Cerberus Drilling Campaign
EP 491 and EP 475

Referral under the Environment Protection and Biodiversity Conservation Act 1999

Referral of proposed action

Project title: Cerberus Exploration Drilling Campaign

1 Summary of proposed action

1.1 **Short description**

In May 2014 Carnarvon Petroleum Ltd. (CVN) secured four exploration permits offshore Western Australia (TP/27, EP-490, EP-491 and EP-475) covering approximately 3,700km^2 in the heart of the Carnarvon Basin in Western Australia (Figure 1).

Within these permit areas the intention is to drill possibly up to four exploration wells for the Cerberus drilling campaign, located wholly in State waters, where water depths are up to 30m.

Drilling will be conducted using a jack-up rig and is scheduled for May 2017 but timing is dependent on rig availability, each well is expected to take approximately 16 days.

1.2 **Latitude and longitude**

Table 1: Coordinates of Provisional Well Locations within Permit areas.

Well	Rudder	Honey Badger	Belfon	KES
Latitude	20° 40’ 51.61”	20° 39’ 59.43”	20° 38’ 23.52”	20° 54’ 49.62”
Longitude	115° 43’29.97”	115° 51’ 25.98”	115° 54’ 58.50”	115° 48’ 20.24”

1.3 Locality and property description

The proposed well locations are in shallow water ranging between 15 – 30m in WA state waters east of Barrow and Varanus Island and West of Dampier. Proximity to nearest land/ coastal receptor is listed in Table 2.

Table 2. Approximate location of nearest landfall/ sensitive receptor.

Closest landfall	Rudder (km)	Honey Badger (km)	Belfon (km)	Kes (Km)
Main Land (WA)	49	40	36	21
Dampier	102	88	82	98
Montebello Is.	26	34	42	50
Lowendal Is.	16	27	37	22
Barrow Is.	27	39	49	35
North sandy Is.	47	52	57	26
Stewert Is.	30	29	27	15
Murion Is. World Heritage	166	177	160	161
Ningaloo World Heritage	190	203	209	184
Sholl Is.	33	32	38	9
Eagle Hawk Is.	73	61	52	44
Enderby Is.	77	63	57	76
Rosemary Is.	86	78	67	60
Turtle nesting	16	27	37	9
Seabird breeding	16	27	33	9

The well coordinates within the permit areas are listed in section 1.2 and the location illustrated in Figure 1.

1.4 Size of the development footprint or work area (hectares)

The footprint of the rig is to be confirmed in the Bridging document as a rig has not been sourced yet. A generic jack-up rig would have a footprint similar to a leg spacing of 45m x 3 legs at approximately 1000m^2 (0.1 hectares). The total for the three legs is approximately 339m^2 (0.0339 hectares). The well head is approximately 20m^2 (0.002 hectare).

1.5 Street address of the site

N/A

1.6 **Lot description**

The Cerberus drilling project is in WA state water permits EP 475 and EP 490. The WA Department of Mines and Petroleum (DMP) is responsible for the regulation of petroleum activities in these permit areas.

1.7 **Local Government Area and Council contact (if known)**

N/A

1.8 **Time frame**

The proposed Cerberus drilling campaign will commence May 2017 and the duration will be approximately 16 days per well with a small window in between each well of between 2-3 days for a rig move. The timing is dependent on rig availability with a three month window of opportunity to avoid cyclones and whale migration.

1.9	**Alternatives to proposed action**	x	No
			Yes, you must also complete section 2.2
1.10	**Alternative time frames etc**	x	No
			Yes, you must also complete Section 2.3. For each alternative, location, time frame, or activity identified, you must also complete details in Sections 1.2-1.9, 2.4-2.7 and 3.3 (where relevant).
1.11	**State assessment**		No
		x	Yes, you must also complete Section 2.5
1.12	**Component of larger action**	x	No
			Yes, you must also complete Section 2.7
1.13	**Related actions/proposals**	x	No
			Yes, provide details:
1.14	**Australian Government funding**	x	No
			Yes, provide details:
1.15	**Great Barrier Reef Marine Park**	x	No
			Yes, you must also complete Section 3.1 (h), 3.2 (e)

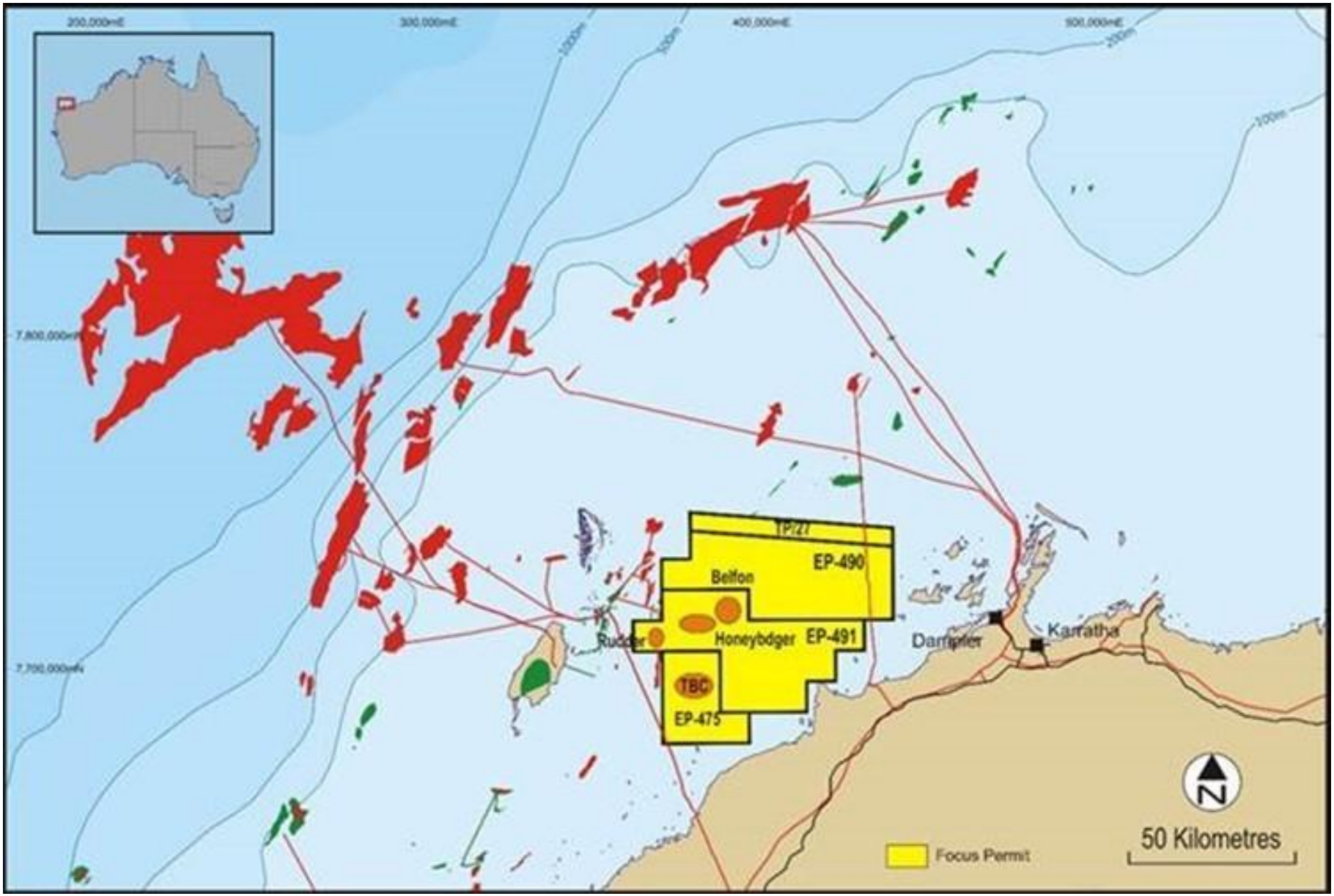

Figure 1: Exploration blocks and prospect centres TP/27, EP-490, EP-491 and EP-475.

2 Detailed description of proposed action

2.1 Description of proposed action

Carnarvon Petroleum Ltd as operator of the four WA state water permits TP/27, EP 475, EP 490 and EP 491, intend to drill up to four exploration wells ranging in depth from 500m – 3000m. The approximate location of each well is shown in section 1.2 in water depths ranging from 15 to 30m. The purpose of the wells are to explore for hydrocarbons.

Drilling Rig

Due to the shallow water depths the intention is to use a jack-up rig. Prior to the rig being jacked into position an ROV will be used to perform a seabed survey ensuring that it is safe for the rig to be jacked into position. The exact specifications of the rig will be detailed in the bridging document to the Generic EP submitted to the western Australian (WA) Department of Mines and Petroleum (DMP). The drilling rig will be supported by two supply vessels, with one always on station at the rig.

Mobilisation

As the jack-up rig has not been contracted the point of mobilisation is currently unknown. The current jack-up rig market has several jack-ups available in the Australasia region and the rig of choice if mobilised from outside Australia will obtain all the necessary AQIS inspections and clearance prior to arrival in Australia.

Support

Once the rig is on location it will be supported by up to two support vessels. These vessels will supply the Jack-up with fresh water, food and drilling equipment as required. The support vessels will be used by the rig to conduct safety lookouts and monitor the exclusion zone around the rig.

Drilling

Drilling will take place 24 hours a day and is planned to take from 10 days for the 500m well to 16 days for the 2000m well. The well is planned as a vertical well. The main drilling activities are listed in Table 3 and no well test (flaring) will be performed.

Contingencies, such as well re-spud, side track and lost circulation, may be required if any operational or technical issues occur when drilling the wells. These contingencies may generate additional volumes of drilling fluids and cuttings.

Contingencies are considered in the Carnarvon Petroleum Well Operations Management Plan (WOMP), which will set clear standards, procedures and guidelines in preparing for and handling well control incidents.

Table 3. Main drilling activities.

Item	Operation	**Time** (days)	**Cumm. Time** (days)
1	Prepare to Drill	1.00	1.00
2	Drill 36" Hole to 100m BRT (5m/hr)	0.50	1.50
3	Run 30" Conductor and Cement	1.00	2.50
4	Drill 17-1/2" Hole to 600m BRT (25m/hr)	1.00	3.50
5	Run 13-3/8" Casing and Cement	2.00	5.50
6	Run BOP and Test	1.00	6.50
7	Drill 12-1/4" Hole to 1,200m BRT (30m/hr)	1.00	7.50

8	Run 9-5/8" Casing and Cement	1.50	9.00
9	Drill 8-1/2" Hole to 2,000m BRT (30m/hr)	1.20	10.20
10	Wiper Trip and Run Wireline Logs	4.00	14.20
11	Plug and Abandon Well	1.50	15.70

Each exploration well will be spudded and drilled vertically using seawater with frequent hi-viscosity sweeps. In the top section total drilling fluid losses are expected within this section with cuttings and seawater expected to be lost in shallow formations. A casing string will be installed into this hole and blow out preventer installed atop the casing. Pressure integrity of the well will be verified to relevant standards, prior to drilling out. Drilling vertically to the well target depth (TD) will then be completed. The prospect will be evaluated using electric logging tools. The generic drilling program for each of the four prospects will include;

- Installation and cementing of the well conductor pipe;
- Drilling of the top-hole sections using seawater and pre-hydrated bentonite sweeps;
- Insert and cement drill casing;
- Test and install the blow out preventer (BOP) on the conductor pipe;
- Install the main riser;
- Displace the top-hole section with water based mud;
- Drilling of bottom hole section until new formation is reached;
- Drilling to reach target depth (TD) of well;
- Undertake logging activities; and
- Plugging and abandoning the well.

Cement plugs will be used and the casing will be cut below the mudline. All equipment and infrastructure will be removed from the seabed. A detailed drilling program will be provided in the bridging document to the Generic EP for each prospect on completion of well design. Drilling operations will be subject to State Regulations. The Carnarvon Petroleum Safety Management System (SMS) and Environmental Management System (EMS) Health, Safety and Environment (HSE) Policy provides detail on risk management and procedures.

Drilling will result in the discharge of drill cuttings and drilling fluids. The main functions of drilling fluids include providing hydrostatic pressure to prevent formation fluids from entering into the well bore, keeping the drill bit cool and clean during drilling, carrying out drill cuttings, and suspending the drill cuttings while drilling is paused and when the drilling assembly is brought in and out of the hole. The base case for drilling is to use water based muds (WBM) for all hole sections.

Based on experience and information from other exploration and appraisal offset wells in the area, the riser-less sections will be drilled using seawater and highly viscous sweeps (bentonite, caustic soda, guar gum). The basic formulation of WBM likely to be used has seawater as the base fluid with additives for controlling borehole stability improving drilling performance and reliability. Water based muds will be discharged adhered to drill cuttings and as whole fluid, at completion of well sections or when qualities have been degraded below technical specifications.

Vertical Seismic Profiling

Vertical Seismic Profiling VSP may be undertaken during the drilling campaign to investigate further the sub-surface geology the permit areas. VSP utilises a sound source suspended in the water column and recorders located down hole to provide a high-resolution seismic image of the immediate vicinity of the well. The sound source used for VSP is similar to, but much smaller than those used during seismic surveys.

A maximum total array volume of 750 cubic inch is typically used. The source will be discharged 5 to 10 m below sea surface up to five times at approximately 20 second intervals, with recordings taken down hole at specific depths. Additional recordings are made at 5 to 7 minute intervals as the down hole tool is repositioned within the well. The total duration of VSP activities (excluding soft starts) is estimated to take approximately 7 to 10 hours, but will be dependent on well characteristics and the schedule of activities.

Cementing
Cementing operations are undertaken to ensure well integrity, including the following activities:

- Cementing the steel casings and conductor in place;
- Sealing the annulus between the casing string and the formation;
- Sealing a lost circulation zone;
- Setting a plug in an existing well from which to side track; and
- Plug and abandoning or suspending the well.

Cement will be transported as dry bulk to the jack-up rig by a support vessel and will be mixed with water in the cementing unit to form wet grout or cement slurry immediately prior to use. The cement slurry will then be injected down to the well by high pressure pumps. Cement products used for the Project will be at least ranked Group D pursuant to the OCNS.

Remotely Operated Underwater Vehicles
The jack-up rig will be equipped with a remotely operated underwater vehicle (ROV). ROVs are used extensively during drilling operations for:

- Pre-spud hazard survey;
- Monitoring of BOP;
- Monitoring subsurface infrastructure, gas watch, and unplanned discharges; and
- Potential participation in the 'SERPENT' research programme.

Fuel Transfer
The transfer of fuel will occur in accordance with strict conditions for preventing spills to the marine environment. Offshore transfers of fuel will be conducted in accordance with the rig contractor's transfer procedures. Onshore transfers will be conducted in accordance with vendor procedures.

Power Generation
Electrical power on the jack-up rig and support vessels is provided from diesel powered generators. The average diesel fuel usage during drilling operations is in the order of 15,000 L per day for a typical jack-up and 5,000 L per day for a support vessel. Diesel usage from power generation will generate exhaust gas emissions released into the atmosphere.

Lighting
The jack-up rig and support vessels will display navigational lighting as required and will be lit to ensure operational safety on a 24 hour basis. Lighting levels will be determined primarily by operational safety and navigational requirements as determined as part of a Vessel Safety Case assessment.

Solid Waste
The jack-up rig and vessels produce a variety of solid wastes, including domestic and industrial wastes, such as aluminium cans, bottles, paper, cardboard and scrap steel. Segregation into designated skips and waste containers will take place on-board the jack-up rig and support vessel. Solid waste will be disposed of onshore in accordance with the Project specific Waste Management Plan.

Hazardous Waste
Hazardous waste, such as chemicals and chemical containers, batteries, waste oil, medical wastes and used absorbent booms, will be generated from the Project. Hazardous waste will be disposed of onshore in accordance with the Project specific Waste Management Plan.

Sewage, Grey water and Putrescible Waste
The volume of sewage and grey water generated is estimated to be in the order of 6 m per day, with putrescible galley wastes expected to be approximately $3m^3$ per day from the jack-up rig and 1m for a support vessel. Discharge of sewage, grey water and putrescible waste will be in accordance with MARPOL requirements and the Project specific Waste Management Plan.

Cooling Water
Seawater will be used as a heat exchange medium for the cooling of machinery engines on the jack-up rig. Seawater will be pumped on board the jack-up rig, and may be treated prior to circulation through heat exchangers and subsequently discharged to the sea surface. Approximately 12,000 m^3 of cooling water will be pumped, circulated and discharged to sea each day. It is anticipated that cooling water will be discharged at less than 3ºC above ambient sea surface temperature in compliance with World Bank guidelines (IFC 2007).

