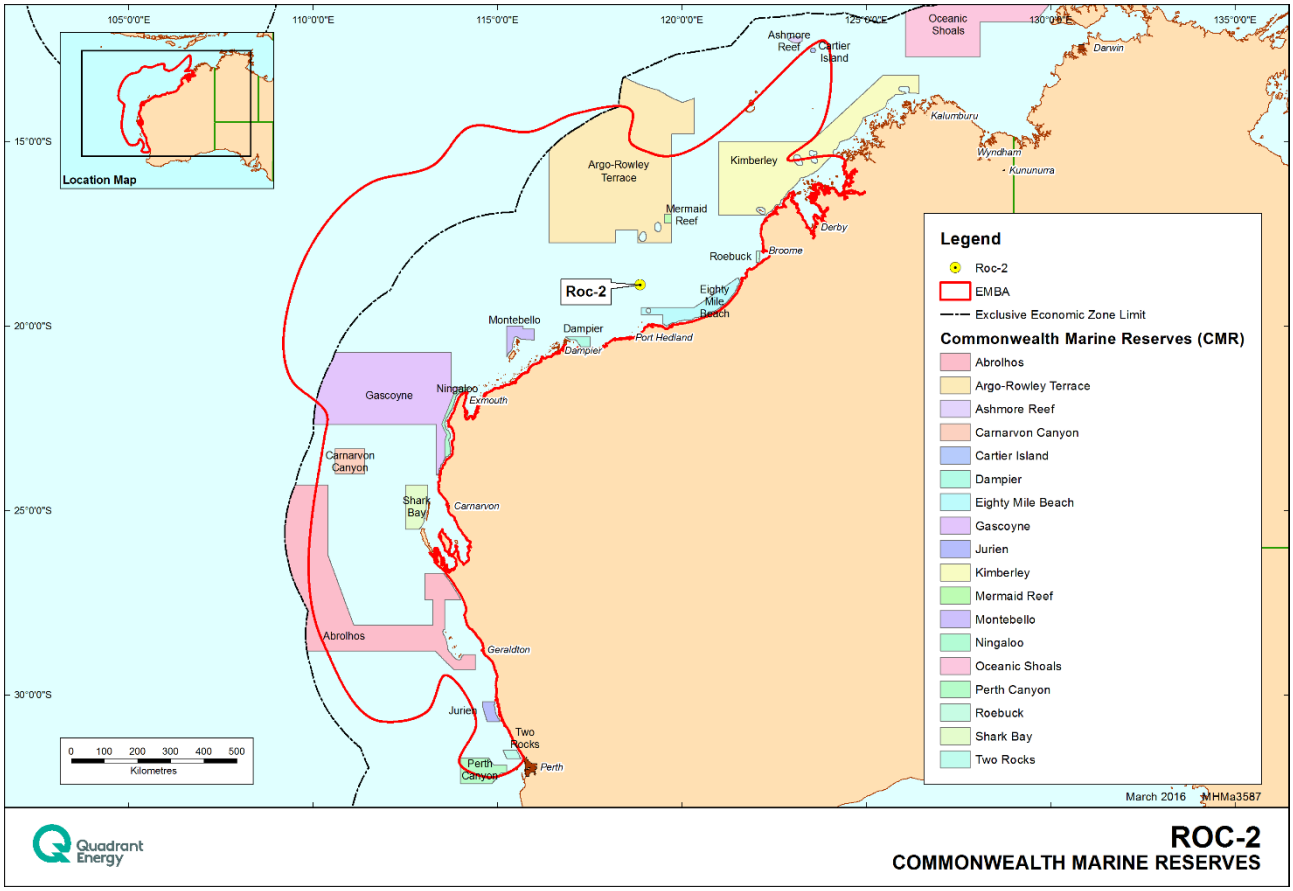

Figure 4-4: Protected/significant areas (Commonwealth marine reserves) that occur within the EMBA

Argo-Rowley CMR

The Argo-Rowley Commonwealth Marine Reserve (Multiple Use Zone – IUCN Category VI; Marine National Park Zone – IUCN Category II) protects the following conservation values (DoE 2014):

- Foraging areas that are important for migratory seabirds as well as the endangered loggerhead turtle;
- Important habitat and foraging for sharks;
- Protection for communities and habitats of the deeper offshore waters (220 metres to over 5,000 m) of the region;
- Seafloor features including aprons and fans, canyons, continental rise, knolls/abyssal hills and the terrace and continental slope;
- Communities and seafloor habitats of the Northwest Transition and Timor Province provincial bioregions;
- Connectivity between the existing Mermaid Reef Marine National Nature Reserve and reefs of the Western Australian Rowley Shoals Marine Park and the deeper waters of the region;
- Two key ecological features in the reserve.

Dampier Commonwealth Marine Reserve

The Dampier Commonwealth Marine Reserve (Marine National Park Zone – IUCN Category II; Habitat Protection Zone – IUCN Category IV) covers an area of approximately 1,252 km^2 and protects the following conservation values (DoE 2104):

- Foraging areas for migratory seabirds that are adjacent to important breeding grounds;

- Important foraging areas for marine turtles adjacent to significant nesting sites;
- Part of the migratory pathway of the protected humpback whale;
- Protection for offshore shelf habitats and shallow shelf habitats adjacent to the Dampier Archipelago; and
- Communities and seafloor habitats of the Northwest Shelf Province provincial bioregion as well as the Pilbara (nearshore) and Pilbara (offshore) meso-scale bioregions are included.

Eighty Mile Beach Commonwealth Marine Reserve

The Eighty Mile Beach Commonwealth Marine Reserve (Multiple Use Zone – IUCN Category VI) covers an area of approximately 10,785 km^2 and protects the following conservation values (DoE 2014):

- Foraging areas for migratory seabirds that are adjacent to important breeding grounds**;**
- Important foraging areas for marine turtles adjacent to significant nesting sites;
- Part of the migratory pathway of the protected humpback whale;
- Areas adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish;
- Protection for terrace, banks and shoal habitats on the shelf, with depths ranging from 15–70 m; and
- Communities and seafloor habitats of the Northwest Shelf Province provincial bioregion and the Canning, Northwest Shelf, Pilbara (nearshore), Pilbara (offshore) and Eighty Mile Beach meso-scale bioregions.

Kimberley Commonwealth Marine Reserve

The Kimberley Commonwealth Marine Reserve (Multiple Use Zone – IUCN Category VI; Habitat Protection Zone – IUCN Category IV; Marine National Park Zone – IUCN Category II) covers an area of approximately 74,469 km^2 and protects the following conservation values (DoE 2014):

- Important foraging areas for migratory seabirds, migratory dugongs, dolphins and threatened and migratory marine turtles;
- Important migration pathway and nursery areas for the protected humpback whale;
- Adjacent to important foraging and pupping areas for sawfish and important nesting sites for green turtles;
- Protection for communities and habitats of waters offshore of the Kimberley coastline (ranging in depth from less than 15–800 m);
- Representation of continental shelf, slope, plateau, pinnacle, terrace, banks and shoals and deep hole/valley seafloor features;
- Communities and seafloor habitats of the Northwest Shelf Transition, Northwest Shelf Province and Timor Province provincial bioregions along with the Kimberley, Canning, Northwest Shelf and Oceanic Shoals meso-scale bioregions; and
- Two key ecological features included in the reserve are:
    - Ancient coastline (an area of enhanced productivity attracting baitfish which, in turn, supplies food for migrating species); and
    - Continental slope demersal fish communities (the second richest area for demersal fish species in Australia).

Mermaid Reef Commonwealth Marine Reserve

The Mermaid Reef Commonwealth Marine Reserve (Strict Nature Reserve – IUCN Category Ia) has been re-named from the previous Mermaid Reef Marine National Nature Reserve and covers an area of approximately 540 km^2. During periods of high tide, Mermaid Reef is completely submerged underwater, and therefore, is under the legal jurisdiction of the Australian Commonwealth government (DSEWPaC 2012). The reef is listed on Australia's Commonwealth Heritage List and protects the following conservation values (DoE 2014):

- National and international significant habitats including, coral formations, geomorphic features and diverse marine life;
- Key area for over 200 species of hard corals and 12 classes of soft corals with coral formations in pristine condition;
- Important areas for sharks including the grey reef shark, the white tip reef shark and the silvertip whaler;
- Important foraging area for marine turtles;
- Important area for toothed whales, dolphins, tuna and billfish;
- Important resting and feeding sites for migratory seabirds;
- The reserve, along with nearby Rowley Shoals Marine Park, provides the best geological example of shelf atolls in Australia; and
- Examples of the seafloor habitats and communities of the Northwest Transition**.**

Montebello CMR

The CMR protects the following conservation values (DoE 2014):

- Foraging areas for migratory seabirds that are adjacent to important breeding areas;
- Areas used by vulnerable and migratory whale sharks for foraging;
- Foraging areas for marine turtles which are adjacent to important nesting sites;
- Section of the north and south bound migratory pathway of the humpback whale;
- Shallow shelf environments with depths ranging from 15–150 m which provides protection for shelf and slope habitats, as well as pinnacle and terrace seafloor features;
- Seafloor habitats and communities of the Northwest Shelf Province provincial bioregions as well as the Pilbara (offshore) meso-scale bioregion; and
- One key ecological feature.