Deck Drainage
The jack-up rig is designed to have open and closed Drainage areas, with the main deck drainage generally discharging overboard during routine operations. The jack-up rig main deck and moon pool areas have open drains which will discharge deck drainage with trace amounts of hydrocarbons directly overboard. Rig floor drainage however may be routed to the flowline for mud recovery and re-use in the active mud system.

Machinery spaces located in open drainage areas will be bunded. The pump rooms and engine rooms are within closed drainage areas. In normal operating conditions closed drainage areas are closed or plugged and drainage is diverted to the closed drain system. Run-off and bilges from closed drains are transferred to a separation tank where separation of oily sludge and water occurs. Following separation, water with oil in water content of less than 15 ppm is discharged overboard in accordance with MARPOL 73/78 Annex I.

Jack-up rigs under consideration by Carnarvon Petroleum will have a dedicated holding tank for the collection of oily waste material prior to transfer to a support vessel for transport to shore for disposal (approximately 8,000 L/month). In the event of heavy rainfall, the drains are opened to prevent the closed drain system being overwhelmed and deck drainage is diverted directly overboard.

2.2 Alternatives to taking the proposed action
Not Applicable

2.3 Alternative locations, time frames or activities that form part of the referred action
Not Applicable

2.4 Context, planning framework and state/local government requirements
The proposed Cerberus drilling campaign will be subject to a range of planning and environmental approvals. In particular, it will conform to the Western Australian Petroleum Submerged Lands (Environment) Regulations 2012. A Generic EP (the Cerberus Drilling Campaign Generic EP) and Oil Pollution Emergency Plan (OPEP) has been prepared according to the Western Australian Petroleum Submerged Lands (Environment) Regulations 2012.

The WA DMP guidelines for the preparation and submission of an Environmental Plan were adhered to. The WA DMP guidelines for the preparation and submission of an Environmental Plan were

adhered to. The Generic Environmental Plan, comprises a description of the environmental effects, risks and proposed mitigation measures, to be accepted by the Designated Authority (WA DMP) prior to any activities being undertaken. Vessel and sea-going operations during the Project will also adhere to all relevant Australian and international statutes, regulations and agreements applicable to the Project.
Relevant sections of the Generic EP address DMP Regulatory requirements. In preparing and submitting the Generic EP it demonstrates:

- The EP is appropriate for the nature and scale of the activity;
- Environmental impacts and risks of the activity will be ALARP;
- The environmental performance objectives, environmental performance standards and measurement criteria are appropriate to the project.
- Implementation strategies, monitoring, recording and reporting arrangements are appropriate to the project;
- There has been an appropriate level of consultation with authorities, persons and organisations in developing the plan; and
- Complies with the relevant Act, the relevant Petroleum (Environment) Regulations and applicable State statutes.

A number of State and Federal Acts regulate oil exploration and production in Western Australia. Drilling for oil requires consideration of relevant Acts and Regulations in preparing and submitting this generic EP including:

- Petroleum (Submerged Lands) Act 1982 – details requirements for administration of Petroleum Hydrocarbon activities by the Department of Mines and Petroleum;
- Petroleum (Submerged Lands) (Environment) Regulations 2012 – details requirements of the proponent for carrying out a Petroleum Hydrocarbon activity;
- Environmental Protection and Biodiversity Conservation Act (EPBC) 1999 – details requirements for administration of Matters of National Environmental Significance by the Commonwealth Department of Environment including:
    - World heritage properties
    - National heritage places
    - Wetlands of international importance (listed under the Ramsar Convention)
    - Listed threatened species and ecological communities
    - Migratory species protected under international agreements
    - Commonwealth marine areas
- Environmental Protection (Sea Dumping) Act 1981 – details requirements for administration of shipping activities by the Australian Maritime Safety Authority involving dumping of waste;
- Historic Shipwrecks Act 1976 – details requirements for administration of maritime artefacts and their reporting, access to and conservation;
- Native Title Act 1993 – details the rights of indigenous people when accessing and using land, water column or seabed to carry out an activity;
- Quarantine Act 1908 and Regulations – details the requirements for control of invasive species;
- Protection of the Sea (Prevention of Pollution form Ships) Act 1983 details requirements for administration of shipping activities by the Australian Maritime Safety Authority involving standards and protocols for waste discharges;;
- Environmental Protection Act 1986 – requirements for administration of proposed activities under the jurisdiction of the Environmental Protection Authority that have an impact on the environment requiring assessment;

- Environmental Protection Regulations 1987 - details requirements of the proponent for carrying out an activity with the potential to impact the environment;
- Environmental Protection (Controlled Waste) Regulations 2004 - details requirements of the proponent for carrying out an activity where waste streams have the potential to impact the environment;
- Conservation and Land Management Act 1984 – details requirements for administration of the use, protection and management of certain public lands and waters and flora and fauna by the Department of Parks and Wildlife and Department of Environmental Regulation;
- Wildlife Conservation Act 1950 – details requirements for administration of the conservation and protection of wildlife by the Department of Parks and Wildlife;
- Fisher Resources Management Act 1994 – details requirements for administration of Fisheries and bringing non-endemic or noxious fish species in WA; and
- Aboriginal Heritage Act 1972 – details requirement's for the preservation of places and objects customarily used by or traditional to original aboriginal inhabitants or their descendants.

These Acts address the requirements that need to be met to carry out an exploration drilling activity by Carnarvon Petroleum in an area where wider regional influences include:

- Presence of hydrocarbons;
- Vessel activity;
- Migratory species transit the area;
- Threatened species found regionally;
- Sensitive Flora and Fauna resident regionally;
- Marine Parks and Reserves in the region;
- Shipwrecks exist in the region;
- Impacts to sustainable fisheries management; and
- Places and objects of aboriginal heritage exist in the region.

Relevant Ratified International Conventions Australia is a signatory to include:

- Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds and Birds in Danger of Extinction and Their Environment (Japan Australia Migratory Birds Agreement; JAMBA);
- Agreement between the Government of Australia and the People's Republic of China for the Protection of Migratory Birds and Their Environment (Chinese Australia Migratory Birds Agreement; CAMBA);
- Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (Republic of Korea Australia Migratory Birds Agreement; ROKAMBA);
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention),
- Convention on Wetlands of International Importance Especially Waterfowl Habitat (RAMSAR Convention);
- International Convention for the Prevention of Pollution from Ships, London, 1973 (MARPOL);
- United Nationals Convention on the Law of the Sea 1982 (UNCLOS); and
- Protocol to International Convention on the Prevention of Marine Pollution by Dumping of Waste and Other Matter, 1996.

These conventions obligate Carnarvon Petroleum to take due consideration of migratory species and wetlands as outlined in the relevant legislation when planning for and carrying out the Cerberus

exploration drilling campaign. Furthermore, the shipping conventions are enshrined in the relevant legislation and along with migratory species and wetlands conventions and developed legislation, require implementation of performance standards demonstrating any potential impact is reduced to As Low As Reasonably Practicable (ALARP).

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

The approach to environmental impact assessment followed ISO 31000 and ISO 14001 standards as outlined in the WA DMP guidance notes for preparation and submission of a Generic EP.
The Carnarvon Petroleum Cerberus Exploration Drilling Campaign Generic EP describes and assesses all aspects and potential environmental impacts of the Project. Furthermore, it includes an Implementation Strategy detailing environmental management measures, environmental performance objectives, defined roles and responsibilities, along with reporting requirements.
The Exploration Oil Pollution Emergency Plan describes how Carnarvon Petroleum will respond to potential hydrocarbon spills for spills arising from exploration activities.

Relevant legislation:
Petroleum Submerged Lands Act 1982

Status of approvals:
A Generic Environmental Plan (EP) and Oil Pollution Emergency Plan (OPEP) have been prepared and are under assessment by the WA DMP.

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2.6 Public consultation (including with Indigenous stakeholders)

Carnarvon Petroleum on commencement of its Generic EP began and committed to a thorough and transparent consultation process, this is a continuing process that will continue through to and post completion of this project. Carnarvon Petroleum engaged with the WA DMP to discuss Native Title at the offset. A summary of the outcomes of the consultation process is presented in **Table 4.**

Throughout the preparation of the Generic EP and OPEP, consultation was undertaken with the following stakeholders and continues:

- Australian Maritime Safety Authority (ASMA);
- WA DMP;
- WA Department of Transport (DoT);

- WA Department of Parks and Wildlife (DPaW);
- WA Department of Fisheries (DoF); and
- Pilbara Port Authority (PPA).

To address Native Title, consultation with DMP determined the significance of any Native Title issues for the:

- Yaburara and Mardudhunera People;
- Ngarluma Aboriginal Corporation; and
- Yindjibardni Aboriginal Corporation.

Consultation with industry includes the following organisations:

- Australian Marine Oil Spill Centre (AMOSC);
- Pilbara Port Authority;
- AMSNOR;
- CITIC Pacific Mining;
- Chevron (Barrow Is.);
- Apache Energy (Varanus Is.); and
- Vermillion Oil and Gas (Wandoo production platform).

Other potentially affected stakeholders approached include:

- Western Australian Fishing Industry Council (WAFIC);
- Individual Fisheries license/lease holders;
- Recfishwest;
- Aquaculture Council of WA;
- Pearl Producers Association; and
- Telstra.

Table 4: Potentially affected stakeholder concerns and actions taken to address those concerns.

Organisation	Concerns	Action
Government		
DMP	• Native Title – advocated for early consultation with identified aboriginal groups to avoid any complications or difficulties in the future regarding access to land or infrastructure developments ashore	• Letters were sent to representatives of Aboriginal groups
DoT	• Incident Command – concerned about the capacity for CVN to put together an IMT for a Tier 3 oil spill response • Advocated for contracting out key roles within an IMT structure • Suggested that AMOSC could fill those roles as well as providing equipment and training • Although DoT is the control agency the operator (polluter) is still required to resource the IMT and 'on the ground' response operations. • The expectation is that Carnarvon will have standby contracts in this regard to access the necessary personnel and resources. • Short shoreline contact times in the unlikely event of a blowout require careful consideration. ie it is not possible to prevent shoreline contact.	• Meetings were held with AMOSC • Benefits of membership were discussed • Notification letter was sent to DoT to facilitate further discussion • DoT will review and provide feedback on the OPEP

Organisation	Concerns	Action
DPaW	• Information requirements – DPaW will need to make an assessment of information provided to determine whether CVN EP and OPEP content has addressed DPaW concerns • This included demonstrating adequate baseline data on Marine Parks and the ability to respond to oiled wildlife • Feedback on the EP and OPEP was concerning clarification within the documents CVN's ability to carry out OWR, to address response times and actions in relation to human safety versus animal welfare, how the sensitivities were ranked, seabird locations away from spill areas (fly ashore), and the decision-making role of DPaW under the CALM Act during OWR • Maintain an independent capacity to carry out Oiled Wildlife Response	• Concerns have been addressed in the EP and OPEP • The revised EP and OPEP have been sent to DPaW for comment • Outstanding issues will be covered in the bridging document and OSMP • Confirm OWR arrangements with AMOSC, other government departments and contractors • An Oiled Wildlife Response Plan will be developed
DoF	• Consultation – DoF recommended that CVN initiate and maintain ongoing consultation with WAFIC, Recfishwest and directly with fishers, including start and end dates and spatial extent of activities • An oil spill response officer is to be contacted within 24 hours of CN reporting an incident to the appropriate authority • Baseline marine data requested to be collected to compare against any post spill monitoring and to refer to the NOPSEMA guidance note on OSMP's in this regard • Strategies in EP and/or OPEP requests to deal with mitigating risks to spawning grounds and nursery areas for key fish species • Risk of translocation of marine pests and diseases into or within WA waters is minimised and that vessel hulls, sea chests and niche areas are clean before each voyage. Suspected or confirmed presence of any marine pes or disease must be reported within 24 hours • DoF will update advice if required ie the drilling program starts after a 6 month period from date of issue of letter • CVN has to notify DoF at least 3 months before the commencement date of drilling • DoF indicated that contacting individual license/lease holders was needed. If some are contacted and others are not it can cause issues for the department, as had been the case previously	• Notification letters have been sent to industry group representatives. • Concerns have been addressed in the EP and OPEP • Outstanding issues will be covered in the bridging document and OSMP • Notification letters sent to license holders • Adequate baseline will be demonstrated through assessment of available literature • A Marine Biosecurity Management Plan will be developed • DoF will encourage WAFIC to engage further with CVN as the activity is in State waters
Resources Industry		
PPA	• Contacted by CVN due to having a spill response plan inclusive of the Dampier Archipelago and a limited amount of equipment located at Dampier Port	• Followup phone call has been done to determine availability of spill response resources
AMOSC	• Membership guarantees access to training, resources and personnel from within AMOSC and amongst other operators that are members of AMOSC • If not a member then CVN still has to demonstrate access to appropriate resources to combat a major oil spill • AMOSC does not do first strike and CVN would need to demonstrate this capability in addition to access to AMOSC resources for escalation of response • AMOSC prepares tactical response plans that align with OPEPs • CVN needs to align with regional developments in OSR and this is best done through membership with AMOSC	• CVN will become a member of AMOSC • IMT training will be undertaken by key CVN staff • Spill response training will be undertaken by key contractor staff • Confirm OWR arrangements in support of CVN capacity

Organisation	Concerns	Action
CITIC	• Contacted by CVN due to having a spill response plan and a limited amount of equipment located at Cape Preston Port	• Followup phone call has been done to determine availability of spill response resources

AMSNOR	• Based in Pilbara at Dampier Port and able to deploy for first strike
	• Have stockpiles for Tier 3 response and access to vessels for quick response
	• Able to be on standby and provide crew equipment training prior to and during drilling
	• Able to place equipment on location, and train crew on location and ashore
	• CVN has the company and vessel specifications and is working with AMSNOR to provide an initial response solution and ongoing arrangements for standby OSR
	• AMSNOR has an ongoing development program in the region designed to meet OSR needs intot he future
		• AMSNOR is providing a quote for being on standby during drilling inclusive of:
		  • Placing equipment on location
		  • Access to stockpiles ashore
		  • On location crew training in equipment use
		  • Shore based crew training in equipment use
		  • Incorporation of capability into OPEP and bridging document

Chevron	• Human safety during initial response and exposure to hydrocarbon vapor and ignition sources • Use of dispersants given seawater intake on Barrow Island and presence of regional demersal fisheries and coastal fisheries habitats and mangroves	• The bridging document and accompanying OSMP will take these comments into consideration
Apache	• Confirmation from AMOSC that a letter indicating Apaches and other operator commitment in the region to stand up if called upon is needed or not • Shipping spills in State waters will result in a WA DoT lead response and this needs to be taken into account	• AMOSC will be contacted regarding the need for letters of commitment to mutual aid • WA DoT will be contacted regarding hydrocarbon activity shipping spills and response arrangements integrating with CVN's response arrangements
Vermilion	• Shortfalls in CVN capability to demonstrate risk reduction to ALARP • It is important to consider the Pilbara Port response capability • Use of dispersants needs to be objective and not based on personal opinion and on demonstration of net environmental benefit final approval for use is still needed.	• Pilbara Port will be contacted regarding spill preparedness and response arrangements and their integration with CVN spill preparedness and response
Organisation	**Concerns**	**Action**
Other Industry		
WAFIC	• Consultation – DoF recommended that CVN initiate and maintain ongoing consultation with WAFIC, Recfishwest and directly with fishers, including start and end dates and spatial extent of activities • Indicated that for the whole hydrocarbon industry no consultation would ever represent full consultation under the current regulatory system because of a lack of transparency in the EP process • Had no problems with the notification process and being kept informed of developments throughout the drilling program • Pointed out that concerns are never addressed because they never get to see if or how they are implemented	• Notification letter sent • Followup phone call to address any concerns or issues • CVN intends to meet with WAFIC and see what potential exists to work through wider industry issues into the future • CVN will arrange to meet stakeholders face to face

Organisation	Concerns	Action
	• A box ticking exercise	in Dampier prior to and during the drilling campaign
Fisheries and aquaculture lease/license holders	• DoF advised that CVN consult with individual lease/license holders and to do so by applying for a list of lease/license holder contact details from the DoF register • **See DoF and WAFIC notes**	• A notification letter was sent to all lease/license holders on the DoF register • CVN will arrange to meet stakeholders face to face in Dampier prior to and during the drilling campaign
Recfishwest	• Consultation – DoF recommended that CVN initiate and maintain ongoing consultation with WAFIC, Recfishwest and directly with fishers, including start and end dates and spatial extent of activities	• Notification letter sent • Followup phone call to address any concerns or issues
Aquaculture Council	• Consultation – DoF recommended that CVN initiate and maintain ongoing consultation with WAFIC, Recfishwest and directly with fishers, including start and end dates and spatial extent of activities	• Notification letter sent • Followup phone call to address any concerns or issues
Pearl Producers Association	• Consultation – DoF recommended that CVN initiate and maintain ongoing consultation with WAFIC, Recfishwest and directly with fishers, including start and end dates and spatial extent of activities	• Notification letter sent • Followup phone call to address any concerns or issues
Telstra	• Damage to subsea fibre optic cable within blocks where CVN is conducting drilling operations for identified prospects	• CVN has determined that the location of the cable through the Belfon prospect is not in the vicinity of drilling operations • The prespud rig anchoring ROV survey will confirm location of prospect drilling relative to the location of the fibre optic cable.

2.7 A staged development or component of a larger project

The activity is NOT part of staged development or a component of a larger project.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description
A search using the EPBC Act's protected matters search tool identified that the drilling area does not overlap with any World Heritage Properties.

The closest World Heritage is the Ningaloo Coast World Heritage Area, which is approximately 180km South West at its nearest point.

Nature and extent of likely impact

Due to the distance between the well location and Ningaloo Coast World Heritage Area, the nature of the proposed activities detailed in Section 2 and the management measures to be implemented (see section 5), no planned direct or indirect impacts to World Heritage properties are likely.

3.1 (b) National Heritage Places

Description
There are no national heritage places within the Cerberus permits (TP/27, EP 475, EP 490, and EP 491). The two closest to the area are the Ningaloo Coast and the Dampier Archipelago (including Barrup Peninsular) 180km and 57km respectively.

Nature and extent of likely impact

As per 3.1 (a) World heritage properties

3.1 (c) Wetlands of International Importance (declared Ramsar wetlands)

There are no Ramsar wetlands within or adjacent to the permit area.

Nature and extent of likely impact

N/A

3.1 (d) Listed threatened species and ecological communities

Description

While the results of a search of the EPBC Act Protected Matters Interactive Search Tool indicated that no threatened ecological communities exist, a total of 23 threatened fauna species listed under the EPBC Act as Endangered or Vulnerable could potentially occur within the areas affected or potentially affected by the activity in the **unlikely** event of a major oil spill. The threatened fauna included marine species, some of which are also protected by the EPBC Act as 'migratory species'. This included seabirds and resident shorebirds, turtles, sharks and whales. A summary of relevant species are referenced in **Table 5**.

Under the EPBC Act, an Australian Whale Sanctuary has been established, which protects all whales and dolphins in Australian waters. Australia is also a signatory to a number of international conventions and agreements, which are enacted through the EPBC Act:

- Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention)
- Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);
- Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment (CAMBA).

Table 5. Summary of available information on EPBC Act listed species of relevance.

Species	Comments and references on protected species presence in surrounding area (* = Not a listed species under the EPBC Act 1999)	Key Source	Year	Document Title
Migratory shorebirds (wetland/ littoral)	Present are: **Greater sand plover, Grey plover, Bar-tailed godwit** (December to February); **Common greenshank, Grey-tailed tattier** (September to March); **Ruddy turnstone** (August to May) (**see Bamford et al. 2008, Clarke 2010**).	Commonwealth Department of Environment	2012	Species group report card – seabirds and migratory shorebirds.
	May also encounter: **Pacific golden plover, Curle sandpiper*, Great knot, Red-necked stint, Terek sandpiper and Whimbrel*** (September to March) (**see Bamford et al. 2008, Clarke 2010**).			
	NOTES: Seasonally abundant on Barrow Island during spring and summer at Southern end tidal mudflats and used as staging and non-breeding site.			
	NOTES: Some species also recorded on Mary Ann Passage Islands adjacent to mainland coast **(see Pendoley et al. 2003. Onslow to Cape Preston Coastal Islands Survey).**			
Seabirds Marine birds of prey	**Wedge-tailed Shearwater** - Coastal and pelagic, breeding and non-breeding over August to April including Dampier, passage, Lowendal and Barrow Islands (**see Marchant and Higgins 1990**).	Commonwealth Department of Environment	2012	Species group report card – seabirds and migratory shorebirds.
	Fairy tern* - Sandy/shelly beaches, spits, flats - breeding and non-breeding August to February in sheltered coasts including Dampier Archipelago (**see Higgins and Davis 1996, Hill et al. 1988, Blakers et al. 1984**).			
	Lesser crested tern* - sandy bays, coral reefs, coasts and estuaries, breeding and non-breeding at Lowendal and Montebello islands (**see Surman and Nicholson 2008**).			
	Bridled tern - Lowendal, Montebello, Barrow Islands.			
	Roseate tern - Dampier Archipelago and Lowendal and Montebello Islands, breeding and non-breeding (**see del hoyo et al. 1996, Higgins and Davis 1996**)			
	NOTES: Some species also recorded on Mary Ann Passage Islands adjacent to mainland coast **(see Pendoley et al. 2003. Onslow to Cape Preston Coastal Islands Survey).**			
Green Turtle *Chelonia mydas*	Global distribution and breed extensively in NW Australia (Prince, 1994). Nesting at Barrow and Montebello Island group (**Pendoley 2005a**) and Dampier Archipelago.	Chevron (**see also Commonwealth Department of Environment, 2012**)	2014	Gorgon Gas Development and Jansz Feed Gas Pipeline: Long term marine
	Also nest on the islands between Cape Preston Exmouth Gulf with large juvenile and sub-adults foraging and feeding within nearshore algal rock benthic habitats and mangrove forests (**Pendoley et al. 2003, Maunsell 2004, Imbricata 2013**).			

	Throughout their lives, adults display a high level of philopatry (a tendency to return to a specific area for different parts of their lifecycle) both to their natal nesting areas and to their feeding areas, irrespective of the distance between them. Tagging studies by **Limpus et al. (1992)** showed that distances between nesting and feeding areas can range from 2 kilometres to 2600 kilometres.			turtle management plan (**see also Species group report card - marine reptiles**)
Flatback Turtle *Natator depressus*	Endemic to Australia with southern range known to stop at Exmouth (**Dutton et al. 2002**) (Gorgon long term marine turtle management plan). Significant rookeries focussed on Barrow Island, Mundabullangana, Montebello Island Group, the Dampier Archipelago (**Pendoley 2005a, Limpus 2009, Pendoley et al. 2014**). Migratory corridor overlaps with humpback whales, blue whales, olive ridley turtles and whales sharks (**Pendoley et al. 2014**).			
	Nests on all inshore coastal islands between Cape Preston and Exmouth (**Pendoley et al. 2003, K Pendoley pers obs**). Flatback turtle in the Pilbara exhibit an inter-nesting migration not observed in other species, travelling between their offshore island nesting sites and shallow coastal waters during the 14 day inter-nesting period between laying egg clutches (**Whittock et al., 2014**).			
	Flatback turtles differ from other marine turtles in that they do not have a pelagic phase to their lifecycle. Instead, hatchlings grow to maturity in shallow coastal waters thought to be close to their natal beaches. This may explain why flatback turtles are one of only two species of marine turtles not to have a global distribution (**Hamann et al. in press; Walker & Parmenter 1990**), although there is evidence that some flatback turtles undertake long-distance migrations between breeding and feeding grounds (**Limpus et al. 1983, Pendoley et al. 2014**).			
Loggerhead Turtle *Caretta caretta*	Dampier archipelago is the current known northern limit of nesting in WA (**see Prince 1994**). Occasional nesting records from Varanus and Rosemary islands in the Pilbara.			
Hawksbill Turtle *Eretmochelys imbricata*	Northwest shelf has important breeding beaches (**Limpus 2002**). Genetically distinct breeding population at Dampier Archipelago. Also breeds at Barrow (**Pendoley 2005a**), Lowendal and Montebello Islands.			
	Nest in low numbers on coastal islands between Cape Preston and Onslow (**Pendoley et al. 2003, K Pendoley pers obs**).			
	Hawksbill turtle feeding grounds are known to occur in the Mary Anne and Great Sandy Island groups to the south of the Barrow Shoals (**Pendoley 2005, K Pendoley pers obs**)			
	There is a single breeding stock in the region: the Western Australian stock, which is centred on the Dampier Archipelago (**Limpus 2009a**). It is the largest stock in the Indo-Pacific region (**Limpus 2002**). The most significant breeding areas include Rosemary and Delambre Islands in the Dampier Archipelago, Varanus Island in the Lowendal group, and Ah Chong and South East Islands in the Montebello group.			
Olive Ridley Turtle	Their occurrence in the region is presumed to be primarily for foraging purposes. They have been recorded foraging as far south as the Dampier Archipelago – Montebello Islands area, (**DEWHA 2007; Donovan et al. 2008**). Primarily carnivorous, feeding on gastropod molluscs and small crabs from soft bottom habitats ranging in depth from 6 to 35 metres (**Limpus 2008**c). Olive ridley turtles may also forage in pelagic waters.			

Dugong	Dugong are generally associated with shallow seagrass meadows on which they feed and have been observed in the shallow waters over the Barrow Shoals, along the east coast of Barrow Island and over the Lowendal Shelf to the north east. They are likely to be occasional visitors to any area of sub tidal seagrass in the vicinity (**Marsh et al. 2002**) (**see Environmental Statement/Environmental Review and Management Programme for the Gorgon Development**).	Commonwealth Department of Environment	2012	Species group report card - Dugong
Cetaceans, Humpback Whale	Migrate North in May each year with pregnant females and immature individuals arriving first in the North west from June onwards. Breeding and calving is between August and September when the southern migration starts. **Migratory corridor overlaps with flatback turtles, blue whales, olive ridley turtles and whales sharks (Pendoley et al. 2014)**	Commonwealth Department of Environment	2012	Species group report card - Cetaceans
Cetaceans, other whales	**Whale species*** that may occasionally visit the region include the short-finned pilot whale, false killer whale, killer whale, Bryde's whale, minke whale, sei whale, pygmy blue whale, fin whale, melon headed whale and the sperm whale. (**see Environmental Statement/Environmental Review and Management Programme for the Gorgon Development**).			
Whale sharks	**Migratory corridor overlaps with humpback whales, blue whales, olive ridley turtles and flatback turtles (Pendoley et al. 2014)**	Commonwealth Department of Environment, 2012	2012	Marine bioregional plan for the Northwest marine Region
	Whale sharks occur around the offshore Islands of the Montebello/Lowendal/Barrow Island Group and their movements are thought to be associated with local productivity events (see Last and Stevens 1994) They congregate at Exmouth in March to April so will be seen transitioning through these Islands groups prior (see Environmental Statement/Environmental Review and Management Programme for the Gorgon Development). Feed on krill and baitfish associated with Coral mass spawning (**Sleeman et al. 2010, Wilson et al. 2006**). The gastropod, *Amoria macandrewi*, is endemic to sand bars within the Montebello/Lowendal/Barrow Island region and is of higher conservation significance.			
A note on Habitats	An extensive amount of survey and literature review work has been carried out on habitats, species, and use regionally in developing management plans for the Montebello/Barrow Islands Marine Conservation Reserves and the Proposed Dampier Archipelago Marine Conservation Reserve.	Department of Environment and Conservation	2005	Indicative Management Plan for the Proposed Dampier Archipelago Marine Park and Cape Preston Marine Management Area

<u>Birds</u>

Migratory shorebirds including the Greater sand plover, Grey plover, Bar-tailed godwit and the Common greenshank, Grey tailed tattier and Ruddy turnstone can be found seasonally throughout the Barrow-Montebello Island group and the coastal islands chain and throughout the Dampier Archipelago.

Also encountered seasonally to a lesser extent are the Pacific golden plover, Great knot, Red-necked stint and Terek sandpiper. It is unlikely these birds will be encountered within the well location

Seabirds include the Wedge-tailed shearwater, Bridled tern and Roseate tern which nest on numerous Pilbara region islands. Within the well location the Wedge-tailed Shearwater may be encountered.

Turtles

Green turtles have a global distribution and nest throughout the Pilbara islands region with notably large populations occurring at Barrow Island, Montebello Islands, Serrurier Island and the Dampier Archipelago. They also nest throughout the coastal islands chain from Cape Preston to Exmouth Gulf and feed on near shore algal rock benthic communities and mangroves, returning to the vicinity of the same nesting sites every 5-7 years. Hatchlings grow to maturity in offshore oceanic waters. The drilling location does not contain habitats of importance to green turtles, with water depths precluding the presence of suitable feeding habitat (such as seagrass and coral reefs). Given the drilling timing and the distance from the known nesting beaches green turtles may be encountered in the vicinity of the well location.

Flatback turtle nesting sites include Barrow Island, Mundabullangana, Montebello Island Group and the Dampier Archipelago. Collectively, the flatback nesting activity that is scattered across the large number of small coastal islands between Cape Preston and the Exmouth Gulf comprise a major nesting population likely comparable in size to Barrow Island or the Montebello Islands (Whittock et al., 2014). Smaller nesting populations occur on Thevenard Island and within the Lowendal Island group. Hatchlings grow to maturity in shallow Continental Shelf waters. Given the distance of the drilling location from important nesting sites and the known migratory movements of flatback turtles, they may be encountered in the vicinity of the well location.

The northern limit of regular loggerhead turtle nesting occurs at the Muiron Islands while occasional nesting records are available from Varanus and Rosemary islands in the Pilbara. Loggerhead turtles may occur in the vicinity of the well location while travelling to and from the major rookeries.

The Hawksbill turtle has a genetically distinct breeding population at Dampier Archipelago (the largest in the Indo-Pacific) and also breeds at Barrow, Lowendal and Montebello Islands and throughout the coastal island chain. They are known to feed in the Mary Anne and Great Sandy Island groups (Pendoley, 2005). Given the distance of the drilling location from important nesting and foraging sites it is unlikely they will be encountered in the vicinity of the well location.

Olive Ridley turtles forage regionally as far south as the Dampier Archipelago and Montebello Islands, feeding on shellfish and small crabs. Given the drilling timing and the distance from the foraging sites it is unlikely that they will be encountered in the vicinity of the well location.

Whales

Humpback whales migrate North in May each year with pregnant females and immature individuals arriving first in the Northwest from July onwards. Breeding and calving is between August and September with the southbound migration starting October.

The migratory corridor overlaps with flatback turtles, blue whales, olive ridley turtles and whale sharks (Pendoley et al., 2014).

Whale species that may occasionally visit the region include the short-finned pilot whale, false killer whale, killer whale, Bryde's whale, minke whale, sei whale, pygmy blue whale, fin whale, melon headed whale and the sperm whale.

Dugong

Dugong are generally associated with shallow seagrass meadows on which they feed and have been observed in the shallow waters over the Barrow Shoals, along the east coast of Barrow Island and over the Lowendal Shelf to the north east. Foraging scars have also been observed around the Mangrove Islands (K Pendoley pers. obs.) and the shallow waters of the Barrow Shoals and the coastal Islands are thought to provide the females with protection from predation while giving birth. They are likely to be occasional visitors to any area of sub tidal seagrass in the vicinity.

Whale sharks and sharks

Whale sharks occur around the offshore Islands of the Montebello/Lowendal/Barrow Island Group and their movements are thought to be associated with local productivity events. They congregate at Exmouth at Ningaloo Reef in March to April so will be seen transitioning through these Islands groups prior and feed on krill and baitfish associated with Coral mass spawning.

The great white shark (Carcharodon carcharias) is widely distributed throughout temperate and sub-tropical regions in the southern hemisphere, extending from the southern coastline of Australia up to the North West Shelf (DSEWPaC, 2012). It is unlikely that significant numbers of the great white shark will occur in vicinity of the well location.

Grey nurse sharks (Carcharias taurus) have a broad inshore distribution, primarily in subtropical to cool temperate waters around the main continental landmasses. In Western Australia, grey nurse sharks have been regularly reported from the southern waters and up to Shark Bay.

Their preferred habitats have sandy bottomed gutters or rocky caves and are close to inshore rocky reefs or islands. It is therefore unlikely that the grey nurse shark will occur in vicinity of the well location, due to the absence of reefs and islands and the water depths of the drilling area (750m).

Nature of impact

The potential impacts to EPBC-listed threatened species are the same as for migratory species and for convenience have been addressed together in the following section. The key potential impacts associated with the drilling campaign and related activities to listed threatened and migratory species are:

- Effects associated with noise levels;
- Effects associated with the physical presence (light) of the drilling rig and support vessels;
- Effects associated with physical presence (collisions) of the drilling rig and support vessels; and
- Effects associated in the event of a fuel or hydrocarbon spill.

Noise

Further details on noise will be made available on selection of the specific jack-up rig. In general, a semi-submersible drilling rig operates in a similar manner to a jack-up rig and can provide information about the combined noise of drilling and operating bow thrusters.