The Roebuck Commonwealth Marine Reserve

The Roebuck Commonwealth Marine Reserve (Multiple Use Zone – IUCN Category VI) covers an area of approximately 304 km^2 and protects the following conservation values (DoE 2014):

- Foraging habitat area for migratory seabirds adjacent to important breeding areas;
- Foraging area adjacent to important nesting sites for flatback turtles;
- Parts of the migratory pathway of the protected humpback whale;
- Habitat adjacent to important foraging, nursing and pupping areas for freshwater, green and dwarf sawfish;
- Foraging and calving areas for Australian snubfin, Indo-Pacific humpback and Indo-Pacific bottlenose dolphins;
- Protection for shallow shelf habitats ranging in depth from 15–70 m; and

- Ecosystems example of the Northwest Shelf Province provincial bioregion and the Canning meso-scale bioregion.

Rowley Shoals Marine Park

Lying approximately 300 km north-north-west of Broome, the Rowley Shoals comprise three oceanic reef systems approximately 30–40 km apart, namely Mermaid Reef, Clerke Reef and Imperieuse Reef. The Rowley Shoals Marine Park comprises the Clerke and Imperieuse Reefs which lie in State Waters. DPaW has lead management responsibility for the Marine Park, in accordance with the Rowley shoals Management Plan (DEC 2007b).

The Rowley Shoals Marine Park was originally gazetted on 25 May 1990 as a Class A reserve and on 10 December 2004 the boundary was amended to extend the Park to the State Waters limit. The Park now covers approximately 87,632 ha (DEC 2007b). Mermaid Reef lies in Commonwealth waters and comprises the Mermaid Reef Marine National Nature Reserve managed by the Commonwealth Department of Environment (DEWHA 2008).

The Rowley Shoals Marine Park is characterised by spectacular intertidal and subtidal coral reefs, exceptionally rich and diverse marine fauna and high water quality. These attributes and the low level of use of the area contribute to the Park's unique wilderness qualities, which are a significant drawcard for visitors. Lying in the headwaters of the Leeuwin Current, the Shoals are thought to provide a source of invertebrate and fish recruits for reefs further south and as such are regionally significant. The remoteness of the Shoals and low use have ensured that the marine environment of the Shoals is in a near natural state, particularly relative to other reefs in the Indo-West Pacific region which are subject to intense ongoing human pressures and destructive fishing practices. The Rowley Shoals are of national and international significance and provide an important global benchmark for Indo-West Pacific reefs (DEC 2007b).

Barrow Island MP

The Barrow Island Marine Park covers 4,169 ha, all of which is zoned as sanctuary zone (the Western Barrow Island Sanctuary Zone) (DEC 2007). It includes Biggada Reef, an ecologically significant fringing reef, and Turtle Bay, an important turtle aggregation and breeding area (DEC 2007a). Representative areas of seagrass, macroalgal and deep water habitat are also represented within the marine park (DEC 2007a). Passive recreational activities (such as snorkelling, diving and boating) are permitted but extractive activities such as fishing and hunting are not.

Barrow Island MMA

The Barrow Island Marine Management Area (MMA) is the largest reserve within the Montebello/Barrow Islands marine conservation reserves (DEC 2007a) and includes most of the waters around Barrow Island, the Lowendal Islands and the Barrow Island Marine Park, with the exclusion of the port areas of Barrow Island and Varanus Island.

The MMA is not zoned apart from one specific management zone: the Bandicoot Bay Conservation Area. This conservation area is on the southern coast of Barrow Island and has been created to protect benthic fauna and seabirds. It includes the largest intertidal sand/mudflat community in the reserves, is known to be high in invertebrate diversity and is an important feeding area for migratory birds.

As for the other reserves in the Montebello/Barrow Islands marine conservation reserves, the Barrow Island MMA includes significant breeding and nesting areas for marine turtles and the waters support a diversity of tropical marine fauna, important coral reefs and unique mangrove communities (DEC 2007a). Green, hawksbill and flatback turtles regularly use the island's beaches for breeding, and loggerhead turtles are also occasionally sighted.

Montebello Islands MP

The Montebello Islands Marine Park (MP) is an 'A' Class reserve (DEC 2007a) and its northern and western boundaries follow the seaward extent of Western Australian state waters (DEC 2007a). Zoning within the

Montebello Islands MP is a combination of sanctuary, recreation, special purpose (benthic protection), special purpose (pearling), and general use (DEC 2007a).

The Montebello Islands comprise over 100 islands, the majority of which are rocky outcrops; rocky shore accounts for 81% of shoreline habitat (DEC 2007a). Other marine habitats within the marine park include coral reefs, mangroves, intertidal flats, extensive sheltered lagoonal waters, and shallow algal and seagrass reef platform extending to the south of the Montebello Islands to the Rowley Shelf.

Ecologically, the marine park's values include important turtle nesting sites, feeding and resting areas for migrating shorebirds, seabird nesting areas, dugong foraging areas, globally-unique mangrove communities, and highly diverse fish and invertebrate assemblages (DEC 2007a). Also, the sediment and water quality of the marine park are considered pristine (DEC 2007a) and are essential to the maintenance of the marine ecosystems and associated biota.

Economic values within the Montebello Islands MP include commercial pearl culture, commercial line and trap fishing, and an increasing recreational usage (DEC 2007a). Special purpose zones for pearling are established for the existing leaseholder to allow pearling to be the priority use of these areas (DEC 2007a). Commercial fishing includes a trap fishery for reef fishes, mainly in water depths of 30–100 m, and wet lining for reef fish and mackerel. Fish trawling also occurs in the waters near to the Montebello Islands. A tourist houseboat operates out of Claret Bay, at the southern end of Hermite Island, during the winter months. The Montebello Islands are becoming more frequently used by recreational boaters for camping, fishing and diving activities.

Eighty Mile Beach MP

The Eighty Mile Beach Marine Park, located between Port Hedland and Broome, was gazetted on 29 January 2013. It covers an area of approximately 200,000ha stretching for some 220km from Cape Missiessy to Cape Keraudren, and includes sanctuary, recreation, general use and special purpose zones. The park is managed under the Eighty Mile Beach Marine Park Management Plan 2014-20124 (DPaW, 2014).

The listed ecological values of the Eighty Mile Beach Marine Park include the high sediment and water quality, the juxtaposition of the beach, coastal topography and seabed and the diverse and ecologically important habitats and marine/coastal flora and fauna. The listed habitat values of the marine park are as follows:

- The intertidal sand and mudflat communities supporting a high abundance and diversity of invertebrate life and providing a valuable food source for shorebirds (including migratory species) and other fauna.
- The diverse subtidal filter-feeding communities.
- Macroalgal and seagrass communities providing habitat and feeding opportunities for fish, invertebrates and dugongs.
- High diversity intertidal and subtidal coral reef communities.
- Mangrove communities and adjacent saltmarshes provide nutrients to the surrounding waters and habitat for fish and invertebrates.

The listed marine and coastal fauna values are as follows:

- A high diversity and abundance of nationally and internationally important shorebirds and waders (including migratory species) are found in the marine park.
- Flatback turtles are endemic to northern Australia and nest at Eighty Mile Beach.
- Dugongs and several whale and dolphin species inhabit or migrate through the marine park.
- A highly diverse marine invertebrate fauna provides an important food source for a variety of animals, including birds, fish and turtles, along with recreational and commercial fishing opportunities.
- A diversity of fish species provide recreational and commercial fishing opportunities.

- A diversity of sharks and rays, including several protected species, are found in the park.

In addition to these natural values, the marine park contains land and sea important to traditional indigenous owners through identity and place, family networks, spiritual practice and resource gathering. The marine park also has a history of European activity including exploration, pastoralism and commercial fishing (e.g. the pearl oyster fishery). The park contains a historical WWII plane wreck (*Dornier Do-24 X-36*) and shipwrecks (two pearl luggers). The marine park provides tourism opportunity and recreational value through its remoteness, diversity and abundance of habitats and marine fauna and the pristine nature of the marine and coastal environment.
The marine park contains vast intertidal sand and mudflats that extend up to 4km wide at low tide and provide a rich source of food for many species. Eighty Mile Beach Marine Park is one of the world's most important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries thousands of kilometres away (DPaW 2014).

Glomar Shoals

The Glomar Shoals are a submerged feature situated at a depth of 33–77 m, approximately 150 km north of Dampier on the Rowley Shelf (Falkner *et al*. 2009 in DSEWPaC 2012). They consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells (McLoughlin & Young 1985 in DSEWPaC 2012). The area's higher concentrations of coarse material compared to surrounding areas are indicative of a high energy environment subject to strong seafloor currents (Falkner *et al*. 2009 in DSEWPaC 2012).

Biological communities found at the Glomar Shoals have not been comprehensively studied, however the shoals are known to be an important area for a number of commercial and recreational fish species such as rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish. Catch rates at the Glomar Shoals are high, indicating that the area is a region of high productivity (Falkner *et al*. 200 and Fletcher & Santoro 2009 in DSEWPaC 2012).

The Glomar Shoals are regionally important for their potentially high biological diversity and localised productivity. Biological data specific to the Glomar Shoals is limited, however the fish of the shoals are probably a subset of reef-dependent species and anecdotal evidence suggests they are particularly abundant (DSEWPaC 2012).

Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals
The Rowley Shoals are a group of three atoll reefs—Clerke, Imperieuse and Mermaid reefs—located about 300 km north-west of Broome. Mermaid Reef lies 29 km north of Clerke and Imperieuse reefs and is totally submerged at high tide. Mermaid Reef falls under Commonwealth jurisdiction and forms the Mermaid Reef Commonwealth Marine Reserve. Clerke and Imperieuse reefs constitute the Rowley Shoals Marine Park, which falls under Western Australian Government jurisdiction (EA 2000).

4.1.4 Hot Spots

The locations that have been ranked priority 1,2 or 3 (identified in Quadrant Energy's *Environmental Sensitivities and Priorities for Protection* guidelines EA-91-ZI-10008) that occur within the EMBA are also listed in **Table 4-2.** These areas are considered regionally to have High Environmental Values (HEVS).