For the drill ship West Navion transect sound measurements were measured outward at intervals of 500, 1,000, 2,000, 5,000 and 10,000 m on the sea surface and at 50, 100 and 200 m depth with 6 transects for each range and depth. For a harbour porpoise, harbour seal and killer whale, out to 2000 m there is an increase in perceived noise levels from the drill ship but then it settles to a relatively constant value. The perception of noise is not influenced by the use of bow thrusters and general drilling activities have a perceived sound that is lower than other biological noise common to the marine environment.

Airguns have been found to alter the vocal behaviour of blue whales and may similarly affect other baleen whales (Di Iorio and Clark, 2010). It is unknown whether there may also be physical effects on some species of cetaceans (DEWHA, 2008a). High levels of seismic profiling activity may result in baleen whales (e.g. humpback whales) detouring from migration routes, or cause their displacement from important breeding and calving areas.

There is limited data on the impacts of noise pollution on marine turtles although one study indicated turtles exhibit avoidance behaviour when proximate to noise emitted during seismic profiling (McCauley et al., 2000). However, dependent on the location of the activity and time of year, profiling may cause changes in their foraging, inter-nesting, courting or mating behaviour.

Light

Light pollution along, or adjacent to, nesting beaches poses a particular issue for turtles because it alters critical nocturnal behaviours, particularly the selection of nesting sites and the passage of adult females and emerging hatchlings from the beach to the sea (Limpus, 2009).

The impacts of these changes include a decrease in nesting success, beach avoidance by nesting females and disorientation, leading to increased mortality through predation, road kill or dehydration (Limpus, 2009; Lorne and Salmon, 2007; Witherington and Martin, 2000). Given the particular sensitivity of turtles during nesting, light pollution from coastal and industrial development poses the most serious threat to turtle populations.

Bright lighting can disorient flying birds and subsequently cause their death through collision with infrastructure or starvation due to disruptions in the ability to forage at sea (Wiese et al., 2001). Light pollution is a particular issue for wedge-tailed shear waters due to their nocturnal habits and migratory shorebirds as they under take their migratory flights at night (Geering et al., 2007). This is evident for young fledglings, in particular wedge-tailed shear waters, leaving breeding colonies for the first time.

Bright lights can also impact on migrating birds. Illumination at night from artificial lights can reduce the extent of foraging behaviour in shorebirds (Thomas et al. 2004), potentially reducing their abilities to replace used energy reserves (body fat) or to prepare for breeding or migration. For operational safety reasons, offshore oil and gas facilities are well lit (EPA, 2001) as are vessels at sea.

Collisions

In addition, increasing shipping activity from the Port of Dampier and the large and growing number of humpback whales under taking annual migration along the Western Australian coastline and the presence of increased numbers of inter-nesting turtles in the vicinity of the Dampier Archipelago means that the likelihood of vessel strikes on humpbacks and turtles is also increasing.

A shipping lane/fairway exists within the vicinity of the proposed drilling program connecting Barrow Island with the Port of Dampier and Cape Preston Iron Ore Terminal Anchorage with passage north along the coast and from offshore to the north of the Montebello Islands. Shipping lane/fairways include:

- Barrow Island to Pilbara Port – transiting along the coast;
- Offshore east of Montebello Islands transiting North; and
- Cape Preston Iron Ore terminal east of prospect locations and intersects shipping fairway along the coast from Barrow Island.

Oil Spills

Sensitivity to Oil

Regionally important MNES for locations identified from OSTM although potentially vulnerable to oiling will have varying sensitivity to oil. The following information is summarised from APASA, 2014.

Floating Oil

Floating oil poses a coating risk to emergent reefs, vegetation in the littoral zone and shoreline habitats, as well as wildlife on the water surface, such as marine mammals, reptiles and birds. Floating oil is also visible at relatively low concentrations (> ~0.05 g/m^2). Hence, the area affected by visible oil, which might trigger social or economic impacts, will be larger than the area where biological impacts might be expected.

Estimates for the minimum thickness of floating oil that might result in harm to seabirds through ingestion from preening of contaminated feathers, or the loss of the thermal protection of their feathers, has been estimated by different researchers at approximately 10 g/m^2 (French, 2000) to 25 g/m^2 (Koops, Jak and van der Veen, 2004).

Hence, the 1 g/m^2 threshold is likely to be conservative in terms of environmental harm for effects on seabirds for example, and is more indicative of the perceived area of effect of a spill that might require surveillance because it may trigger economic impacts, such as the temporary closure of local fisheries as a precautionary measure. The highest threshold is more likely to be meaningful in terms of potential harm to fauna such as seabirds or fauna on shorelines.

Entrained Oil

Entrained oil presents a number of possible mechanisms for exerting exposure. The entrained oil droplets may contain soluble compounds, having the potential to generate elevated concentrations of dissolved hydrocarbons (e.g. if mixed by breaking waves against a shoreline). Physical and chemical effects of the entrained oil droplets have also been demonstrated through direct contact with organisms, for example through physical coating of gills and body surfaces, and accidental ingestion (NRC, 2005).

The concentrations of physically entrained oil that has been demonstrated to have harmful effects in laboratory studies (NRC, 2005) shows wide variation depending on the test organisms and the initial oil mixture. Reported LC50 values (concentration lethal to 50% of test individuals) for molluscs range from 500 ppb to 2 ppm with 96 h exposure. Wider exposure sensitivities are displayed by crustaceans (100 ppb to 258 ppb) with 96 h exposure, while marine fish larvae appear more sensitive again with LC50 values of 45 ppb after 24 h exposure.

As indications of increasing potential impact on different receptors, thresholds for concentrations of entrained oil were defined here at 10 ppb, 100 ppb and 500 ppb. The lowest threshold is considered a conservatively low estimate of the lowest concentration that may be harmful to sensitive marine organisms with relatively long exposure (tens of hours; French, 2000).

Because of the requirement for relatively long exposure times, this threshold is more meaningful for larvae and organisms that might be entrained (and therefore moving) within the oil plumes. The higher thresholds are more relevant to short duration (acute) exposure to organisms or fixed habitats affected by the dynamically varying plume.

Dissolved Aromatic Hydrocarbons

For dissolved aromatic compounds, reported LC50 for PAHs (Polycyclic Aromatic Hydrocarbons) with 96 h exposure range between 6 and 410 ppb for sensitive species and insensitive species respectively, with an average of ~50 ppb (French-McCay, 2002).

Note that the values for LC50 increases as the time of exposure decreases, as marine organisms can typically tolerate higher concentrations of toxic hydrocarbons over short durations (French,

2000; Pace et al., 1995). Actual toxicity depends on both concentration and the duration of exposure, being a balance between acute and chronic effects. Threshold concentrations were defined here at 6 ppb, 50 ppb and 500 ppb.

Time-Integrated Exposure to Dissolved Aromatic Hydrocarbons

The mode of action of soluble (dissolved) hydrocarbons results in a narcotic effect, resulting from interference with cell function that occurs as hydrocarbons are absorbed across cell membranes within the tissues of organisms (French-McCay, 2002).

The narcotic effect varies among specific hydrocarbon compounds, with these variations mostly attributable to the lipid solubility of the compounds. Over periods of hours to a few days, the narcotic effect has been found to be additive, both for the range of soluble hydrocarbons that are present and with increasing exposure concentration (French, 2000; NRC, 2005).

The effect of exposure time is, however, not additive in a linear fashion. Organisms exposed to soluble hydrocarbons display toxic responses that follow an exponential relationship with time of exposure.

This is due to the fact that concentrations of hydrocarbons take time to be absorbed and build up in the tissues of organisms until an equilibrium is reached, when rates of absorption into and desorption from the lipid phase of the organism are equal (i.e. the uptake of chemical by the organism is the same as the elimination of the chemical by the organism; French-McCay, 2002; NRC, 2005). Toxic responses in the organism occur when the concentration of the nonpolar organic chemicals in the tissues reaches a critical concentration.

Because the toxicity of dissolved hydrocarbons to aquatic organisms increases with time of exposure, organisms may be unaffected by brief exposures to a given concentration but affected at long exposures (French-McCay, 2002).

These considerations indicate that the assessments for exposure based on instantaneous thresholds are likely to be conservative because they are derived from toxicity assessments over longer exposure durations and can be triggered in the exposure assessment by exposure durations as short as one hour.

Extent of likely impact

Noise

The extent of any potential acoustic disturbance to marine fauna various seasonally based on breeding cycles and movement of fauna through the general area. Inter-nesting turtles in the vicinity of the Dampier Archipelago are more likely to be exposed to acoustic disturbance than during nesting.

Whales and whale sharks moving through the drilling prospect locations are more likely to be exposed to acoustic disturbance during their migration period. For turtles, whales and whale sharks the potential to be exposed to acoustic disturbance increases from June through to October.

For each of the four prospect locations the potential exists for marine life to be exposed to acoustic disturbance out to a radius of 2km from the well location. Furthermore, vessels using the shipping fairways to and from the Port of Dampier will have the potential to cause acoustic disturbance to fauna within a few hundred metres of the vessel.

However, potential impacts from vessel noise in and around rig operations are unlikely to be greater than that from existing vessel traffic in the vicinity of the operational area from other commercial activities.

It is also likely that the potential for significant impacts to marine fauna would only exist within a few metres of the sound source (propellers and hull) and given that vessels would be continually operating within the operational area, the likelihood is that marine fauna would avoid approaching the vessels and rig.

Light

Point source lighting impacts are unlikely to be significant given the short duration of the drilling campaign and the drilling is a considerable distance from turtle nesting beaches and bird rookeries. Potential impacts are expected to be localised and temporary. The operational area does not contain any critical habitat.

The nesting beaches in the vicinity of the proposed drilling prospects are located between 16km (Lowendal) and 73km (Eaglehawk Island Dampier Archipelago) distant. The visibility of the lights and the glow from the drilling rig at the nearest rookery on the Lowendal Islands are expected to be relatively minor over the 16km distance and undetectable from star light over distances in excess of 30km.

Fledgling wedge tailed Shearwaters are the most sensitive age class for this species and it is possible they may be attracted by light from a drilling rig over 16km. If a bird were to fly out and investigate the light they are able to land on the rig and fly away when the sun rises the following morning.

Collisions

The shipping fairway Northwest along the coast is approximately 5km wide and frequented by vessels. Use of this recommended route mitigates against any potential collision with marine fauna. However, the Likelihood of an encounter with marine fauna increases from June through to October during the migration period for whale and whale sharks.

For support vessels transiting between Dampier Port and the Prospect sites the potential for collision with fauna such as turtles and dugongs exists. A turtle interesting buffer exists for the Dampier Archipelago at a transit distance of approximately 40km. Dugongs also frequent this area as feeding grounds are present.

From the edge of the inter-nesting turtle buffer at the Dampier Archipelago to the prospect sites is approximately a further 40km. With vessels moving at speed through this area at certain times of the year there is an increased potential for collision with marine fauna, in particular migrating humpback whales and whale sharks.

As the rig is stationary and any vessels operating within 500m of the rig will be either stationary or moving at speeds less than 6 knots it is unlikely there would be risk of collision with marine fauna.

Oil Spills

Oil Spill Trajectory Modelling (OSTM) was carried out by APASA (APASA, 2014) for which the following summary is provided to inform choices on alternatives to the proposed action.

This assessment is based on a worst case scenario for the region, identified as a 77 day well blow out occurring in either summer or winter and based on prevailing metocean conditions in the region.

Data from several Carnarvon Basin crude oils were analysed in order to define a crude oil surrogate for this study (CVN EP-490-491 Proxy, referred to as light crude for simplicity).

Specifically, five light crude oils with API gravity between 29 and 38 were considered when defining the properties of light crude relevant for oil spill modelling.

Characteristics defined for the light crude proxy are summarised in **Table 6**.**Error! Reference source not found.** The data is indicative of a medium to light crude with a relatively high proportion of volatile components as well as a substantial content of residual compounds.

Table 6: Characteristics defined for the crude proxy

Oil type	Initial Density (g/cm^3) (15 C)	Viscosity (cP)	Component	Volatile (%)	Semi-volatiles (%)	Low-volatility (%)	Residual (%)	Aromatics (%)
			Boiling Pt (Celsius)	<180 ºC C4 to C10	180-265 ºC C10 to C15	265-380 ºC C15 to C20	>380 ºC >C20	Of whole oil <380 ºC
Crude Proxy	0.8549	4 (20 ºC)	**Non-persistent**				**Persistent**	
			% of total	22.0	25.0	29.0	24.0	4.0
			% of aromatics	2.0	1.0	1.0	-	-

Following discharge to the ocean the crude would immediately start to weather, losing 22% of the total spill volume to evaporation in the first 12 hours. A second fraction (25%) of moderate volatility hydrocarbons will take up to 24 hours to evaporate, while the heavier of the volatile hydrocarbons (29%) will persist for several days.

The remaining 24% of residual high molecular weight and complex polycyclic aromatic hydrocarbons will persist for weeks to months, weathering by biochemical and photochemical degradation.

Given the substantial content of residual compounds and the tendency to form stable emulsions at four times the original volume of oil, dispersant application should be considered. Use of dispersants is outlined in **Section 5.**

For modelling purposes, the proportion of low molecular weight aromatic hydrocarbons in the crude was established at 4%. The solubility of this class of compounds will results in dissolved aromatic hydrocarbons (DAH) in the water column, particularly when the oil is entrained in the water column by breaking surface waves (at wind speeds of 12 knots (~6 m/s) or greater).

The crudes from the study area also form stable emulsions of asphaltenes and sulphur. Consequently the emulsified crude oil proxy was defined as a water in oil mixture of 75%.

This water content implies that the volume of emulsified crude will be four times the original volume of oil. It is important to emphasise that all volumes reported are for oil only unless otherwise specified.

The consistency of seasonal tidal, current and wind flows in the region and the proximity of prospect drilling locations to each other mean that modelling one spill location is representative of all four drilling locations.

From the spill modelling analysis report by APASA, the following information on the resolution of the drift current model hindcast data (HYCOM), tidal model data (HYDROMAP) and wind hindcast model data (CFSR) show that:

- HYCOM resolution is 1/12th of a degree (~ 7km at mid-latitudes);
- HYDROMAP resolution is variable between 2 and 15km; and
- CFSR resolution is 1/4th of a degree (~ 20-25km at mid-latitudes).

The proximity of prospects to each other is in this range of resolution, meaning metocean forcing to the oil spill modelling would be similar for the other prospects.

A modelled Zone of Potential Impact (ZPI) allows identification of potential sensitive receptors that may be affected by a hydrocarbon release (spill) of harmful concentrations (**Figure 6**).

Risks to those receptors can be managed and reduced to As Low As Reasonable Practicable (ALARP) during a spill response.

The ZPI describes the area that could potentially be impacted at the surface and within the water column (sub-surface) by hydrocarbons spilled.

The ZPI has been defined from OSTM based on time integrated and entrained oil threshold levels for credible spill scenarios, as the combination of:

- The Zone of High Exposure (ZoHE: area of potentially toxic effects) – ca > 6ppb DAH;
- The Zone of Moderate Exposure (ZoME: area within which entrained oil impacts are recoverable in a short period of time) ca ≤ 10ppb entrained oil; and
- The Zone of Influence (ZoI: potential exposure but no detectable impact on biota) defines the limit of extent of the hydrocarbon spill for floating oil at 1g/m^2. The ZoI lies outside of the ZPI identified as relevant for MNES.

Interpretation of the ZPI in the context of the presence of sensitive receptors important for MNES that are present (including shorelines) is provided in **Table 7**.

Recognising that not all sensitive receptors interact with surface waters, the ZPI was defined based on the surface and sub-surface down to 10m (dissolved and entrained) and DAH at all depths modelled data.

By cross referencing the environmental sensitivities within a ZPI against spill fate, appropriate response options can be determined. In this way, unnecessary response options related to the Zone of Influence (ZoI) are avoided and any impact on the environment due to responding to an oil spill is reduced to ALARP. Environmental sensitivities within the ZPI were cross referenced against:

- Time for floating oil to come ashore;
- Time for entrained oil to reach identified threshold levels; and
- The probability of occurrence of DAH.

Locations identified regionally and relevant to MNES include:

- Lowendal Islands;
- Barrow Island;
- Montebello Islands;
- Dampier Archipelago;
- Adjacent mainland coast/Islands (Northern and Middle Is. coast); and
- Ningaloo Coast North.

For summer and winter the spill direction and maximum distance, highest probability of occurrence, average volume along the shoreline in litres and average length of shoreline oiled (km) was considered (**Table 8**) for locations relevant to MNES.

Table 7: Regional locations and spill fate within the identified ZPI.