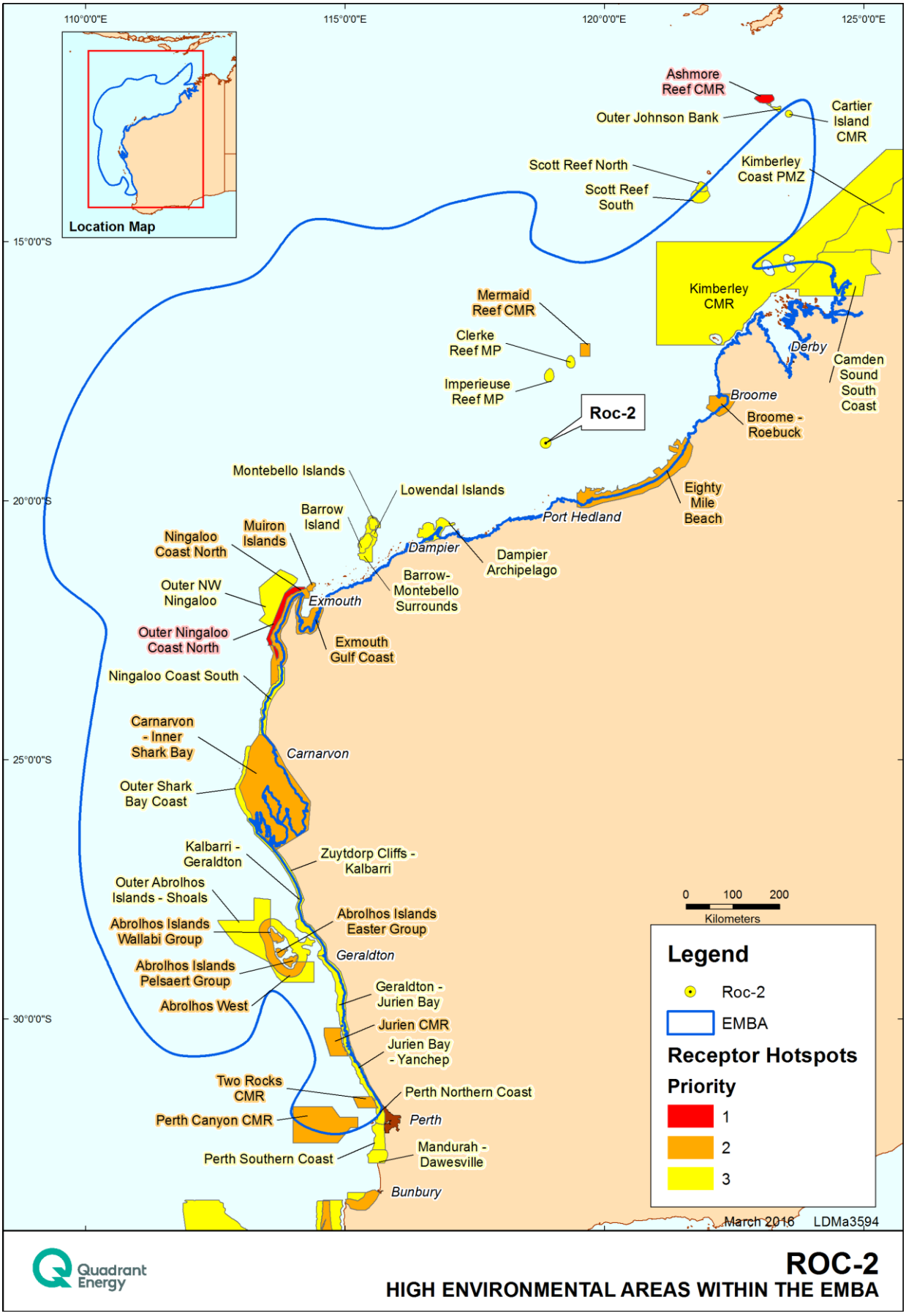

Figure 4-5: High Environmental Areas (HEVs) within the EMBA

4.1.5 Marine Fauna

Desktop searches of the Operational Area and larger EMBA were undertaken using DoE's Protected Matters Search Tool for the purposes of identifying species listed under the EPBC Act. The search identified 103 Listed Threatened Species (LTS) and 102 Listed Migratory Species (LMS) as having the potential to occur within the EMBA**.**

An assessment of all the marine and coastal species was undertaken to identify if these species have the potential to occur in either the Operational Area or larger EMBA. Those listed threatened or vulnerable species that have been identified as likely to be present in the Operational Area or EMBA are summarised in **Table 4-4**. Migratory species are only listed for the Operational Area only.

Table 4-4: Environmental values and sensitivities – marine fauna

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory	Operational Area presence[2]	Particular values or sensitivities within Operational Area	EMBA presence	Particular values or sensitivities within EMBA
Common Name	**Scientific Name**					
Protected Species and Communities: Fish and Sharks						
Great white shark	*Carcharodon carcharias*	V,M	✓	Transient individuals may occur	✓	Foraging, feeding or related behaviour known to occur
Green sawfish	*Pristis zijsron*	V, M	✓	Transient individuals may occur	✓	Breeding areas known to occur
Whale shark	*Rhincodon typus*	V, M	✓	Transient individuals may occur	✓	Foraging feeding behaviour known to occur
Shortfin mako	*Isurus oxyrinchus*	M	✓	Transient individuals may occur	✓	Species or habitat known to occur
Longfin mako	*Isurus paucus*	M	✓	Transient individuals may occur	✓	Transient individuals may occur
Reef manta ray	*Manta alfredi*	M	✓	Transient individuals may occur	✓	Transient individuals may occur
Giant manta ray	*Manta birostris*	M	✓	Transient individuals may	✓	Transient individuals may occur

[2] Determined from an EPBC search of the Operational Area boundary of 1.5 km radius around the well location

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory	Operational Area presence[2]	Particular values or sensitivities within Operational Area	EMBA presence	Particular values or sensitivities within EMBA
Common Name	**Scientific Name**					
				occur		
Grey nurse shark	*Carcharias taurus*	V			✓	Species or habitat known to occur
Dwarf sawfish	*Pristis clavata*	V			✓	Breeding areas known to occur
Largetooth Sawfish	*Pristis pristis*	V			✓	Breeding areas known to occur
Northern River Shark, New Guinea River Shark	*Glyphis garricki*	E			✓	Species or habitat known to occur
Blind cave eel	*Ophisternon candidum*	V			✓	Species or habitat likely to occur
Blind gudgeon	*Milyeringa veritas*	V			✓	Species or habitat likely to occur
Blue whale	*Balaenoptera musculus*	E,M	✓	Migration route known to overlap PA	✓	Foraging feeding related behaviour known to occur within the area.
Humpback whale	*Megaptera novaeangliae*	V,M	✓	Transient individuals may occur	✓	Breeding known to occur
Bryde's whale	*Balaenoptera edeni*	M	✓	Transient individuals may occur	✓	Species or habitat may occur
Killer whale	*Orcinus orca*	M	✓	Transient individuals may occur	✓	Transient individuals may occur

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory	Operational Area presence[2]	Particular values or sensitivities within Operational Area	EMBA presence	Particular values or sensitivities within EMBA
Common Name	**Scientific Name**					
Spotted bottlenose dolphin	*Tursiops aduncus*	M	✓	Transient individuals may occur	✓	Species or habitat likely to occur
Antarctic minke whale	*Balaenoptera bonaerensis*	M			✓	Species or habitat may occur
Sperm whale	*Physeter macrocephalus*	M			✓	Foraging feeding related behaviour known to occur within the area.
Dugong	*Dugong dugon*	M			✓	Breeding known to occur
Indo-pacific humpback dolphin	*Sousa chinensis*	M			✓	Species or habitat likely to occur
Sei whale	*Balaenoptera borealis*	V, M			✓	Species or habitat may occur
Fin whale	*Balaenoptera physalus*	V, M			✓	Species or habitat may occur
Southern right whale	*Eubalaena australis*	E, M			✓	Breeding known to occur
Australia sea-lion	*Neophoca cinerea*	V			✓	Breeding known to occur
Protected Species and Communities: Marine Reptiles						
Loggerhead turtle	*Caretta caretta*	E,M	✓	Transient individuals may occur	✓	Breeding areas known to occur
Green turtle	*Chelonia mydas*	V,M	✓	Transient individuals may occur	✓	Breeding areas known to occur
Leatherback turtle	*Dermochelys coriacea*	E,M	✓	Transient individuals may	✓	Foraging or feeding behaviour known to occur

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory	Operational Area presence[2]	Particular values or sensitivities within Operational Area	EMBA presence	Particular values or sensitivities within EMBA
Common Name	**Scientific Name**					
				occur		
Hawksbill turtle	*Eretmochelys imbricata*	V,M	✓	Transient individuals may occur	✓	Breeding areas known to occur
Flatback turtle	*Natator depressus*	V,M	✓	Transient individuals may occur	✓	Breeding areas known to occur
Short-nosed seasnake	*Aipysurus apraefrontalis*	CE			✓	Species or habitat known to occur
Olive ridley turtle	*Lepidochelys olivacea*	E, M			✓	Foraging or feeding behaviour known to occur
Protected Species and Communities: Marine Birds						
Lesser frigatebird	*Fregata ariel*	M	✓	Transient individuals may occur	✓	Breeding known to occur
White tailed tropicbird	*Phaethon lepturus fulvus*	E, M			✓	Breeding likely to occur
Fairy Prion	*Pachyptila tutur subantactrica*	V.M			✓	Species or habitat known to occur
Roseate tern	*Sterna dougallii*	M			✓	Breeding known to occur
Brown booby	*Sula leucogaster*	M			✓	Breeding known to occur
Australian lesser noddy	*Anous tenuirostris melanops*	V			✓	Breeding known to occur
Streaked Shearwater	*Calonectris leucomelas*	M			✓	Species of species habitats may occur
Northern royal albatross	*Diomedea epomophora sanfordi*	E			✓	Foraging or feeding behaviour known to occur