		Lowendal	Barrow	Montebello	Dampier	North/Middle Is. Coast	Ningaloo Coast North
SUMMER							
Floating oil ashore (time) hours	1 g/m^2	5	9	47	86	31	129
	10 g/m^2	5	9	47	86	31	129
Entrained oil (time to threshold) hours	10 ppb	4	10	101	186	33	300
	100 ppb	5	11	126	358	32	NC
	500 ppb	31	19	1,844	NC	44	NC
DAH (%) occurrence	> 6ppb	97	93	61	10	22	2
	> 50ppb	51	28	6	2	2	2
	> 500ppb	2	2	2	2	2	10
WINTER							
Floating oil ashore (time) hours	1 g/m^2	6	7	16	NC	NC	141
	10 g/m^2	6	7	16	NC	NC	141
Entrained oil (time to threshold) hours	10 ppb	6	7	28	NC	NC	1,473
	100 ppb	9	8	30	NC	NC	NC
	500 ppb	12	9	1,463	NC	NC	NC
DAH (%) occurrence	> 6ppb	100	100	100	2	2	2
	> 50ppb	97	34	16	2	2	2
	> 500ppb	2	2	2	2	2	2

Table 8: Scenario 1 – 77 day blowout summary of key oil spill modelling results for the Cerberus drilling campaign.

Scenario	Key Results Summary						
Scenario 1 This scenario investigated the probability of exposure to surrounding regions due to			Direction and maximum distance	Highest probability of occurrence	Minimum time to arrival at shoreline	Largest volume along the shoreline (Liters) (AVERAGE)	Maximum length of shoreline oiled (km) (AVERAGE)
	≥ ≥	1g/m^3	Northeast &	Lowendal Is.,	Lowendal Is. 5 hrs.	Lowendal, Montebello	Lowendal 36km,

a surface blowout of crude, discharging for a period of 77 days at a constant rate of 24,026 bbl/day (3,820 m^3/day), yielding a total release volume of 1,850,000 bbl (294,127 m^3).			northwest 1,800 km	Montebello and Barrow Islands 100%. Dampier Archipelago 79%. Middle Is. Coast >50% Northern Is. Coast 87%. Ningaloo Coast North 49%	Barrow Is. 9 hrs. Montebello Is. 47 hrs Dampier Archipelago 86 hrs Middle Is. Coast 31 hrs Northern Is. Coast 20 hrs Ningaloo Coast North 129 hrs	and Barrow Is. >1,500,000L Dampier Archipelago >3,000,000L Middle Is. Coast >1,600,000L. Northern Is. Coast >1,400,000L Ningaloo Coast North >800,000 liters	Montebello 31km, and Barrow Is. 87km, Dampier Archipelago 83km, Middle Is. Coast. 48km, Northern Is. Coast 38km, and Ningaloo Coast North 45km
		10g/m^3	Northeast & northwest 1,300 km	Lowendal, Montebello and Barrow Islands >90%. Dampier Archipelago 75%. Middle Is. Coast >50% Northern Is. Coast 87%. Ningaloo Coast North 43%	Lowendal Is. 5 hrs. Barrow Is. 9 hrs. Montebello Is. 47 hrs Dampier Archipelago 86 hrs Middle Is. Coast 31 hrs Northern Is. Coast 20 hrs Ningaloo Coast North 129 hrs		
	Winter	1g/m^3	West and southwest 1,800 km	Lowendal Is., Montebello and Barrow Islands 100%. Ningaloo Coast North 8%	Lowendal Is. 6 hrs. Barrow Is. 7 hrs. Montebello Is. 16 hrs Ningaloo Coast North 141 hrs	Lowendal, Montebello and Barrow Is. >2,000,000L Ningaloo Coast North >2,900L	Lowendal 37km, Montebello 34km, Barrow Is. 54km, and Ningaloo Coast North <1km
		10g/m^3	West and southwest 1,300 km.	Lowendal Is., Montebello and Barrow Islands 100%. Ningaloo Coast North 8%	Lowendal Is. 6 hrs. Barrow Is. 7 hrs. Montebello Is. 16 hrs Ningaloo Coast North 141 hrs		

The following information is summarised from spill trajectory modelling undertaken for the worst case 77 day blowout scenario by APASA, 2014. The extent of impacts on marine fauna can be determined by association with the impact an oil spill may have on their habitats. Oil spill trajectory modelling showed that depending on the time of the year, summer or winter impacted locations include:

- Great Sandy Island Nature Reserve – Islands;
- Barrow Island Marine Park;
- East Barrow Island Turtle nesting beaches;
- Barrow Island Bandicoot Bay – wading birds habitat;
- Turtle nesting beaches on the Lowendal and Montebello Islands;
- Dugong feeding grounds of the Dampier Archipelago;

- Turtle nesting beaches of the Dampier Archipelago;
- Dampier estuary and saltmarsh entrance on the coast adjacent to the Archipelago and on Barrup peninsula;
- During bird migration season – beaches used in transit for locations listed above, and
- Ningaloo reef.

In order of priority the degree of impact decreases from:

- Summer - Lowendal/Montebello/Barrow Is. > Damper Archipelago > Ningaloo Reef
- Winter - Lowendal/Montebello/Barrow Is. > Ningaloo Reef > Dampier Archipelago

Note for the Montebello Islands the time to threshold concentrations of entrained oil and % DAH is considerably longer than for other areas identified in the region. This may be due to the complexity of topography in combination with the influence of tides and currents. If protection and deflection is not feasible or does not work and containment and recovery is difficult then natural bio-degradation is preferred i.e. no net environmental benefit in cleaning up oil as it will cause more damage than would otherwise occur from weathered oil undergoing natural bio degradation. To consider use of dispersants requires approval from DMP and WA DoT as the HMA for the State. Considerations are summarised in **Table 9** below for use of dispersants if oil trajectories show an imminent threat to sensitivities in the locations. Further information on consideration of the use of dispersants is discussed in **Section 5**.

Table 9. Threatened locations associated with threatened species and ecological communities and use of dispersants.

Sensitivity	Trajectory shows oil threatening	Dispersant use at drilling locations (spill source)
Intertidal flats, mangroves and saltmarsh/saltflats, intertidal reef, mud and tidal flats	Two estuarine systems adjacent to the Dampier Archipelago	**YES**
	Estuarine system immediately south of Cape Preston	**YES**
	Estuarine system on mainland coast opposite Dampier Archipelago	**YES**
	Dampier Archipelago	**YES**
	East and Southeast coast of Barrow Island - Bandicoot Bay	**YES**
Coral reefs, limestone pavement and marcoalgae, nearshore subtidal rocky reef, sand beaches, rocky coastline, offshore subtidal reef	Offshore reef system next to Cape Preston – Regnard Marine Management Area	**NO**
	Northern and western Barrow Island	**NO**
	Lowendal Islands	**NO**
	Montebello Islands	**NO**
	Ningaloo reef	**NO**

NOTE: Dispersant should be applied outside the 20m depth contour due to entrained oil mixed with surface applied dispersant having the potential to mix in the water column down to a depth of 10m (IPIECA 2001, 2015a, b and c). See Section 5 Measures to avoid or reduce impacts – 'Escalation of Oil Spill Response and Use of Dispersants'.

3.1 (e) Listed migratory species

As per 3.1 (d) Listed threatened species and ecological communities

3.1 (f) Commonwealth marine area

The project is not in a Commonwealth marine area but in the unlikely event of an uncontrolled release of hydrocarbon the potential exists to impact a Commonwealth marine area. The waters surrounding Barrow Island and the Montebello Islands are encompassed by the Montebello – Barrow Island commonwealth marine conservation reserves is predominantly zoned a Marine Management Area, with special protection provided to the Barrow Island Marine Park (over the west coast Biggada Reef), the Bandicoot Bay conservation area, the northern Montebello's sanctuary zone, the southern Montebello's sanctuary zone, the Willy Nilly Lagoon Sanctuary zone

and the northern Montebello's Special Purpose zone.

The Montebello Islands is low lying and includes 95 islands larger than 50m in length and 170 smaller islets and reefs. They are composed of Pleistocene limestone and cross-bedded sandstones, capped in places with consolidated or active sand dunes with elevation up to 40m. Most islands are rocky terrain without any beaches. The existing environment of the offshore Pilbara region has been described in several reports (Tap, 2001, Command, 1992, Hadson, 1990, Jones, 1986) and other oil industry reports. The geomorphology of the region has been summarised in a report of the Marine Reserves Selection Working Group, also known as the Wilson Report (1994). Two distinctive coastal types are recognised, near shore and offshore with the 10m bathymetric contour used as a representative dividing line. Barrow Island and the Montebello Islands are part of a shallow submarine ridge, which extends north from the mainland near Onslow (IUCN, 1993). The ridge contains extensive areas of intertidal and shallow sub tidal limestone pavement surrounding the numerous, mostly small island found in the region.

Nature and extent of likely impact

The following information is summarised from spill trajectory modelling undertaken for the worst case 77 day blowout scenario by APASA, 2014. Given the nature of the tides and currents off the continental shelf of Northwest Australia and the composition of the light crude oil as the Leeuwin current moves southward it is likely the Montebello Islands will be considerably more impacted in winter compared to summer in the unlikely event of an oil spill by prolonged exposure to any remaining entrained oil and dissolved PAHs.

Since the time for floating oil ashore at 1 and 10gm/^{2} is 47 hours in summer and winter, for the Montebello Islands the heavier volatile hydrocarbons will persist in addition to the residual high molecular weight PAH's on arrival of the surface slick. In summer and winter approximately 31 and 34km of coastline will potentially be impacted by 1.5 and 2 million litres of weathered oil respectively. The crudes from the study area also form stable emulsions of asphaltenes and sulphur. Consequently the emulsified crude oil proxy was defined as a water in oil mixture of 75%. This water content implies that the volume of emulsified crude will be four times the original volume of oil. During summer and winter the probability of occurrence is approximately 71% and 79% respectively.

For modelling purposes, the proportion of low molecular weight aromatic hydrocarbons in the crude was established at 4%. The solubility of this class of compounds will result in dissolved aromatic hydrocarbons (DAH) in the water column, particularly when the oil is entrained in the water column by breaking surface waves (at wind speeds of 12 knots (~6 m/s) or greater). For the Montebello Islands a 10ppb threshold for entrained oil is reached in summer after 101 hours of exposure whereas in winter this is reduced to 0 hours. For both seasons the % DAH occurrence at a threshold greater than 6ppb is 61% in summer and 100% in winter.

3.1 (g) Commonwealth land

Description

The Project area is not located on Commonwealth land

Nature and extent of likely impact

N/A

3.1 (h) The Great Barrier Reef Marine Park

Description

The Project area is not located within the Great Barrier Reef Marine Park

Nature and extent of likely impact

N/A

3.1 (i) A water resource, in relation to coal seam gas development and large coal mining development

Description

N/A

Nature and extent of likely impact

N/A

3.2 Nuclear actions, actions taken by the Commonwealth (or Commonwealth agency), actions taken in a Commonwealth marine area, actions taken on Commonwealth land, or actions taken in the Great Barrier Reef Marine Park

3.2 (a)	**Is the proposed action a nuclear action?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (b)	**Is the proposed action to be taken by the Commonwealth or a Commonwealth agency?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment		

3.2 (c)	**Is the proposed action to be taken in a Commonwealth marine area?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(f))		

3.2 (d)	**Is the proposed action to be taken on Commonwealth land?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(g))		

3.2 (e)	**Is the proposed action to be taken in the Great Barrier Reef Marine Park?**	X	No
			Yes (provide details below)
	If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))		

3.3 Other important features of the environment

3.3 (a) Flora and fauna

The Project area is not deemed to have important environmental features such as flora and fauna species of interest. The Project area is likely to contain minimal epibenthic infauna as a result of the water depth and strong currents experienced in the area.

3.3 (b) Hydrology, including water flows

Not Applicable

3.3 (c) Soil and Vegetation characteristics

Not Applicable

3.3 (d) Outstanding natural features

The waters surrounding Barrow Island and the Montebello Islands are encompassed by the Montebello – Barrow Island marine conservation reserves is predominantly zoned a Marine Management Area, with special protection provided to the Barrow Island Marine Park (over the west coast Biggada Reef), the Bandicoot Bay conservation area, the northern Montebello's sanctuary zone, the southern Montebello's sanctuary zone, the Willy Nilly Lagoon Sanctuary zone and the northern Montebello's Special Purpose zone.

A planned marine conservation area over waters of the Dampier Archipelago east 50km east of the permit areas is yet to be gazetted and most of the islands in the region are either nature reserves or conservation parks including;

- Barrow Island Nature Reserve (Class A nature reserve);
- Boodie, Double, Middle Islands Nature Reserve (reserve with a conservation order, previously referred to a Class C nature reserve);
- Great Sandy Islands Nature Reserve (Class B nature reserve); and
- Passage Islands (Class CB Nature Reserve).

The boundaries of these reserves extend to the low water mark, thereby encompassing the intertidal zone. This provides all the intertidal fauna with protection under the Conservation and Land Management Act (CALM) 1984.

3.3 (e) Remnant native vegetation

N/A

3.3 (f) Gradient (or depth range if action is to be taken in a marine area)

The water depths of the Project area range between 15 and 30m.

3.3 (g) Current state of the environment

The marine environment in proximity to the Project area is generally undisturbed other than low level fishing activity, and shipping and oil and gas exploration activities. Regionally, the Pilbara is one of the most vital and dynamic wealth producing regions in Western Australia, responsible for the production of goods and services worth more than $16 billion per annum. The mining and petroleum industries continue to be the predominant earners for the region, with a total value of production of $15.3 million per annum, which accounts for more than 55% of the state's total mineral and energy production. While the mineral and petroleum sectors will continue to be the mainstay of the Pilbara's economy, the region is continuing to diversify and expand its economic base with the continued development of its tourism, retail, trade and agricultural industries.

For Western Australia there is already more than a forty year history of marine management using targeted large and small-scale spatial closures to various fishing activities to ensure sustainable harvesting of fish stocks and the protection of their environment (Penn and Fletcher, 2010). The habitat areas protected include large sections of WA's continental shelf waters where all trawl fishing is prohibited which provides comprehensive protection to all sensitive habitats, eliminating any fishing gear disturbance to approximately 35% of continental shelf waters. In addition, management controls within the other areas effectively restrict trawl fishing to even smaller areas, such that about 90% of the continental shelf habitats are actually protected in practical terms.

Annual recruitment into adult invertebrate and fish stocks occupying these habitats is variable along the WA northern coastline (Caputi et al., 1996). Seasonal changes in water temperature are thought to influence this recruitment variability by impacting positively or negatively on spawning and egg and larval stages. This variability is related to the Leeuwin current which brings low nutrient warm water down along the continental shelf.

For the Barrow – Montebello Island complex a high diversity of hard corals with at least 150 species (54 genera) of hard corals recorded to date, from limited surveys (Berry, 1993). Species diversity and community structure vary with different environmental conditions such as exposure to wave action, currents and water clarity. Provide food, substrate and shelter for a wide variety of marine life, including sponges, sea stars, sea urchins, crustaceans, molluscs, worms and fishes, some of which are targeted by recreational and commercial fishers. They also protect coastlines from wave erosion. The coral reef communities in the reserves are currently in good condition with no significant human impacts reported.

For the Dampier Archipelago coral communities occur throughout the proposed reserves and together, the shallow intertidal and sub tidal reef communities comprise 8% (approximately 18,300 ha) of the major marine habitats. The most diverse coral areas in the proposed reserves are found on the seaward slopes of Delambre Island, Hamersley Shoal, Sailfish Reef, Kendrew Island and north-west Enderby Island.

Live coral cover can vary greatly from reef to reef, as indicated by contrasting covers of 10 to 60% on Sailfish Reef and Hamersley Shoal, respectively. The proposed reserves have a high diversity of hard corals, with at least 229 species recorded from Western Australian Museum (WAM) surveys. This diversity of corals may be attributed to the variety of substrates and oceanographic conditions within the proposed reserves.

3.3 (h) Commonwealth Heritage Places or other places recognised as having heritage values

There are no Commonwealth Heritage Places or other places recognised as having heritage values within the Project area. The wide variety of wildlife and the wild, natural appearance of the land and seascapes within the regional reserves have the potential to support an increasing nature-based tourism industry. This high nature-based tourism potential was identified in the Pilbara Development Commission's ecotourism management strategy for the Pilbara offshore islands. In 2004/2005, a total of 339,000 tourists visited the Pilbara region, spending approximately $225 million. Tourism is also generated through interest in the cultural heritage and history of the area, including the extensive rock art of the Burrup, and historical buildings at Cossack and Roebourne.