Value/Sensitivity		EPBC Act Status CE = Critically Endangered E = Endangered V = Vulnerable M = Migratory	Operational Area presence[2]	Particular values or sensitivities within Operational Area	EMBA presence	Particular values or sensitivities within EMBA
Common Name	**Scientific Name**					
Amsterdam albatross	*Diomedea exulans amsterdamensis*	E			✓	Species or habitat may occur
Tristan albatross	*Diomedea exulans exulans (D. dabbenena)*	E			✓	Species or habitat may occur
Wandering albatross	*Diomedea exulans (sensu lato)*	V			✓	Foraging or feeding behaviour known to occur
Sooty Albatross	*Phoebetria fusca*	V			✓	Species or species habitat may occur in area
Northern giant-petrel	*Macronectes halli*	V			✓	Species or habitat may occur
Soft-plumaged petrel	*Pterodroma mollis*	V			✓	Foraging or feeding behaviour known to occur
Blue petrel	*Halobaena caerulea*	V			✓	Species or habitat may occur
Australian Painted Snipe	*Rostratula australis*	E			✓	Species or habitat likely to occur
Australian fairy tern	*Sternula nereis nereis*	V			✓	Species or habitat known to occur
Indian yellow-nosed albatross	*Thalassarche carteri*	V			✓	Foraging or feeding behaviour may occur
Shy albatross	*Thalassarche cauta cauta*	V			✓	Foraging or feeding behaviour likely to occur
White-capped albatross	*Thalassarche cauta steadi*	V			✓	Foraging or feeding behaviour likely to occur
Black-browed albatross	*Thalassarche melanophris*	V			✓	Species or habitat may occur
Campbell albatross	*Thalassarche melanophris impavida*	V			✓	Species or habitat may occur

4.2 Socio-economic Environment

Socio-economic activities that may occur within the Roc-2 EMBA include commercial fishing, shipping and oil and gas exploration and production (**Table 4-5**).

Table 4-5: Environmental (Socioeconomic) Values and Sensitivities in the Roc-2 EMBA

Category	Receptor within EMBA	Present in Operational area	Present in EMBA
Commonwealth Commercial fisheries	North West Slope Trawl Fishery	×	✓
	Western Tuna and Billfish Fishery	✓	✓
	Skipjack Tuna (Western) Fishery	✓	✓
	Western Deepwater Fishery	✓	✓
	Southern Bluefin Tuna Fishery	✓	✓
State Commercial Fisheries	Marine Aquarium Fish Fishery	×	✓
	Northern Demersal Scalefish Managed Fishery	×	✓
	Pilbara Line Fishery	×	✓
	Nickol Bay Prawn Managed Fishery	✓	✓
	Broome Prawn Managed Fishery	×	✓
	Onslow Prawn Managed Fishery	×	✓
	Pilbara Fish Trawl Managed Fishery	✓	✓
	Pearl Oyster Managed Fishery	✓	✓
	Pilbara Trap Managed Fishery	✓	✓
	Aquaculture Pearling Sites	×	✓
	Specimen Shell Managed Fishery	✓	✓
	Beche-de-mer Fishery	✓	✓
	Mackerel Managed Fishery (Area 2 – Pilbara and Area 3 - Gascoyne/West Coast)	✓	✓
	Octopus	✓	✓
	West Coast Deep Sea Crab (Interim) Managed Fishery	✓	✓
	Kimberley Prawn Managed Fishery (KPMF)	×	✓
	The Kimberley Gillnet and Barramundi Managed Fishery (KGBF)	×	✓
	Gascoyne Demersal Scalefish Fishery	×	✓
	Exmouth Gulf Prawn Fishery	×	✓
	West Coast Rock Lobster Fishery	×	✓
	Shark Bay Prawn and Scallop Limited Entry Fishery	×	✓

Category	Receptor within EMBA	Present in Operational area	Present in EMBA
	Shark Bay Crab Interim Managed Fishery	×	✓
	Abrolhos Islands and Mid West Trawl Managed Fishery (AIMWTMF)	×	✓
	West Coast Demersal Scalefin Interim Managed Fishery	×	✓
Shipping	The Roc-2 well location is located within reasonable proximity to a designated shipping route (AMSA 2014) with two north-south oriented lanes servicing Port Hedland ~6km distance away. Commercial shipping moves through the offshore waters en route to or from the marine terminals at, Barrow and Varanus Islands. Shipping using NW Shelf waters includes iron ore carriers, oil tankers and other vessels proceeding to or from the ports of Dampier, Port Walcott and Port Hedland; however, these are predominantly heading north from these ports. Large cargo vessels carrying freight bound or departing from Fremantle, transit along the WA coastline heading north and south in deeper waters.	×	✓
Recreational fishing	Within the North Coast Bioregion, recreational fishing is experiencing significant growth, with a distinct seasonal peak in winter when the local population increases significantly. Increased recreational fishing has also been attributed to those involved in the construction or operation of developments within the region. Consultation has indicated recreational fishing hotspots include Eighty Mile Beach, the Montebello Islands, Barrow Island, the Lowendal Islands, the Muiron Islands, Dampier Archipelago, the Broome North Coast and the Ningaloo and Exmouth Coast are of high value to recreational fishers. Charter Boat and tourism operators also frequent those areas not easy accessible by recreational fishers including Mermaid Reef, Imperieuse Reef, Clerke Reef, Camden Sound, the Lacepede Islands and the Kimberley Coast.	×	✓
Oil and Gas	The area of the NW Shelf is a major oil and gas hub in Australia, with several companies operating on the Shelf. The area of activity occurs in a particularly isolated area of the NW Shelf with respect to the main oil and gas operational and exploratory fields. There are currently no operating fields in the Operational Area. The nearest operating facility is Santos' Modec Venture II FPSO and Woodside's Angel oil field and associated infrastructure, located > 240 km and 247 km from the Operational Area respectively	×	✓
Tourism	In the waters immediately surrounding the Operational Area, tourism activities are limited due to its distance from the mainland and island shorelines. However, there are many sources of marine-based tourism within the environment that may be affected. Aquatic recreational activities such as boating, diving and fishing occur near the coast and islands off of the Pilbara and Ningaloo coasts. These activities are concentrated in the vicinity of the population centres such as Broome, Roebuck Bay, Exmouth, Dampier and Onslow.	×	✓

Category	Receptor within EMBA	Present in Operational area	Present in EMBA
Cultural Heritage	No known sites of Cultural Heritage significance within the operational area or wider environment.	×	✓

5. STAKEHOLDER CONSULTATION

Quadrant recognises that its development activities have the potential to impact the community and the environment, particularly in locations which feature or are near sensitive receptors, or that overlap with other economic, cultural or community uses.

To facilitate informed assessment by stakeholders of the likely potential impact of Quadrant activities, Quadrant seeks to establish long-term and meaningful dialogue with those stakeholders who have an interest in its present and planned future activities in Australia.

Quadrant clearly articulates engagement and consultation standards, goals, and mechanisms, seeks to effectively manage change during the life of its projects and activities, and strives to continuously improve all aspects of its stakeholder engagement processes. The key stakeholders identified for the activity are based on the operational area and EMBA and are provided in **Table 5-1**.

Table 5-1: Summary of Key Stakeholders Consulted for the Activity

Group	Stakeholder
Marine Conservation	• Department of Fisheries (DoF) • Department of Parks and Wildlife (DPaW)
Shipping safety and security	• Australian Maritime Safety Authority (AMSA) • Department of Defence (DoD) • Department of Transport (DoT)
Adjacent regulator	• Department of Mines and Petroleum (State)
Fishing bodies	• A Raptis and Sons • Austral Fisheries • Australian Fisheries Management Authority (AFMA) • Australian Southern Bluefin Tuna Association (ASBTIA) • Commonwealth Fisheries Association (CFA) • Fat Marine • Marine Tourism WA • MG Kailis • Pearl Producers Association • Quest Maritime Services • Recfishwest • RNR Fisheries • Shark Bay Seafoods • Western Australian Fishing Industry Council (WAFIC) • Western Wild Fisheries • WestMore Seafoods
Karratha/Port Hedland Stakeholder Reference Group	• City of Karratha • Dampier Port Authority • Pilbara Port Authority • Town of Port Hedland

Quadrant maintains a comprehensive stakeholder database, which is overseen by a dedicated Consultation Coordinator. The purpose of the database is to enable the identification, initial and ongoing contact with an appropriate group of stakeholders for any given project, and to facilitate the building of long-term and meaningful dialogue with those stakeholders with whom Quadrant has regular contact.

Details of the Roc-2 drilling program including project summary, coordinates, location map, water depth, distances to key regional features, exclusion zone details and estimated timing were distributed to stakeholders in a detailed consultation package on February 23, 2016.

Consultation was previously undertaken for the drilling of Roc-1 (5.6 km away from Roc-2). Details of Reoc-1 were included in the second, third and fourth editions of Quadrant Energy's *Jack Up Drilling Campaign Consultation Package* (distributed by Apache Energy at the time) which was distributed to stakeholders

quarterly from October 2014 to April 2015. Additionally stakeholders were issued a Consultation Package regarding five-year drilling activities in the Bedout Basin on March 12, 2015.

5.1 Addressing consultation feedback

Quadrant's Consultation Coordinator is available before, during and after completion of the proposed activity to ensure opportunities for stakeholders to provide feedback are available. Consultation feedback is provided to relevant activity personnel to ensure the Quadrant Energy business has a thorough understanding of how the activity is being received by relevant persons.

Prior to commencement of an activity covered by this EP, a risk assessment will be undertaken to identify potentially affected stakeholders. This stakeholder set will be notified prior to commencement of the activity, ensuring that any commitments arising from the consultation process are recognised as performance standards required for that activity.

5.2 Summary

Quadrant Energy considers that consultation with regulators and key stakeholders for this activity has been adequate; all stakeholders and relevant parties have been actively engaged by Quadrant Energy regarding its activities on the NW Shelf (including this Activity) and also, where applicable the proposed oil spill response strategies for these activities.

No objections to the Roc-2 activity were raised during this consultation period.

All correspondence with external stakeholders is recorded in the stakeholder database and Quadrant Energy will remain available before, during and after completion of the development activity. Concerns will be listed against contact details for the relevant project personnel. Consultation material will be provided to relevant personnel and is summarised in **Table 5-2**.Quadrant Energy has detailed communications procedures for the life of the project and will maintain two-way communications with stakeholders regarding the Activity and all current or proposed activities undertaken on the NW Shelf. Many stakeholders have stated that they will contact Quadrant Energy by exception, that is, if upon receiving the Stakeholder Information Package they feel the activity poses a risk to them, they will contact Quadrant Energy.

Table 5-2: Consultation summary for activity

Stakeholder	Assessment of Consultation Undertaken
Fishing bodies	
A Raptis and Sons	A Raptis and Sons were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date, and the stakeholder has previously confirmed that no response means 'no concern' with the given activity. No action arising from this consultation for this EP.
Austral Fisheries	Austral Fisheries were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date, and the stakeholder has previously confirmed that no response means 'no concern' with the given activity. No action arising from this consultation for this EP.
Australian Fisheries Management Authority	AFMA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. Previous interaction with stakeholder has reassured Quadrant Energy that a response would only be received in the event of concern regarding the proposed activity. No response regarding the Roc-2 activity has been received to date.
Australian Southern Bluefin	ASBTIA were provided the Roc-2 Drilling consultation package on February 23,

Stakeholder	Assessment of Consultation Undertaken
Tuna Industry Association (ASBTIA)	2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No response regarding the Roc-2 activity has been received to date.
Commonwealth Fishing Association	The CFA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No response regarding the Roc-2 activity has been received to date.
Fat Marine	Fat Marine were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No response regarding the Roc-2 activity has been received to date.
Marine Tourism WA	MTWA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment has been received to date relating to Roc-2 Drilling; previous interaction with stakeholder has reassured Quadrant Energy that a response would only be received in the event of concern regarding the proposed activity.
MG Kailis	MG Kailis were provided the Roc-2 Drilling consultation package on February 23, 2016, and Stephen Hood from MG Kailis responded on February 23 requesting a map of the proposed Roc-2 well location against State Fisheries. Quadrant provided this map on February 25, 2016. Quadrant made a follow up call to Mr Hood on March 15, 2016, to ensure these maps were received. Upon no answer a detailed message referring to email dates and leaving return contact details was left. Mr Hood emailed a response to Quadrant on March 20, 2016, noting *"drilling will have some impact on our fishing operations in the Pilbara Fish Trawl, but providing there is good communications and exclusion zones are minimised, I don't see too many issues with it"*. Quadrant commits to ongoing consultation with MG Kailis to minimise any impacts to Pilbara Fish Trawl, as successfully completed with the Roc-1 drilling campaign. Quadrant outlined exclusion zone details via email on March 21, 2016. Quadrant Energy understands the planned Roc-2 activity is located within the Pilbara Fish Trawl State Fishery and commits to open and transparent consultation with MG Kailis, including the provision of specific timing and rig details prior to commencement of the activity.
Pearl Producers Association (PPA)	The PPA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment has been provided on this project at time of submission.
Quest Maritime Services	Quest Maritime Services were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Recfishwest	Recfishwest were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
RNR Fisheries	RNR Fisheries were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Western Australian Fishing Industry Council	WAFIC were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Western Wild Fisheries	Western Wild Fisheries were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.

Stakeholder	Assessment of Consultation Undertaken
WestMore Seafoods & Shark Bay Seafoods	These fishers were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. Gary Kessell at Westmore Seafoods also represents Shark Bay Seafood, and operates within the Western Deep Water Trawl Fishery, North West Slope Trawl Fishery, Shark Bay Prawn Fishery, Pilbara Fish Trawl, Nickol Bay Prawn Fishery and the Kimberley Prawn Fishery zones. No comment on this activity has been received to date, and the stakeholder has previously confirmed that no response means 'no concern' with the given activity. No action arising from this consultation for this EP.
Karratha/Dampier Stakeholder Reference Group	
Dampier Port Authority	The DPA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Pilbara Port Authority	The Pilbara Port Authority were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
City of Karratha	The City of Karratha were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. A response was received on March 10, 2016, noting no objection to this activity.
Town of Port Hedland	The Town of Port Hedland were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Marine Conservation	
Department of Fisheries	Information regarding the planned Roc-2 drilling activity was lodged using DoF's online Environmental Impact Assessment form on March 1, 2016. DoF previously provided advice for the permit WA-437-P, dated 24 August 2015, regarding fishing activities and fish spawning grounds in the area, OPEP advice and biosecurity. DoF's advice for permit WA-437-P is referenced in the accepted *Roc-1 Exploration and Appraisal Drilling EP* (EA-00-RI-101178.01). Quadrant Energy responded to DoF on October 6, 2015, addressing each of the key issues raised in correspondence received on 24 August 2015, which DoF accepted via email on October 15, 2015, again referenced in the *Roc-1 Exploration and Appraisal Drilling EP* (EA-00-RI-101178.01). DoF advised Quadrant in an email dated March 16, 2016, the advice provided for and accepted in October 2015 was still valid for the Roc-2 drilling activity. Quadrant Energy incorporates this advice from DoF in all Quadrant Energy EPs. Quadrant Energy commits to ongoing consultation with DoF to ensure this advice remains valid through the lifecycle of this EP using DoF's online Environmental Impact Assessment form. Additionally DoF receive Quadrant Energy's Quadrant Energy *Quarterly Consultation Updates*.
Department of Parks and Wildlife	DPaW were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. DPaW advised in consultation for the Roc-1 drilling activity that due to the distance from any marine park, this area would not be of interest and DPaW would not provide comment on the Roc 1 EP, to date Quadrant have not received any

Stakeholder	Assessment of Consultation Undertaken
	comment from DPaW on the information that was provided for the proposed Roc -2 activity.
Shipping safety and security	
Australian Maritime Safety Authority	AMSA were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. AMSA responded to this consultation on March 8, 2016, noting vessel traffic in the area mainly consists of support craft. Quadrant Energy ensures control measures are in place during drilling activities to manage and minimise risk in relation to the presence of other sea users, marine navigation and vessel safety.
Department of Defence	The Department were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. No comment on this activity has been received to date.
Department of Transport	DoT were provided the Roc-2 Drilling consultation package on February 23, 2016, and responded with thanks and confirmation of receipt on March 8, 2016. In a phone conversation with Matt Verney of DoT on March 18, 2016, Quadrant was advised new guidelines for consultation would likely be received post the submission of the Roc-2 EP to NOPSEMA, therefore Quadrant should continue in preparation of this EP and address new guidelines when relevant in ongoing consultation. DoT receive all Quadrant Energy's Quarterly Consultation Update documents. Advice received through previous consultation and interaction with DoT has been adopted by Quadrant Energy in the preparation of the OPEPs.
Adjacent Regulators	
State Department of Mines and Petroleum	DMP were provided the Roc-2 Drilling consultation package on February 23, 2016, and receive all Quadrant Energy's Quarterly Consultation Update documents. Quadrant provided additional information in line with DMP's consultation guidelines via email on March 17, 2016. Quadrant notes this information was in line with the information provided and accepted by DMP in the preparation of the *Roc-1 Exploration and Appraisal Drilling EP* (EA-00-RI-101178.01). DMP is a valued stakeholder and Quadrant Energy commits to open on ongoing consultation before, during and after this activity Including the provision of pre-start and cessation notifications as per DMP's consultation guidelines.

6. ENVIRONMENTAL HAZARDS AND CONTROLS

The impact and risk assessment approach is consistent with the requirements of AS/NZS ISO 31000:2009 Risk Management – Principles and guidelines and ISO/IEC 31010 Risk management – Risk management techniques. The approach can be mapped to the requirements of the OPGGS (E) Regulations for an EP, as described by NOPSEMA (N4700-GN1074 Rev 1 2013). The key steps are illustrated in **Figure 6-1**.