Numerous shipwrecks in the Dampier Archipelago/Cape Preston region survive as testimonies to the treachery of the coastline including many pearling luggers from the nineteenth century, the 30 tonne yacht Sedjatra from World War II, which was wrecked off the north west tip of Enderby Island, and a Catalina flying boat belonging to the 10th Air Wing of the United States Navy, which was wrecked on Enderby Island during the same period. More recently, during cyclone Orson in 1989, a dredging

barge (DB20) broke its moorings off West Lewis Island and was wrecked on Eaglehawk Island. It is likely, given the nature of the waters of the proposed reserves, that there are other wrecks within the Archipelago that are as yet undiscovered.

3.3 (i) Indigenous heritage values

There are no cultural heritage features situated within the Project area. The wider region is however culturally and environmentally diverse, and is well-known for its heritage assets.

3.3 (j) Other important or unique values of the environment

No other important or unique values of the environment occur within the Project area or Permit areas. The regional distribution of coastal benthic habitats is affected by the frequent passage of tropical cyclones that shape sandy beaches; redistribute boulders and sand sheets over sub tidal pavements; and, in extreme cases, cause widespread destruction of biotic habitats.

The marine flora comprises vascular, flowering plants such as mangroves and seagrasses and non-vascular, non-flowering plants such as macro algae and microalgae. Samphire plants inhabit the upper intertidal zone in isolated, sheltered pockets throughout the region. The marine macrophytes are generally widespread within the region although they tend to be restricted to particular substrates within a given area.

The Leeuwin Current connects the marine plant assemblages of the region with assemblages in the Rowley Shoals to the north. The distribution of marine macrophytes is dependent on substrate type, light availability and wave exposure. The biomass of most species varies seasonally in response to reproductive and growth cycles, water temperature and exposure to wave energy.

3.3 (k) Tenure of the action area (eg freehold, leasehold)

The Project is located wholly in State waters within permits WA-EP 475 and EP 490.

3.3 (l) Existing land/marine uses of area

The Pilbara region has one of the highest boat ownership rates in Australia, and recreational fishing is a highly popular pursuit. The areas that are accessed by recreational fishers depend on the tide and weather conditions. Fishers tend to fish near coral and sub tidal rocky reefs offshore and make use of the artificial habitat provided by the gas pipeline. Sites close to boat launching access are also used extensively.

Game fishers target very large species such as marlin and sailfish in deeper offshore waters, while sport fishers troll for smaller pelagic species such as tuna and mackerel. Line fishers generally target coral trout, spangled emperor, black snapper and trevally, while shore based fishers target Barramundi and Salmon. Recreational fishing activities may extend out as far as drilling area but the numbers would be very low.

One of the principal commercial fisheries in the North Coast Bioregion focuses on tropical finfish, particularly the high value emperors, snappers and cods that are taken by the Pilbara Fish Trawl Fishery and the Pilbara and Northern Demersal trap fisheries.

Other fisheries do not operate or are rarely fished including:

- The Pilbara Trap Managed Fishery
- Trolling for Spanish mackerel in waters of 20m depth or more;
- Tuna longliners are currently not active in the region; and
- The North Coast Shark Fishery is not currently active.

Zones 2 and 3 of the Onslow Prawn Managed Fishery fall within the Montebello/Barrow islands region. Prawn trawling is generally restricted to inshore areas near the mainland coast and west of the costal island chain between Cape Preston and Onslow but it is not currently fished.

A shipping lane/fairway exists within the vicinity of the proposed drilling program connecting Barrow Island with the Port of Dampier and Cape Preston Iron Ore Terminal Anchorage with passage north along the coast and from offshore to the north of the Montebello Islands.
Shipping lane/fairways include:

- Barrow Island to Pilbara Port – transiting along the coast;
- Offshore east of Montebello Islands transiting North; and
- Cape Preston Iron Ore terminal east of prospect locations and intersects shipping fairway along the coast from Barrow Island.

Other tenures include:

- Oil and gas pipelines – there are a number of subsea pipelines and wellhead platforms/monopods in the vicinity of the Gorgon Development, including:
    - Chevron Australia export pipeline located within the Barrow Island Port boundary; the Apache Energy East Spar; Wonnich, Harriet, and Double-Island pipelines (with their associated topside monopods and wellhead platforms); and
    - Two export natural gas pipelines running between Varanus Island and the mainland.
- Cape Preston Iron ore terminal (CITIC Pacific Mining) and transhippers operating approximately 20km offshore loading ships at the Transhipment Facility.

3.3 (m) Any proposed land/marine uses of area

The Project area does not overlap with any marine parks or reserves.

4 Environmental outcomes

No marine fauna injury caused by vessel collision

Removal of individuals from a population can occur due to injury and motility as a result of a vessel collision. Limiting the potential for a collision to impact a population of whales or whale sharks and turtles benefits MNES by reducing any contribution to cumulative impacts in the region reducing population sizes over time. This contributes to ensuring the survival of these threatened and endangered species in the region.

Baseline Data

The busiest Australian ports, in terms of tonnes of cargo handled are Dampier, Newcastle, Port Hedland, Hay Point, Gladstone, Port Walcott, Port Kembla, Brisbane, Melbourne and Sydney (Bureau of Transportation and Regional Economics 2003). Barrow Island Port handles very few ships and very little cargo volume in comparison to these ports. There are several other tenures:

- Recommended track – this is the recommended path for shipping movements according to surveyed conditions.
- Prohibited entry areas – these exclusion zones are around wells, platforms and other oil and gas infrastructure and vary between 4.5-9 nautical miles but do not overlap with CVN prospects.
- Oil and gas pipelines – there are a number of subsea pipelines and wellhead platforms/monopods in the vicinity of the Gorgon Development, including:
- Chevron Australia export pipeline located within the Barrow Island Port boundary; the Apache Energy East Spar; Wonnich, Harriet, and Double-Island pipelines (with their associated topside monopods and wellhead platforms); and
- Two export natural gas pipelines running between Varanus Island and the mainland.
- Cape Preston Iron ore terminal (CITIC Pacific Mining) and transhippers operating approximately 20km offshore loading ships at the Transhipment Facility.

There are also gas and oil processing and storage facilities on Thevenard and Varanus islands. Other oil and gas developments are located to the south (Griffin, Thevenard, Crest, Roller, Saladin and Yammaderry) as well as to the north (Goodwin, N. Rankin, Perseus, Cossack, Stag and Wandoo).

Salt production is another major industry in the Dampier area. Dampier Salt Ltd. holds a 15,000 ha lease, between Karratha and Dampier, in which evaporation ponds have been constructed. The Dampier Salt operation produces 3.7 million tonnes of salt per year, valued at $60 million. Fifty per cent of the salt produced in Dampier is exported to Japan and the remainder goes to south East Asia, Europe, America and a small amount to Africa. Dampier Port is the largest port by tonnage in Australia with over 177 million tonnes of product worth exported in 2013 to 2014. The boundaries of Dampier Port encompass Mermaid Sound and include waters to the north, which are used for anchorage of large vessels. The Port also includes the waters between Enderby Island to the north and Eaglehawk and Low islands to the south. The majority of the cargo shipped from this Port is the result of the operations of Hamersley Iron, Woodside Energy and Dampier Salt, all of which operate private wharves.

The Parker Point and East Intercourse Island wharf facilities are operated by Hamersley Iron and can accept vessels up to 150,000 and 320,000 dead weight tonnes respectively. In addition to the private wharves, the PPA manages a public wharf which is located near Phillip Point and maintains responsibility for safety issues in Hampton Harbour where there is a small marine facility exists serving both commercial and recreation vessels. There is also a small coastal harbour at John's Creek, Point Samson. A shipping lane/fairway exists within the vicinity of the proposed drilling program connecting Barrow Island with Cape Preston Iron Ore Terminal Anchorage with passage

north along the coast and from offshore to the north of the Montebello Islands. Vessels en route from the Port of Dampier join this fairway. Shipping lane/fairways include:

- Barrow Island to Pilbara Port – transiting along the coast;
- Offshore east of Montebello Islands transiting North; and
- Cape Preston Iron Ore terminal east of prospect locations and intersects shipping fairway along the coast from Barrow Island.

Degree of Confidence

Given the presence of an MFO during vessel operations and related rig activity and the use of environmental inductions for crew a high degree of confidence exists that there will be no unplanned marine fauna interaction or collision. The ability to document evidence of use of a shipping fairway and recommended track between Dampier and the prospect sites using vessel log books, the presence of marine fauna kit, certification of an MFO, vessel induction records and fauna observation records and reporting supports this level of confidence. The relevant Performance Standard is presented in **Table 10.**

Table 10. Unplanned marine fauna interaction or collision – Environmental Performance Standards, Objectives and Measurement Criteria.

Performance Objective:	No marine fauna injury caused by vessel collision
Environmental Risk:	Unplanned marine fauna interaction or collision

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Marine fauna observation	• During activity at least 1 MFO onboard the support vessel observing for marine fauna during all daylight hours	• Persons on board (POB) list indicated MFO presence MFO training and experience records
Vessel operation	• All vessels must not: Travel at greater than 6 knots within 300m (caution zone) of a cetacean or whale shark known to be in the area Approach closer than 100m of a cetacean or whale shark known to be in the area Change course or speed if a dolphin approaches the vessel or comes within 100m	• Vessel and marine fauna interaction details contained in the MFO final report • Marine fauna interactions recorded in the vessel log
Fauna observation kits	• Fauna observation kits (including as a minimum binoculars and fauna observation recording sheets) available on all vessels	• Fauna observation kit presence
Crew training	• All crew must attend an environmental induction containing basic information on procedures to manage interactions between vessels and marine fauna	• Environmental induction material and attendance records

Vessel/rig machinery used and maintained to minimise noise emissions to marine waters

Limiting the disruption of behaviour or the potential to damage the hearing of whales, whale sharks and turtles will mitigate against any contribution to changes in habitat preference and migration routes in the region for threatened or endangered species. This benefits MNES by ensuring the activity does not contribute to a decline in species presence in the region.

Baseline Data

Borehole seismic surveys using an airgun are now among the most versatile of all downhole measurement techniques used in the oil field (Blackburn et al., 2007). Information is derived about reservoir depth, extent and heterogeneity, as well as fluid content, rock properties, pore pressure oil recovery process and fracture characteristics. For an airgun, pulses are composed of predominantly low frequencies (< 300Hz) with individual airgun signals as high as 250dB re 1uPa(rms) at 1m.

Since the airgun is focused vertically more intense sounds are propagated in the vertical direction rather than the horizontal direction. Zero offset Vertical Seismic Profiling (VSP) receivers are deployed in a vertical array spaced up to 150ft apart in the vicinity of the well. In most cases only a narrow window around the borehole is needed to acquire reflections. Signals are summed and the trace duplicated several times to yield velocities of formations at different depths. This is tied to well log properties and interpreted for prediction and detection of over pressurised zones. Zero offset VSPOs can also be used for deviated wells (horizontal drilling).

A semi-submersible drilling rig operates in a similar manner to a Jack-up rig and can provide information about the combined noise of drilling and operating bow thrusters. For example the perceived underwater noise from the Jack Bates semi-submersible drilling rig was measured at 100m depth under the rig for species listed in **Table 11**. For both killer whales and harbour seals perceived noise levels at 100m depth were 91 and 86 dB respectively. Perceived noise is defined as noise above threshold levels of hearing for an animals.

Table 11. Perceived noise of animals at 100m below semi-submersible drilling rig where perceived noise is measured relative to the threshold level of hearing for a species.

	Killer whale (dB)	Harbour seal (dB)	Harbour porpoise (dB)
Drilling	91.1	70.1	86.3
Not drilling	87.5	67.5	84.4
Not drilling and no thrusters	85.6	67.1	83.9
Not drilling and thrusters	88.7	67.8	84.7

Similarly, for the drill ship West Navion transect sound measurements were measured outward at intervals of 500, 1,000, 2,000, 5,000 and 10,000 m on the sea surface and at 50, 100 and 200 m depth with 6 transects for each range and depth. For a harbour porpoise, harbour seal and killer whale, out to 2000 m there is an increase in perceived noise levels from the drill ship but then it settles to a relatively constant value. The perception of noise is not influenced by the use of bow thrusters and general drilling activities have a perceived sound that is lower than other biological noise common to the marine environment (**Table 12**).

Marine vessels typically produce low frequency sound (<1Khz) from the operation of machinery onboard, flow noise around the hull, propeller cavitation, which is typically the dominant noise (Ross, 1987, 1993). Most sounds are broadband although tones are associated with harmonics of propeller blades. Noise levels can range from less than 160dB re 1uPa @ 1m (trawlers) to over 200 dB re 1uPa @ 1m (super tanker) (WCDS, 2003). A 64m rig tender vessel underway had a broadband source level of 177dB re 1uPa. Peak noise is expected to be confined to the immediate vicinity of the vessel and Rig operations within a radius of a few hundred metres.

Compression waves emitted from point sources or frequency sweep sources have the potential to impact marine life, in particular whales in close proximity to the source (Richardson et. al., 1985). Effects can be physical, perceptual or behavioural. At close range physical damage can occur while at increasing distance from the source noise attenuates grading downward form permanent hearing loss to temporary hearing loss and ultimately avoidance of the sound. To date there is no direct evidence of these effects at low and high frequencies occurring in marine mammals such as whales and dolphins as a consequence of normally operating seismic surveys or other sound sources.

Depending on the time of year of drilling, acoustic disturbance to marine fauna could occur from vessel noise and airgun noise from seismic profiling. However, given that noise levels for vessels will be lower than 200dB re 1uPa @ 1m and for an airgun, pulses are composed of predominantly low frequencies (< 300Hz) with individual air gun signals as high as 250dB re 1uPa(rms) at 1m, and that dynamic positioning thrusters and drilling noise perception is low relative to other biological noise, it is likely that impacts to marine megafauna will be less than the natural noises summarised in **Table 12.**

Table 12. Comparison of sound intensity and frequency of sources.

FUNCTIONALITY		
Source	**Sound intensity (dB re 1uPa @ 1m)**	**Frequency (Hz)**
Undersea earthquake	272	50
Seafloor volcanic eruption	255+	Varied
Lightning strike (sea surface)	250	Varied
Sperm whale clicks	Up to 235	100-30,000
Bottlenose dolphin clicks	Up to 229	Up to 20,000
Breaching whale	200	20
Blue whale vocalisation	190	12-400
Humpback whales (fluke and flipper slaps	192	30-1200
Ambient sound	80-120	Varied
Ships	177	5-100
Seismic	215-230	10-300
Drilling rig (operating)	169	NA
Drilling rig (not operating)	146	NA
References: APPEA, 2006; Thomson et al., 1986; WCDS, 2003; Pidcock et al., 2003; Nedwell and Evans, 2004		

Under the EPBC Act Policy Statement 2.1 background paper (Interaction between offshore seismic exploration and whales) the policy adopts an energy measure threshold of 160dB at 1 uPa2.s (energy flux density) for a single seismic shot at 1km. This is used to determine whale exclusion zones, where seismic surveys must lower their acoustic power output, or shut down completely, in order to prevent significant exposure to sound levels that could induce temporary threshold shift in whales (temporary hearing loss). Sound Pressure Levels (SPLs) from air gun shots that fall below this threshold can operate below this exclusion zone, while if above it the exclusion zone has to extend to 2 km.

Potential impacts from vessel noise in and around rig operations are unlikely to be greater than that from existing vessel traffic in the vicinity of the operational area from other commercial activities. It is also likely that the potential for significant impacts to marine fauna would only exist within a few metres of the sound source (propellers and hull) and given that vessels would be continually operating within the operational area, the likelihood is that marine fauna would avoid approaching the vessels and rig.

Degree of Confidence

Given the presence of an MFO during vessel operations and rig VSP and the use of environmental inductions for crew a high degree of confidence exists that there will be no unplanned marine fauna interaction involving noise emissions. Adhering to the EPBC Policy Act 2.1 requirements while also ensuring that machinery and equipment is maintained in accordance with the manufacturer's specifications and the vessels and rigs planned maintenance system will assist in this regard. The ability to document evidence through use of maintenance records and vessel log books, marine fauna kit, certification of an MFO, vessel induction records and fauna observation records and reporting supports this level of confidence. The relevant Performance Standard is presented in **Table 13**.

Table 13. Acoustic disturbance to marine fauna from vessel/rig operations – Environmental Performance Standards, Objectives and Measurement Criteria

Performance Objective:	Vessel/rig machinery used and maintained to minimise noise emissions to marine waters No adverse Vessel/rig interactions with cetaceans and whale sharks
Environmental Risk:	Acoustic disturbance to marine fauna from vessel operations.