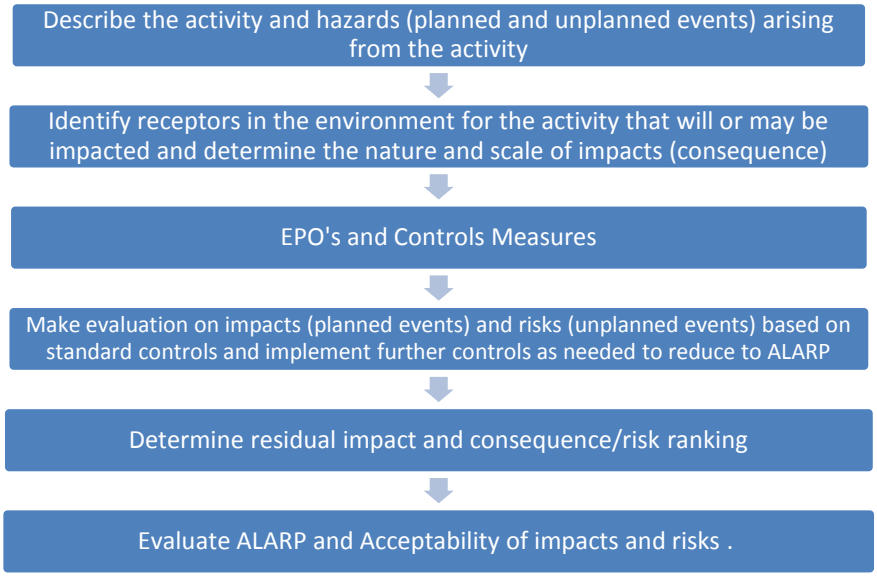

Figure 6-1: Risk and Impact Process

An assessment against the Activity was undertaken and the environmental hazards or aspects were then identified. The risk assessment identified 4 potential unplanned events and 8 planned events. Environmental aspects/hazards identified for the Activity are summarised in **Table 6-1** and **Table 6-2.**

The extent of actual or potential impacts from each planned or unplanned event is assessed using, where required, modelling (e.g. for hydrocarbon spill modelling) and scientific reports. Impact mechanisms and any thresholds for impact are determined and described, using scientific literature and modelling where required. This step looks at the causal effect between the aspect/hazard and the identified receptor. Impact thresholds for different critical life stages are also identified where relevant.

The consequence level of the impact is then determined for each planned and unplanned event based on the severity of the impact to relevant receptors. This process determines a consequence level based on criteria set for Quadrant for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. The consequence definitions are outlined below.

Consequence Level		Consequence Level description
A	Negligible	No impact or negligible impact.
B	Minor	Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect with rapid recovery
C	Moderate	Significant impact to local population, industry or ecosystem factors. Medium term recovery
D	Major	Major long-term effect on local population, industry or ecosystem factors. Slow recovery over decades
E	Critical	Complete loss of local population, industry or ecosystem factors AND/ OR major wide-spread regional impacts with slow recovery.

For unplanned events, a risk ranking is also determined using an assessment of the likelihood (likelihood ranking) of the event as well as the consequence level of the potential impact should that event occur.

For each planned and unplanned event a set of Environmental Performance Outcome(s) (EPO's), Environmental Performance Standards (EPS) and Measurement Criteria (MC) are identified. The definitions of the performance outcomes, standards and measurement criteria are consistent with the OPGGS (E) Regulations. For planned and unplanned events, an ALARP and Acceptability assessment is also undertaken.

6.1 ALARP Evaluation

The ALARP principle is that the residual impacts and risk shall be 'as low as reasonably practicable'. It has particular connotations as a route to reduce risks when considering law, regulation and standards.

For an impact or risk to be ALARP it must be possible to demonstrate that the cost involved in reducing the impact or risk further would be grossly disproportionate to the benefit gained. The ALARP principle arises from the fact that infinite time, effort and money could be spent on the attempt of reducing a risk to zero. It should not be understood as simply a quantitative measure of benefit against detriment. It is more a best common practice of judgement of the balance of impact or risk and societal benefit.

For planned and unplanned events, an ALARP assessment is undertaken to demonstrate that control measures adopted reduce the impact or risk to as low as reasonably practicable (ALARP). This process relies on demonstrating that further potential control measures would require a disproportionate level of cost/effort for the level of impact or risk reduction they would provide. If this cannot be demonstrated then the further controls are implemented. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact and risks.

6.2 Acceptability Evaluation

Quadrant consider the impacts or risks associated with the program to be acceptable if they meet the following set of criteria:

1. A consequence from a planned event is ranked as A or B; or a risk of impact from an unplanned event is ranked low to medium/high;
2. An assessment has been completed to determine if further information/studies are required to support or validate the consequence assessment;
3. Performance standards are consistent with legal and regulatory requirements;
4. Performance standards are consistent with Quadrant Environmental Management Policy;
5. Performance standards are consistent with stakeholder expectations; and
6. Performance standards have been demonstrated to reduce the impact or risk to ALARP.

Table 6-1 and **Table 6-2** summarise the identified hazards and potential impacts associated with the activity. The table also lists the controls to prevent or mitigate impacts such that impacts and risks are reduced to ALARP and are at acceptable levels.

Table 6-1: Environmental Risk Treatment Summary for Planned Events

Event	Potential Impacts	Consequence	Management Controls	Environmental Performance
Light Emissions	Continuous lighting in the same location for an extended period of time may result in alterations to normal marine fauna behavior.	Negligible	No standard controls are in place other than those required for navigational and safety requirements which are detailed in each Vessel Safety Case.	
Noise Emissions	Noise generated by the project vessels, helicopters, VSP and flaring during the removal activity may result in physiological or behavioural impacts to marine fauna.	Negligible	Procedures for interacting with cetaceans	Vessels maintain distance from cetaceans to reduce noise impacts from propellers. Helicopter complies with Part 8 of EPBC Regulations for interacting with cetaceans to reduce noise impacts.
			MODU seismic survey procedures	Includes controls that reduce the risk of harm to marine fauna
Atmospheric Emissions	Air emissions through the release of ozone depleting substances (ODS), bulk transfers and use of fuel may result in a temporary, localised reduction of air quality in the environment immediately surrounding the discharge point.	Negligible	Waste incineration	No incineration within 500m exclusion zone
			Fuel oil quality	Reduced sulphur emissions during the activity.
			Air pollution prevention certification	MODU and support vessels will maintain a current International Air Pollution Prevention (IAPP) Certificate which certifies that measures to prevent ozone-depleting substance (ODS) emissions, and reduce NOx, SOx emissions during the activity are in place.
			Ozone-depleting substance handling procedures	Ozone-depleting substances (ODS) managed in accordance with MARPOL Annex VI to reduce the risk of an accidental release of ODS to air.
			Well test procedures	Includes control measures that reduce the risk of poor quality incineration of hydrocarbons entering the atmosphere.
			Bulk solid transfer procedure	Includes control measures to minimise release to atmosphere
Heat radiation	Heat may locally increase the sea surface water	Negligible	No standard controls in place	

Event	Potential Impacts	Consequence	Management Controls	Environmental Performance
	temperature during well test flaring and through the use of a heat exchanger/heater			
Planned Operational Discharges – Surface and subsea	Operational discharges will be small and depend on rainfall, machinery activity and the number of persons onboard. Discharges include sewage, brine (from desalination), cooling water, deck drainage, oily water and small volumes of chemicals (e.g. corrosion inhibitor and hydraulic fluid). The small volumes of non-hazardous discharges may cause localised nutrient enrichment, organic and particulate loading, thermal impacts and increased salinity primarily in surface (<5 m) waters.	Negligible	Sewage treatment system	Stipulates sewage disposal conditions and limitations
			Deck cleaning product selection procedure	Improve water quality discharge (reduce toxicity) to the marine environment
			Oily water treatment system	Oily mixtures discharged to sea in accordance with MARPOL Annex I. to reduce impacts of planned oil discharges
			Ballast water management plan	The plan addresses requirements for compliance with the International Convention for the Control and Management of Ships' Ballast Water and Sediment 2004 regarding sediment management in ballast waters.
			Waste management plan	Includes controls for putrescible waste disposal to limit environmental impact
Physical Presence/seabed disturbance	The presence of the MODU, helicopters, vessels and the operational area could potentially inhibit commercial shipping, fishing and other oil and gas activities, and the presence of vessels could pose a collision risk and inconvenience to fishing practices during these operations. Disturbance of the seabed as a result of planned activities, leading to disturbance of benthic habitat and associated	Negligible	Maritime notices Regulatory notifications	Information provided on MODU arrival and departure so that the maritime industry is aware of petroleum activities (including how the site is left)
			Quadrant Energy Stakeholder Consultation Strategy	Stakeholders are aware in advance of proposed activities to reduce the impact to them.
			MODU identification system	MODU has a RACON (radar transponder) or Automatic Identification System (AIS) to aid in its detection at sea. This will minimise impacts from physical presence.
			MODU move procedure MODU station keeping system	No accidental contact with the seabed and subsea infrastructure during the MODU move limiting seabed disturbance.

Event	Potential Impacts	Consequence	Management Controls	Environmental Performance
	marine flora and fauna.		Standby vessel Standby vessel mooring procedure	Minimises seabed disturbance to planned locations away from sensitive features
			Pre-lay anchoring procedure	Ensures mariners are aware of pre-laid anchors through notifications and surface marker buoys
Drilling discharges	Environmental receptors have the potential to be impacted through smothering (sediment deposition and toxicological effects) and through reduction to water quality (turbidity and toxicological effects).	Minor	Chemical selection procedure for drilling and completions chemicals Water based mud (WBM) will be used during the Activity	Aids in the process of chemical management that reduces the impact of drilling discharges to sea. Only environmentally acceptable chemicals are used.
			Cuttings management system	Reduces the concentration of drilling mud on cuttings prior to discharge.
			Well test procedures	Ensures well testing fluids are appropriately managed and OIW (oil in water) content is below 30ppm
			Inventory control procedures	Only residual fluids are discharged overboard
			Restrictions on drilling fluids and LCM types	Reduces toxicity and potential environmental impact through the selection of environmentally acceptable fluids
			Bulk solid transfer procedure	Minimises solids released during bulk transfers
			Decision list for disposal of bulk powders, brines, and water based drilling fluids remaining on the MODU at the end of the well	Determines the most appropriate disposal method for unmixed bulk powder, brine and water based drilling fluids.
Hydrocarbon spill response (refer **Section 8**)	Impacts to the environment from implementing source control, monitoring and evaluation, oiled wildlife response and scientific monitoring include those operational impacts	Minor/Medium (risk ranking)	Standard Management Controls as per above, and in addition; Spill response has an overall net environmental benefit Light spill onto shorelines and coastal waters is reduced to ALARP during spill response	(refer **Section 8**)

Event	Potential Impacts	Consequence	Management Controls	Environmental Performance
	previously specified from the operation of vessels and aircraft. Implementing oiled wildlife response may cause additional distress, physical and behavioral impacts, separation and increased predation to wildlife if not undertaken correctly.		Noise emissions reduced to ALARP during spill response Spill response vessel emissions meet MARPOL requirements Impacts from spill response operational discharges are reduced to ALARP Prevention of secondary contamination of oily waste and litter during spill response Disturbance to habitats, fauna and culturally sensitive areas during spill response is reduced to ALARP Additional impacts from dispersant application are reduced to ALARP Reduce disruption to other users of marine and coastal areas and townships during spill response is reduced to ALARP	

Table 6-2: Environmental Impact Treatment Summary for Unplanned Events

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of control
Marine Operations (Interaction with marine fauna)	During the Activity, use of a MODU and support vessels have the potential to result in direct impacts to fauna through collisions with marine mega fauna (cetaceans, whale sharks, turtles).	Low	Procedures for interacting with cetaceans	Vessels maintain distance from cetaceans to reduce noise impacts from propellers. Helicopter complies with Part 8 of EPBC Regulations for interacting with cetaceans to reduce noise impacts.
			Standby vessel (bridge watch)	Monitors surrounding environment to identify and prevent collision risks
Non-hydrocarbon release (surface) – solid	Non-hydrocarbon solids such as plastics have the potential to smother benthic environments and harm marine fauna through	Low	Dropped object prevention procedures	Minimises drop risk during MODU lifting operations that may cause seabed disturbance. MODU objects dropped overboard are recovered to mitigate the environmental consequences from objects remaining in the marine environment, unless

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of control
	entanglement or ingestion. Release of hazardous solids (e.g. wastes) may result in the pollution of the immediate receiving environment.			the environmental consequences are negligible or safety risks are disproportionate to the environmental consequences.
			• Waste (garbage) management procedures • Hazardous chemical management procedures • General chemical management procedures • Maritime Dangerous Goods Code	*As above*
			Bulk solid transfer procedure	Bulk solids transferred in accordance with bulk transfer procedures to reduce the risk of an unintentional release to sea
			Chemical selection procedures	Only environmentally acceptable chemicals would be released in the event of an accidental discharge to sea Reduced toxicity to marine environment.
			Inventory control procedures	Only residual water-based drilling fluids within the MODU surface mud storage tanks or pits could be discharged overboard in the event of an accidental pit discharge
Non-hydrocarbon release (surface) – liquid	An accidental release of chemicals and other non-hydrocarbon liquids into the marine environment may result in a reduction of water quality and potential toxicity impacts to local marine fauna.	Low	Dropped object prevention procedures	Minimises drop object risk during MODU lifting operations that may cause secondary spill (discharges) resulting in reduction in water quality
			Bulk liquid transfer procedures	Reduces risk of accidental discharge to sea
			Hazardous chemical management procedures	Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling and clean up.

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of control
	Ballast exchange may also result in the unplanned introduction of marine species (IMS).		Maritime Dangerous Goods Code	Dangerous goods managed in accordance with International Maritime Dangerous Goods Code (IMDG Code) to reduce the risk of an environmental incident, such as an accidental release to sea or unintended chemical reaction Aids in the process of chemical management that reduces the risk of accidental discharge to sea.
			Deck cleaning product selection procedure	Improve water quality discharge (reduce toxicity) to the marine environment
			• Biofouling vessel risk assessment • Ballast water management plan	Any international and domestic (interstate) MODU or support vessel has a completed biofouling vessel risk assessment (VRASS) to reduce the risk of introduced marine species. Reduce risk of introduced marine species.
Hydrocarbon spill - minor	Accidental loss of fuel and other hydrocarbons, used or stored onboard the MODU and support vessels, during the Activity to the marine environment resulting in a reduction of water quality and potential impacts to local marine fauna.	Low	• Dropped object prevention procedures • Hazardous and general chemical management procedures	Minimises drop risk during MODU lifting operations that may cause secondary spill (discharges) resulting in reduction in water quality Reduces the risk of spills and leaks (discharges) to the sea by controlling the storage, handling. and clean up
			• Maritime Dangerous Goods Code • Bulk liquid transfer procedures • Standby vessel • Oil pollution emergency plan (OPEP) & spill response plans	Reduces risk of accidental discharge to sea Refer **Section 8**

Event	Potential Impacts	Consequence	Management Controls	Effectiveness of control
			• Remotely operated vehicle (ROV) inspection and maintenance procedures	Maintenance on ROV completed as scheduled to reduce the risk of hydraulic fluid releases to sea
			• Well test procedures	Includes control measures that reduce the risk of hydrocarbons from entering the marine environment.
Hydrocarbon release – diesel	Diesel spill as a result of: • Vessel collision • Refuelling incident (fuel hose failure/rupture, coupling failure or tank overfilling) Other minor diesel spills (Structural failure of infrastructure containing diesel on vessel or MODU and Lifting – dropped objects damaging diesel infrastructure	Low	• Refer **Section 8**	
Hydrocarbon realease (loss of containment)	Loss of containment (surface and subsurface) due to: • Shallow gas • Well kick • Failure to keep the hole full • Working over live well • Tripping/swabbing • Loss of primary and secondary well containment Failure to keep the correct mud density	Medium	• Well operations management system • Refer Section 8	Well integrity control measures reduce the risk of unplanned discharges to the marine environment.

7. MANAGEMENT APPROACH

The Roc-2 drilling activity will be managed in compliance with all measures and controls detailed within the EP accepted by NOPSEMA under the OPGGS (E) Regulations, other environmental legislation and Quadrant's Management System (e.g. Environmental Management Policy).

The objective of the EP is to ensure that potential adverse environmental impacts associated with unplanned events and planned events associated with the survey, are identified and assessed, and to stipulate mitigation measures to avoid and/or reduce any adverse impacts to the environment to ALARP.

The EP details specific performance objectives, standards and procedures, and identifies the range of controls to be implemented (consistent with the standards) to achieve the performance objectives. The controls for the activities are summarised in **Section 6**. The EP also identifies the specific measurement criteria and records to be kept to demonstrate the achievement of each performance objective.

As described in the EP, the implementation strategy includes the relevant details of the following:

1. Environmental management policy
2. Environmental performance standards and outcomes
3. Environmental Management System including ownership and objectives, audits, monitoring and review
4. Leadership and responsibilities
5. Workforce training and competency
6. Performance review and continuous improvement
7. Records
8. Management and review of the EP
9. Routine and incident reporting

During the period that activities described in this EP are undertaken, Quadrant will ensure environmental performance is managed through an inspection and monitoring regime undertaken by Quadrant representatives or delegates based on the MODU or vessels.

Environmental compliance of an activity with the EP (and the EPO's) is measured using planned and systematic audits or inspections to identify weaknesses and non-conformances in the system and processes so that they can be identified. Improvement opportunities identified through monitoring, audits and incident investigations are implemented in a controlled manner and communicated to all relevant workforce, contractors and relevant third parties. Audits and inspections are in place to identify possible incidents and actions taken to prevent them from happening.

Non-conformances found are addressed and resolved by a systematic corrective action process and are reported to NOPSEMA where relevant.

Senior Quadrant and vessel contractor personnel will be accountable for ensuring conformance with environmental performance outcomes and standards and all personnel will be empowered to 'stop-the-job' to ensure the activity is being implemented in an environmentally responsible manner. The EP identifies specific responsibilities for each role during the activity.

Incident notification and reporting to NOPSEMA and other regulators will be conducted as per the OPGGS(E)R, as detailed within the EP. Reported HSE incidents and hazards will be communicated to personnel during daily operational meetings.

7.1 Management of Change

Quadrant Energy's *Environmental Management of Change Procedure* (EA-91-IQ-10001) (MOC) process provides a systematic approach to initiate, assess, document, approve, communicate and implement change(s) or proposed change(s), to EPs and OPEPs (currently in force) whilst meeting the requirements of

the OPGGS (E) R. The MOC process is applied where there is a change to an activity (including new activity or new stage of activity), change to environmental impacts or risks, or change in the manner in which the environmental impacts and risk are managed (i.e. controls or implementation strategy) under the EP or OPEP currently in force to ensure compliance with all relevant legislation.

8. HYDROCARBON SPILL RESPONSE ARRANGEMENTS

Credible hydrocarbon spill scenarios are identified in **Table 4-1**. In the event of a spill, initial actions will be undertaken by the Rig OIM/Vessel Master in line with the MODU/ vessel Shipboard Oil Pollution Emergency Plan (SOPEP). Should the spill require further action, such responsibilities will be taken over by the Combat Agency, in this instance Quadrant Energy in accordance with the Roc-2 Drilling Oil Pollution Emergency Plan (OPEP) (EA-00-RI-10154.02).