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Airgun operation	• EPBC Act Policy Statement 2.1 • Soft starts are used • Low power zone maintained at 2km from the acoustic source	• Rig and marine fauna interactions details contained in the MFO final report • Rig and marine fauna interactions recorded in the rig log
Machinery maintenance	• Vessel machinery maintained in accordance with the manufacturers specifications and the vessels planned maintenance system	• Vessel/rig machinery maintenance schedule • Machinery maintenance records
Vessel operation	• All vessels must not: Travel at greater than 6 knots within 300m (caution zone) of a cetacean or whale shark known to be in the area Approach closer than 100m to a cetacean or whale shark known to be in the area. Change course or speed if a dolphin approaches the vessel or comes within 100m	• Vessel and marine fauna interactions details contained in the MFO final report • Marine fauna interactions recorded in the vessel log
Marine fauna observation	• At least one MFO onboard the support vessel for the duration of the drilling program during whale season observing for whales and whale sharks during all daylight hours • MFOs onboard the vessel experienced in whale and whale shark observation, distance estimation and reporting	• Person onboard list indicates MFO presence. • MFO training and experience records
Crew training	• All crew must attend an environmental induction containing basic information on procedures to manage interactions between the supply Vessel/Rig and marine fauna	• Environmental induction material and attendance records

No flying within 500m of a cetacean or whale shark unless in an emergency

Limiting the disruption of migratory behaviour, feeding and mating of whales and whale sharks will ensure these species maintain traditional transitory routes between feeding and calving grounds in the region. This benefits MNES by limiting the potential exposure to the increased risk of alteration of migratory, transitory and feeding or foraging behaviour that may impact on the wider population.

Baseline Data

Helicopters will be used for crew changes during drilling there will be no helicopter refuelling on-board the rig and no helicopter operations at night. Strong underwater sounds are detectable only briefly when the helicopter is directly overhead (Richardson et al., 1995). The noise level underwater depends on the source altitude and lateral distance, receiver depth and water depth.

Sound emitted from the source is typically below 500 Hz and sound pressure in the water directly below quickly diminishes with depth. An audible helicopter sound passing overhead for 4 minutes equates to 38 seconds a 3m depth (Greene, 1985, Richardson et. al., 1995). A Bell 212 helicopter flyover is 162 dB re 1uPa and for a Sikorsky-61 is 108 dB re 1uPa at a distance of 305m away (WCDS, 2003).

Dependant on the time of drilling, noise from helicopters supporting the operation may have localised and temporary impact on birds, cetaceans and potentially other marine fauna. Reactions of cetaceans to circling aircraft may be conspicuous if below an altitude of 300m, is uncommon at 400m and usually undetectable at 600m (NMFS, 2001).

Baleen whales may dive or turn away during overflights but the effect on whales in general seem transient (Richardson and Malme, 1993, Leatherwood et al., 1981). Marine turtles of all ages will dive at the approach of an overhead helicopter at 500ft (K. Pendoley pers. Obs.). Roosting and nesting seabirds are driven into the air by helicopters flying overhead potentially risking collisions with the aircraft, reducing their energy levels and exposing eggs and chicks to predation or dehydration.

The Commonwealth government regulates aircraft operations and all helicopters used have to comply with the Civil Aviation Safety Authority Regulations 1998 that include air worthiness requirements. Potential impacts are no greater than that from existing helicopter traffic in the vicinity of the operational areas (transfer from other oil and gas activities).

Crew changes will not be frequent so there will be limited helicopter traffic associated with the drilling activity. There is no evidence to suggest that helicopters flying overhead have significant behavioural or physical impacts to marine fauna.

Degree of Confidence

Given the presence of an MFO during vessel operations and the use of environmental inductions for crew a high degree of confidence exists that there will be no unplanned marine fauna interaction involving noise from helicopters.

Helicopters whilst not performing either take-off or landing procedures or, involved in an emergency or training exercise must not fly lower than 500m within a 500m radius (ie no fly zone) of a cetacean or whale shark or hover over a no fly zone. The relevant Performance Standard is presented in **Table 14.**

Table 14. Acoustic disturbance to marine fauna from helicopter operation – Environmental Performance Standards, Objectives and Measurement Criteria

Performance Objective:	No flying within 500m of a cetacean or whale shark.
Environmental Risk:	Acoustic disturbance to marine fauna from helicopter operation.

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Helicopter operation	• Helicopters whilst not performing either take-off or landing procedures or, involved in an emergency or training exercise must not: Fly lower than 500m within a 500m radius (ie no fly zone) of a cetacean or whale shark. Hover over the no fly zone	• Helicopter and marine fauna interaction details contained in the MFO final report

Vessel/rig lighting onto marine waters limited to navigational and safety requirements

Limiting the potential for rig and vessel lighting to 'attract' birds to the area and alter turtle orientation behaviour will ensure the drilling campaign does not contribute to alternation of behaviour, or injury and death of seabirds and turtles. This benefits MNES by limiting the potential for the drilling campaign to contribute to population level effects that may alter breeding and nesting behaviour long-term.

Baseline Data

Depending on the time of year of drilling, lighting on the rig and vessels operating offshore has the potential to affect marine fauna, including turtles, seabirds, fish and mobile invertebrates such as squid. Artificial light may disorientate turtle hatchlings leaving the nest and increase the risk of predation. Fish and invertebrates can be attracted to offshore lighting and exposed to predation. Seabird behaviour can be affected as they take advantage of feeding opportunities related by the artificial light source.

Point source lighting impacts are unlikely to be significant given the short duration of the drilling campaign and the drilling is a considerable distance from turtle nesting beaches and bird rookeries. The operational area does not contain any critical habitat. Potential impacts are expected to be localised and temporary.

Recent in-house studies by Pendoley Environmental light modellers suggest that light point sources of a similar scale used on a drilling rig will appear as a relatively small area of dim light (equivalent to an area ~5° across and as bright as the full moon) on the horizon over a distance of 10 – 15km. This low intensity of light minimises potential impacts on hatchling orientation.

The nesting beaches in the vicinity of the proposed drilling prospects are located between 16km (Lowendal) and 73km (Eaglehawk Island Dampier Archipelago) distant. The visibility of the lights and the glow from the drilling rig at the nearest rookery on the Lowendal Islands are expected to be relatively minor over the 16km distance and undetectable from star light over distances in excess of 30km.

Fledgling wedge tailed Shearwaters are the most sensitive age class for this species and it is possible they may be attracted by light from a drilling rig over 16km. If a bird were to fly out and investigate the light they are able to land on the rig and fly away when the sun rises the following morning.

Degree of Confidence

Given the presence of an MFO during vessel and rig operations and the use of environmental inductions for crew a high degree of confidence exists that there will be no unplanned marine fauna interaction involving lighting from the rig and vessel(s). Lighting will be in accordance with AMSA Marine Orders and night-time in sea equipment inspection will be avoided if possible. The relevant Performance Standard is presented in **Table 15**.

Table 15. Artificial lighting impacts to marine fauna – Environmental Performance Standards, Objectives and Measurement Criteria.

Performance Objective:	Vessel/Rig lighting onto marine waters limited to navigational and safety requirements
Environmental Risk:	Artificial lighting impacts to marine fauna

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Deck lighting operation	• Deck lights are switched off and spot lights directed inboard unless inconsistent with: AMSA Marine Orders Part 23: Prevention of Collisions. AMSA Marine Orders Part 21: Safety of Navigation and Emergency Procedures A vessel master safety directive	• Daily vessel lighting inspection checklist • Vessel maintenance records indicate that deck lighting has been directed inboard • Records contained in the vessel log pertaining to lighting safety requirements • Documentation of birds landing on the rig • Documentation of in water fauna behaviour
In-sea equipment inspections.	• Night-time In-sea equipment Inspections avoided if practicable to reduce direct lighting onto marine waters	• Written records of vessel equipment inspection planning meetings • Documentation of in water fauna behaviour

No spill of hydrocarbon to the marine environment

Limiting the potential for an oil spill to occur will stop released hydrocarbons from smothering or coming into contact with MNES regionally and will ensure the potential for population level impacts due to a decreased ability to breed and contribute to subsequent generations is mitigated against. Furthermore, any potential impact on heritage and cultural values in the region is reduced.

Baseline Data

Seabirds are vulnerable to oil spills due to the amount of time they spend on or near the surface of the sea and on foreshores. Shorebirds are most likely to encounter oil within the inter-tidal zone and onshore due to their feeding habits. Seabirds may also come in contact with oil spills while searching for food, since several species of fish are able to sur vive beneath floating oil (AMSA, 2010c).

Seabirds are considered to be significantly affected by oil spills from the direct toxicity of oil; direct oiling of foraging seabirds resulting in fatalities; a reduction in the availability of prey due to exposure of fish eggs and larvae to oil slicks and sheens; degradation of breeding habitat for ground-nesting seabirds; hypothermia; dehydration; and an increased risk of predation (AMSA, 2010c).

Chemicals used to disperse oil pollution can themselves be toxic to marine life (AMSA, 2011b). In addition, even at very low levels, petroleum-based products have been shown to kill seabirds in the embryonic phase (AMSA, 2010b).

Marine mammals may be susceptible to indirect toxic effects through ingestion of contaminated prey. Baleen whales, which skim the surface, are more likely to ingest hydrocarbons than toothed whales, which are 'gulp feeders'. Of the species potentially impacted, humpback whales and blue whales migrating south from their calving grounds are the most vulnerable.

The isolated distribution of inshore dolphin populations and low numbers of animals at many sites means that a spill that affects a biologically important area for any of these species could have population-level impacts due to displacement, loss of habitat, loss of access to prey and/or death of individual dolphins.

The coincidence of large dugong populations and their habitats, and extensive oil and gas exploration and production in the North-west Marine Region is of potential concern for dugongs. While there is little evidence of a substantial impact on dugongs within the region at present and the effects of oil spills on seagrasses may not persist for long periods (e.g. Kenworthy et al., 1993), oil pollution may result in dugong mortality and/or loss of seagrass habitat.

Being air breathers, sea snakes are vulnerable to injury or mortality from oil on the sea sur face (AMSA 2010a; Watson et al. 2009). Oil, its residue and chemicals used to disperse it can be either inhaled or ingested (Gagnon 2009).

Shore birds, bird eggs, adult and juvenile turtles and hatchlings may be impacted by exposure to beached hydrocarbons. Shore birds, turtles, turtle hatchlings and eggs are vulnerable to accumulation of weathered oil along shorelines at certain times of the year. Impacts may occur from physical smothering or acute toxicity from ingestion.

Seasonal presence of sensitive receptors

Quantifying the environmental impact of drilling activities on regional ecosystems and habitats is difficult and will vary depending on seasonality, migration, reproductive success, recruits from previous breeding seasons, food availability, sea temperature, seasonal ocean currents, cyclonic activity and changes in climate etc. Risks to key sensitivities in the region are summarised in **Table 16.**

Table 16. Risks to key sensitivities.

Resource	Impact assessment
Mammals	Whales, dolphins, seals, sea lions, sharks and dugongs are at risk of surface oil when surfacing and by consuming tainted food or by a reduction in the availability of food. Seals are particularly vulnerable to the impacts of oil smothering because of their fur structure and their use of haul outs.
Birds	Birds using the water-air interface are at risk of surface oil, particularly divers. Oiled birds are at risk of hypothermia and oil ingestion following preening. Treatment requires specialist expertise. Recovery of populations depends either on the existence of a pool of young non-breeding adults from which breeding colonies can be replenished, or a high reproductive rate.
Fish and commercial fishing	Adult fish tend to swim away from oil. Adult fish in fish farm pens may be killed, or at least made unmarketable because of tainting. Eggs and larvae in shallow bays may suffer heavy mortalities under slicks. Post-spill recovery often enhanced most by exclusion of commercial fishing pressure during a response.
Invertebrates	Invertebrates include shellfish (both molluscs and crustaceans), worms of various kinds, sea urchins and corals. All these groups may suffer heavy casualties if coated with oil. In contrast, it is quite common to see barnacles, periwinkles and limpets living on rocks in the presence of residual weathered oil.
Planktonic organisms	Serious effects on plankton have not been observed in the open sea. This is probably because high reproductive rates and immigration from outside the affected area counteract short-term reductions in numbers caused by the oil.
Larger algae	Oil does not always stick to the larger algae because of their mucilaginous coating. When oil does stick to dry fronds on the shore, they are sensitive to breakage by the waves and secondary contamination increases for the microorganisms living on them. Intertidal areas denuded of algae are usually readily repopulated once the bulk oil has been removed. Many algae are of economic importance either directly as food, or for products such as agar. Algae cultured for this purpose lose their commercial value if tainted.
Marsh plants	Some species of plant are more susceptible to oil than others. Perennials with robust underground stems and rootstocks tend to be more resistant than annuals and shallow rooted plants. If, however, perennials are killed, the first plants to recolonise the area are likely to be annuals. This is because annuals produce large numbers of tidally dispersed seeds.
Mangroves	The term 'mangrove' applies to several species of tree and bush. They have a variety of forms of aerial breathing roots 'neumatophores' which adapts them for living in fine, poorly oxygenated mud. They are very sensitive to oil because oil films on the breathing roots inhibit the supply of oxygen to the underground root systems, reduces their ability to maintain salt balance. Even light oiling can result in defoliation and mortality.
Marine reptiles	The impacts of oil to turtles, sea snakes and crocodiles (in near-shore areas) at sea are not known, although they may be able to detect and avoid small slicks like marine mammals. Greatest risks are posed to shoreline turtle nesting sites – high sensitivity during nesting (October to March) and hatching season (April to May).
Seagrass beds	Near-shore impacts through the smothering of leaves in shallow intertidal areas. Rapid recovery expected if oiling not persistent. Longer term impacts if oil impacts sediments and damages roots.
Coral reefs	Effects range from none on deep, well-flushed reefs to coral death in shallow water. Larval coral losses likely if present. Coral expected to be highly sensitive during mass spawning.

Degree of Confidence

Given the developed Performance Standards for the drilling campaign and the use of spill preparedness training and environmental inductions for crew a high degree of confidence exists that there will be no spill of hydrocarbons to the marine environment. The relevant Performance Standard is presented in **Table 17 and 18**.

Table 17. Non-routine oil spill due to well kick or blowout – Environmental Performance Standards, Objectives and Measurement Criteria.

Performance Objective:	No spill of hydrocarbon to the marine environment
Environmental Risk:	Non-routine oil spill due to well kick or blowout

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Rig blowout preventer	• Blowout preventer installed	• Equipment maintenance checklist Record of maintenance in rig log
Subsea Safety Valves	• Subsea Safety Valves to shut in well, and shutdown valves to minimise amount released	• Equipment maintenance checklist • Record of maintenance in rig log
Drilling profile	• Knowledge of drilling depths, strata and pressure changes prior to drilling • Mud system is the primary barrier	• Geological survey report on drilling location, including shallow gas study
Rig/Vessel Oil Spill Response	• Oil spill response executed in accordance with CVN OPEP	• Audit of the OPEP
	• Oil spill response executed in accordance with the vessels SOPEP as required under MARPOL 73/78	• Audit of the SOPEP
		• Current International Oil Pollution Prevention Certificate
Awareness and training	• All crew must attend an environmental induction containing basic information on spill response measures	• Environmental induction material and attendance records
	• Oil spill exercise conducted prior to the commencement of drilling	• Spill exercise recorded in Vessel/rig log

Table 18. Non-routine oil spill due to Vessel/rig collision – Environmental Performance Standards, Objectives and Measurement Criteria.