The following response strategies may be applied to credible spill scenarios:

- Monitor and evaluate: surveillance and spill fate modelling;
- Source control: relief well and well intervention including the use of a capping stack. Subsurface dispersant operations will be required in association with the source control strategy of capping stack;
- Containment and recovery of oil;
- Chemical dispersion of floating oil;
- Wildlife operations: including hazing and capture/treatment;
- Shoreline operations for protection/deflection and clean-up; and
- Operational and scientific monitoring: to determine extent of spill and impact and recovery assessment of sensitive marine receptors exposed to oil – tier 3 spills.

A justification and description of the strategies is provided in **Table 8-1.**

8.1 Preparedness and Implementation of Response Arrangements

Quadrant Energy will implement its OPEP in the event of a significant hydrocarbon spill (tier 2 or 3). In order to maintain a state of oil spill preparedness, personnel with OPEP responsibilities will be made aware of their obligations, oil spill response equipment will be maintained, contracts with critical equipment and personnel suppliers will be managed, and agreements will be in place with national regulatory agencies for support in oil spill response. Quadrant Energy will also implement its oil spill response exercise and training schedule.

Following acceptance of an OPEP, the arrangements of the plan are tested by the Emergency & Oil Spill Coordinator through a communications test to all external agencies and companies with roles defined within the plan. The external agencies and companies/suppliers are notified of the start-up schedule of the activity and are evaluated for the preparedness to deliver on their committed function.

The Communications Tests are repeated annually for activities that extend longer than 1 year, and are repeated if the response arrangements change over time.

Table 8-1: Applicable oil spill response strategies for the Activity

Strategy	Applicability		Justification and Description
	Crude	Diesel	
Source control	Yes	Yes	Source control is one of the first response strategies implemented when mounting a spill response. Source control minimises the volume of hydrocarbons lost to the environment by securing the source of the spill. For diesel refuelling spills and diesel tank rupture (collision scenarios source control options include emergency shut down (ESD) of pumps, closing drainage system, implementing shipboard spill clean-up equipment, redistributing stored hydrocarbons into slack tanks or into other vessels, vessel trimming and plugging and repairing of leaks. For a loss of well control scenario, source control options include MODU ESD systems and BOP, implementing subsea response tool kit and capping stack and drilling for a relief well.
Source control (subsurface chemical dispersion)	Yes (only as part of source control)	No	In the event of a loss of well control (at the seabed), dispersants can be used to clear the water around the wellhead to maintain safe operating conditions and assist in well intervention activities. Supply of dispersant is not required until the subsurface dispersant system can be deployed and installed. Subsurface chemical dispersants will only to be used at the wellhead location where the release has occurred.
Monitor and evaluate	Yes	Yes	Monitor and Evaluate activities include vessel and aerial surveillance, spill fate modelling and use of tracking buoys. Surveillance activities are used to monitor and evaluate the dispersion of the released hydrocarbon, and to identify and report on any potential impacts to flora and fauna that may occur while the spill disperses. Surveillance results are used to assist in escalating or de-escalating response strategies as required.
Mechanical dispersion	No	No	Mechanical dispersion will not be applied to a diesel or crude spill because of the nature of the product—preferentially relying on evaporation rather than dispersing toxic components of the fuel into the water column.
Surface chemical dispersion	Yes	No	Surface chemical dispersant may be viable, either by vessel or plane. Quadrant Energy considers Legendre crude to be the closest analogue hydrocarbon during a loss of containment event from the Activity. Legendre crude is light crude with relatively low viscosity and low asphaltene content and volatilisation or evaporation is its preferred fate. There is a window of 30-72 hours post optimal evaporation time and prior to weathering beyond the ability of potential effective chemical dispersion, in which surface chemical dispersant could be applied. Chemical dispersants increase the oil concentrations in the water column and increase risk of exposure to organisms that live in the water column. Although the effect of dilution rates in the water column should not be underestimated. Chemical dispersion will only be considered when there is a net environmental benefit. Applicability of chemical dispersant is limited to the conditions and circumstances described in the OPEP (EA-00-RI-10154.02).
Protection and deflection	Yes	No	Booms can be used to create physical barriers on the water surface to protect sensitive receptors in nearshore environments in close proximity to the area requiring protection and/or in deeper water further from the protection priority with the intent of taking the oil plume off its trajectory path to the sensitive receptors. Booms can also deflect the oil spill to easier locations for other response strategies. Activities are focused on areas of high protection value in low energy

Strategy	Applicability		Justification and Description
	Crude	Diesel	
			environments based upon real time operational surveillance provided the environmental and metocean conditions are favourable for an effective implementation. Consequently, this strategy may not be applicable across all receptors identified as priority for protection. The diesel spill is not predicted to impact shorelines.
Containment and recovery	Yes	No	For a spill resulting from this Activity, volatilization/evaporation is the preferred way to remove hydrocarbons from the water surface before the risk of contacting shorelines/sensitive receptors. Applicability of containment and recovery is undertaken once maximum evaporation has occurred and only to be considered if a net environmental benefit.
Shoreline clean-up	Yes	No	This response has potential to cause more harm due to secondary disturbance associated with the clean-up than light oiling of shorelines, so applicability is based on using aerial surveillance reconnaissance, the Oiled Shoreline Response Team (OSRT) and Net Environmental Benefit Analysis (NEBA) in the shoreline clean-up assessment. Shoreline clean-up activities, dependent on the outcome of a shoreline cleanup assessment, may include the use of water flushing, sorbent pads and booms and the use of manual hand tools to remove oil residues and oiled sediment. High volume, low pressure flushing may be considered if the oil enters high priority/ slow recovery habitats such as mangroves or wetlands. The diesel spill is not predicted to impact shorelines.
Oiled wildlife response	Yes	Yes	Applicable for marine fauna that come close to the spill when on the water and shorelines and those affected by hydrocarbons. Response will be in accordance with best practice procedures as outlined within the WA Oiled Wildlife Response Plan (WAOWRP). Hazing only is to be considered for the diesel spill due to the highly evaporative and non-persistent nature of the diesel, and the distance offshore of the drill location.
Operational and Scientific Monitoring	Yes	Yes	Operational monitoring activities include initial surveillance monitoring, hydrocarbon characterisation and weathering, shoreline and coastal habitat assessment and megafauna assessment. Scientific monitoring activities may include water and sediment quality monitoring, shoreline and coastal habitat monitoring (including sandy/rocky shores, intertidal zones and mangroves), benthic habitat monitoring and monitoring of seabird/shorebirds, marine mammals and turtles. In addition fish, fisheries and aquaculture and seafood monitoring may be initiated. Extent/impact of spill to determine the extent of operational and scientific monitoring. Resources are available to implement operational and scientific monitoring as required.
In situ burning	No	No	In-situ burning is not an applicable response strategy given several limiting factors that are likely to prevent implementation. For in-situ burning to be undertaken oil has to be thicker than 1-2 mm and as diesel and 'light oil' spills (non-persistent oil - Group II) tend to have high evaporation rates and spread into very thin films this strategy is not applicable for this activity. In-situ burning cannot be undertaken in rough conditions as containment is likely to be interrupted by winds greater than approximately 20 knots and waves are higher than 3 feet. As such, this response strategy is not applicable for this crude.

8.2 Net Environmental Benefit Analysis

During any response incident, there is a documented decision making process to ensure that response strategies are identified and evaluated prior to implementation via the Incident Action Plan (IAP). The Incident Control Team use a Net Environmental Benefit Analysis (NEBA) process to inform the development and refinement of the IAPs, to ensure the most effective response strategies with the least detrimental environmental impacts are identified, documented and executed. The Environmental Team Lead is responsible for reviewing the priority receptors identified within the EP and the OPEP, and with real time knowledge of the fate and transport of the spill, apply the NEBA.

The application of the NEBA is to:

- Identify sensitivities within the area potentially affected by a spill at that time of the year;
- Assist in prioritising and allocating resources to sensitivities with a higher ranking; and
- Assist in determining appropriate response strategies.

8.3 Oil Spill Response Resources

Oil spill response equipment and resources are a combination of Quadrant, AMOSC (Australian Marine Oil Spill Centre Pty Ltd), AMSA, DoT, National Plan (NatPlan), OSRL (Oil Spill Response Limited), and other operator resources available through the AMOSPlan mutual aid arrangements. Under the Memorandum of Understanding (MOU) between AMSA and Quadrant, AMSA will provide all resources available through NatPlan to support a Quadrant spill response. The DoT coordinates the State Response Team (SRT) oil spill response personnel and equipment resources. The DoT will work with Quadrant in an oil spill response and will define termination criteria for the shoreline operations designed to reduce the environmental impacts and risk to as low as reasonably practicable (ALARP) in State waters. Where oil contacts shorelines in Commonwealth waters, Quadrant will work with the Department of the Environment to establish shoreline clean-up priorities, activities and termination criteria.

In the event of an oiled wildlife response, Quadrant will activate the West Australian Oiled Wildlife Response Plan (WAOWRP) and work with DPaW in determining resources and capability requirements. DPaW and Industry (AMOSC) Oiled Wildlife Advisors (OWAs) ensure minimum standards for oiled wildlife response, as outlined within the WAOWRP, are met and ensure timely mobilisation of appropriate resources (equipment and personnel) through communication with the wildlife logistics team. Quadrant are able to access:

- AMOSC core group responders;
- DPaW staff and approved volunteers/subject matter experts;
- Additional local resources under current contracts and suppliers; and
- Access international support through Wildlife Response Services.

During and post-spill scientific response monitoring activities require resources external to Quadrant and include specialist technical capabilities. Astron Environmental Services Pty Ltd (Astron) is contracted as Quadrant's primary control support agency for scientific response monitoring activities. If additional support is required, Quadrant has Master Service Agreements with other service providers to support scientific response monitoring activities.

9. CONTACT DETAILS

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