Performance Objective:	No spill of hydrocarbon to the marine environment
Environmental Risk:	Non-routine oil spill due to Vessel/Rig collision

FUNCTIONALITY		
Control measures	**Performance standards**	**Measurement criteria**
Navigational equipment and procedures	• Navigation equipment and vessel procedures compliant to AMSA Marine Orders Part 30: Prevention of Collisions and Marine Orders Part 21: Safety of Navigation and Emergency Procedures	• Daily Vessel/Rig lighting inspection checklist
		• Environmental audit of navigational systems prior to mobilization
	• Vessel/Rig equipped with an automatic radar plotting aid (ARPA) system which can identify, track and project the closest approach for any vessel (time and location) within the operational area and radar range	• Environmental audit of navigational systems prior to mobilization
Stakeholder notification	• Australian Hydrographic Office (AHO) notified of operational areas, activities and durations at least six weeks prior to the drilling, which	• CVN correspondence to AHO

	triggers AHO to issue a Notice to Mariners	• AHO Notice to Mariners
	• Australian Maritime Safety Authority (AMSA) Rescue Coordination Centre (RCC) notified of operational areas, activities and durations two weeks prior to drilling, which triggers RCC to issue a AusCoast warning	• CVN correspondence to AMSA RCC • AMSA RCC AusCoast warning
Vessel bridge-watch	• Visual bridge-watch on all Vessel 24 hours per day	• Vessel Log of times and persons on watch
	• Crew undertaking vessel watch qualified in accordance with International Convention of Standards of Training, certification and Watch-keeping for Seafarers (STCW95), AMSA Marine Orders Part 3: Seagoing Qualifications or certified training equivalent	• Training records demonstrate current qualifications
Vessel supply/patrols	• At least one support accompanying drilling rig at all times to identify and deter possible vessel collision threats	• Records contained in vessel log
	• Support vessel maintains the requested 500m clearance zone around the rig when standing off	• Records contained in vessel log
	• Limitations on metocean conditions supply boats can unload in and monitoring of workboat location and activity when alongside the rig	• Records contained in vessel log
Fuel consumption	• Fuel tanks nearest hull are used first on transit from port to the drilling Rig operational area	• Fuel usage records • Records contained in vessel log
	• Fuel tanks nearest hull are empty before entering operational area	• Fuel usage records • Records contained in vessel log
Fuel transfer	• In the event of a tank rupture, fuel in the ruptured tank pumped to other tanks on the vessel	• Records contained in vessel log
Oil Spill Response	• Oil spill response executed in accordance with CVN OPEP	• Audit of the OPEP
	• Oil spill response executed in accordance with the vessels Shipboard Oil Pollution Emergency Plan (SOPEP) as required under MARPOL 73/78	• Audit of the SOPEP • Current International Oil Pollution Prevention Certificate
Awareness and training	• All crew must attend an environmental induction containing basic information on spill response measures	• Environmental induction material and attendance records
	• Oil spill exercise conducted prior to the commencement of drilling and then every three months after	• Spill exercise recorded in vessel log

5 Measures to avoid or reduce impacts

The Project is restricted to the permit areas; alternative locations for the Project undertaken by Carnarvon Petroleum as the permit holder are not permitted (Section 2.3).

An alternative time frame, location or activity is not proposed; however the anticipated Project duration (expected 3 months) may be extended, as the time frame for completion of works is dependent on rig availability and analysis of geophysical data as it is collected.

As such, the entire program may extend for more than 3 months, but will consist of discrete 16 day events at each well location.

Oil Spills and Initial Response

Measure

- No spill of hydrocarbon to the marine environment

Explanation of Effectiveness

A summary of how field personnel in the Emergency Response Group (ERG) will control a spill at its source by stopping or minimising the flow or release of hydrocarbons is present in **Table 19**.

A commitment to minimising the risk of any hydrocarbon release, implemented through project planning, including support vessel/Jack-up Rig selection, well design, well control procedures and use of Blowout Preventers' suitable for all conditions that may be encountered during the drilling campaign will ensure that the residual risk of a loss of well control is ALARP.

During normal drilling operations the hydrostatic pressure of the drilling fluid is greater than the pressure of the fluids in the formation. The maintenance of sufficient hydrostatic head exerted by drilling fluid to hold back the formation fluid pressure is termed as "Primary Well Control".

If due to any reason hydrostatic pressure in the well bore falls below the formation pressure, formation fluid may enter in the well bore.

If this happens, the primary well control may be temporarily lost and a proper use of blow out preventers and kill procedures will provide secondary well control. Secondary well control involves detection and safe handling of kicks so as to re-establish primary well control.

For a diesel spill from a vessel collision a number of source control strategies exist including:

- Transfer of fuel from ruptured tank to intact tanks;
- Shifting of water tanks and fuel tank contents to other tanks to alter buoyancy;
- Use of ballast tanks to shift hull breach to high side to slow or stop breach;
- Repair breach temporarily if possible and go alongside; and
- Placement of booming around the vessel to contain the spill.

In the event a vessel fuel tank is ruptured, cargo of the affected tank is to be secured via transfer to another storage area on-board the vessel, transfer to another vessel, through pumping in water to affected tank to create a water cushion (Tank water bottom).

Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will minimise the volume of fuel spilt.

Table 19. Summary of key source control strategies for each of the scenarios identified.

Scenario	Considerations	Actions
Blowout	In the event of a loss of well control event, multiple directional well trajectories will be generated to determine step out capabilities for possible relief well designs. Each well has multiple possible relief well surface locations that have already been assessed for shallow hazards to minimize shallow gas risk. Relief well locations will be selected based upon prevailing seasonal current and wind data	Plan a relief well
	Additional drill rigs for relief well drilling may be sourced by a Mutual Aid Memorandum of Understanding (MoU) – APPEA. The MOU is an agreement across APPEA members, to undertake reasonable endeavours to assist and cooperate with other signatories to provide mutual aid in the event of an emergency.	Organise another rig to drill relief well
	A capping stack may be sourced from the OSRL base in Singapore to plug the well and stem the flow of hydrocarbon from the well head.	Organise delivery and installation of capping stack
Well Kick	This process reviews the decision about which BOP to use for close-in and circulation. Other issues include the impact of varying drill-pipe lengths and tool joint space out in the BOP stack, cold mud viscosity/gels that mask shut-in casing pressure, and the potential for influx passing through the BOP stack prior to kick detection and shut-in.	Close in BOP
	The need to adjust choke pressure correctly for choke and kill (C&K) line friction when establishing circulation. Specifics include how to measure C&K line friction, the selection of circulation rate, ways to use the second C&K line, choosing between the "Driller's" and "Wait and Weight" method, lost return and blowout prevention, and recognizing that narrower mud weight/formation integrity margins may increase potential for lost returns or even underground flow.	Increase mud volume to choke and kill well
Vessel Collision	In the event a vessel fuel tank is ruptured, fuel of the affected tank is to be secured via transfer to another storage area on-board the vessel or transfer to another vessel.	Shift fuel of affected tank
	Trimming the vessel may also be used to avoid further damage to intact tanks. These actions will minimize the volume of fuel spilt through pumping in water to affected tank to create a water cushion (Tank water bottom).	Shift cargo and/or pump aboard water and alter ballast tank levels
	Use or deploy bunding and/or booms to contain spills that may arise due to collision and release of stored hydrocarbons, and from spills arising from machinery and equipment onboard. Bunded areas will minimize the volume of hydrocarbons escaping to marine waters.	Deploy/use bunding and/or booms to contain spill

Timeframe for the Measure

- Immediately Available Personnel and Equipment

Emergency Management Team (EMT) positions not filled by Carnarvon Petroleum personnel will be supplemented by access to additional personnel through membership with AMOSC.

The contractor rig Emergency Response Group (ERG) will assist the Carnarvon Petroleum EMT with carrying out initial actions and subsequent response arrangements using available equipment.

The contractor support vessel crew will assist the Carnarvon Petroleum EMT with carrying out initial actions and subsequent response arrangements using available equipment.

- Personnel and Equipment Available Within 6 Hours

AMSNOR provide rapid first strike oil spill response service for large and small projects in the Oil and Gas Hubs of Australia. A combination of NorLense equipment and fully trained crew of Australian Marine Services personnel is provided.

The minimal requirements for personnel to operate the AMSNOR equipment and a 24/7 dedicated response team allows mobilisation quickly if a pollution accident occurs. AMSNOR have certified technicians and personnel for commissioning, servicing and training of the NorLense Oil spill equipment based in Australia ready to support the client's 24/7.

As part of the Pilbara Port Oil Spill Contingency Plan, arrangements are in place for personnel to response to oiling of the Dampier Archipelago using available equipment. Through membership with AMOSC the Chevron Barrow Island and Quadrant Energy Varanus Island oil spill response teams can be stood up to defend offshore islands using available equipment.

- Personnel and Equipment Available Within 24 Hours

The WA State Response Team (SRT) is comprised of officers from Control Agencies, Support Agencies and other stakeholder agencies located in the Metropolitan region. Activation of the SRT is through the Jurisdictional Authority.

The National Response Team (NRT) comprises experienced personnel who can be seconded from Commonwealth/State/NT agencies and industry. NRT members are managed, trained and seconded through AMSA. Requests to AMSA for Activation of the NRT is through the Jurisdictional Authority.

Through membership with AMOSC, Carnarvon Petroleum has access to Tier 3 equipment that can be deployed to site within 24 hours of notice. Access to AMSA resource such as dispersants and their application through aerial spraying is also available. Both AMSA and AMOSC also stockpile Oiled Wildlife Response equipment. Toll Logistics and Braemar Howells are also able to provide trained personnel to participate in oil spill response.

Escalation of Oil Spill Response

Net Environmental Benefit Analysis (NEBA) is a decision-making process used to identify and prioritise key sensitivities vulnerable to a hydrocarbon impact. Additionally, NEBA takes into account the advantages, limitations and added risks associated with individual oil spill response techniques and strategies. The following steps were conducted to complete a NEBA:

- Key ecological values, habitats/ecosystems and socioeconomic sensitivities were identified within the ZPI and shoreline impact areas in the Generic EP.
- Each of the identified sensitivities were given a priority ranking of either high, medium or low depending on the likelihood and severity of the potential impact of hydrocarbon and whether or not that sensitivity is listed as Threatened (T) or Migratory (M) under the EPBC Act.
- For each sensitivity, response options were evaluated to determine which are potentially viable (i.e. will result in an overall increased environmental benefit) and those that are not preferred because they will have an additional negative impact on that sensitivity.

NEBA is a multi-use tool that should be revisited regularly. In the event of a spill, the NEBA should be used to aid the following:

- Identification of sensitivities within the ZPI 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 with support of real-time metocean conditions, oil spill tracking and the availability of resources.

The NEBA matrix prioritises environmental sensitivities, and assesses the individual net effect that each response option may on it. This process enables the trade-off effect and provides the ability for an informed decision to be made. If there are conflicting outcomes for a particular response option then the sensitivity with the higher priority becomes the preferred response option.

Use of dispersants

Authorisation must be in place before proceeding with dispersant application. Written authorisation from WA DMP and permission from WA DoT as the designated HMA is required prior to dispersant application in State waters.

Use of dispersants increases the amount of entrained oil in the water column, which potentially shortens the times to threshold concentrations listed for entrained oil and dissolved PAHs outlined for locations and species identified as important for MNES.

Appropriateness of dispersant use will be reviewed at the time of a spill taking into account real-time modelling and current NEBA. CVN will use Finasol or Slickgone available from AMOSC and AMSA stockpiles. Alternatively, if another approved dispersant is approved and/or stockpiled by AMSOC and AMSA then Carnarvon Petroleum will use that. Activities involved in the application of dispersants include:

- Basic field testing;
- Aerial application;
- Vessel application; and
- In-situ SMART monitoring of application.

In addition to these activities, continual monitoring, evaluation and surveillance of dispersant application and effectiveness will continue throughout the response operations.

Note only agents listed on AMSA's Oil Spill Control Agent (OSCA) register as 'approved' dispersants, or grandfathered stock, may be used during a response.

Oiled Wildlife Response

In the event of a spill, a response will be activated commensurate to the size and level of risk in accordance with the Carnarvon Petroleum OPEP. The initial response actions will extend to the monitoring of the spill to determine whether there is the potential for impact to sensitive biological receptors and habitats, as well as shoreline assessment surveys to establish which locations are oiled, wildlife observed and access and logistics considerations.

In the event that there is an imminent risk to, or actual impacted wildlife observed, then the response strategies, based on the risk to wildlife may be implemented. The degree to which this activity will occur depends on an assessment of location and environmental conditions existing within the ZPI at the time of the spill.

Where oiled wildlife response is required, this will be determined through the planning team, in consultation with a potential OWR Advisor who has access to specialist knowledge and mobilisation capability which would be integrated into the overarching CVN response structure, who will brief Operations and liaise with the OWR coordinator at site on implementation.

While Carnarvon Petroleum will lead the incident control, it does not have the organisational capability to manage all aspects of wildlife response, and as such will take a collaborative approach with other agencies and industry. Engagement of an externally sourced OWR response capability is detailed in the bridging document to the Generic EP submitted to WA DMP. In the event of a spill requiring oiled wildlife response, an OWR Response team will be used to undertake response actions. These actions will be at the direction of the OWR Advisor engaged in an ongoing capacity.

6 Conclusion on the likelihood of significant impacts

6.1 Do you THINK your proposed action is a controlled action?

X	No, complete section 6.2
	Yes, complete section 6.3

6.2 Proposed action IS NOT a controlled action.

The proposed activity is not a controlled action as it is not likely to have a significant impact on any matter of national environmental significance for the following reasons:

- There are no World Heritage Areas, National Heritage Places, Wetlands of International Significance (Ramsar Sites) or Threatened Ecological Communities in close proximity to the well site.
- The Project area does not contain significant habitat for any Listed Threatened or Migratory species.
- The Project area does not overlap with known breeding or aggregation areas of humpback whales, blue whales and other EPBC-listed Threatened cetaceans.
- DE guidelines for minimising interactions with cetaceans will be adhered to during all activities in the marine environment.
- No significant impacts to other marine users and stakeholders have been identified.
- The jack-up rig and support vessels will be managed by reputable companies that possess all relevant international certificates (e.g. oil pollution, sewage, invasive marine species), quarantine clearances and management systems that support the implementation of the environmental commitments put in place for the Project.
- Carnarvon Petroleum will implement stringent management measures in accordance with EPBC Act Policy Statement 2.1 when utilising the VSP acoustic source to minimise noise impacts on marine fauna.

Specifically, performance standards have been developed that ensure adherence to EPBC Act Policy Statement 2.1 regarding seismic activity including;

- Acoustic disturbance to listed marine fauna from vessel and rig operations has been assessed (drilling, Vertical Seismic Profiling (VSP), rig noise, vessel prop noise, Dynamic Positioning (DP) thruster noise, and helicopter noise)
- VSP is localised specifically to the well rather than being a mobile source of sound;
- Observation zone, low power and shut down zones around the sound source for both cetaceans and turtles are as required;
- Drilling is not in marine conservation/park areas containing fauna of concern under Matters of National Environmental Significance;
- A vessel will not travel greater than 6 knots within 300m (caution zone) of a cetacean (or whale shark) known to be in the area;
- A vessel will not approach closer than 100m of a cetacean (or whale shark) known to be in the area; and
- If a dolphin approaches the vessel or comes within 100m the vessel master must not change the course or speed of the vessel suddenly.

Stringent management, including installation of BOPs during drilling in accordance with relevant regulations and strict procedural controls on all activities with the potential for hydrocarbon release, will be implemented during the Project to ensure the likelihood of a spill is minimised.

Consultation with DPaW focussed on worst case scenario oil spill planning and response implementation regarding both EPBC Act fauna and non-EPBC Act fauna under the Wildlife Conservation Act;

- Consultation with WA Department of Parks and Wildlife (DPaW) sought clarification of how response strategies for an oil spill were up or downgraded relative to the environmental sensitivity, including EPBC Act protected species (see Oil Pollution Emergency Plan - OPEP).
- Shoreline response and clean-up will be assessed and directed by wildlife experts from DPaW, taking into consideration the human health and safety implications of any response strategy.

Carnarvon Petroleum has assessed the presence of sensitivities in relation to drilling and Net Environmental Benefit Analysis (NEBA) for oil spill response as part of OPEP preparation and determined that with the identified control measures in place they are unlikely to be impacted.

6.3 Proposed action IS a controlled action

	Matters likely to be impacted
	World Heritage values (sections 12 and 15A)
	National Heritage places (sections 15B and 15C)
	Wetlands of international importance (sections 16 and 17B)
	Listed threatened species and communities (sections 18 and 18A)
	Listed migratory species (sections 20 and 20A)
	Protection of the environment from nuclear actions (sections 21 and 22A)
	Commonwealth marine environment (sections 23 and 24A)
	Great Barrier Reef Marine Park (sections 24B and 24C)
	A water resource, in relation to coal seam gas development and large coal mining development (sections 24D and 24E)
	Protection of the environment from actions involving Commonwealth land (sections 26 and 27A)
	Protection of the environment from Commonwealth actions (section 28)
	Commonwealth Heritage places overseas (sections 27B and 27C)

7 Environmental record of the responsible party

		Yes	No
7.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** Carnarvon Petroleum (Thailand) Ltd a wholly owned subsidiary of Carnarvon Petroleum Ltd successfully carried out an onshore drilling campaign onshore Thailand meeting all environmental requirements including zero discharge with zero incidents and no impact to the environment. Carnarvon will be using an experienced drilling contractor that is familiar with the region and can demonstrate a full understanding of the NOPSEMA and WA DMP standards for drilling offshore.	x	
7.2	**Has either (a) the party proposing to take the action, or (b) if a permit has been applied for in relation to the action, the person making the application - ever been subject to any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources?** **If yes, provide details** Not Applicable		x
7.3	**If the party taking the action is a corporation, will the action be taken in accordance with the corporation's environmental policy and planning framework?** Carnarvon Petroleum Ltd believes that HSE is paramount above all else, we strive to ensure we leave the environment as we found it and that all staff, contractors and community are protected in all that we do. We have developed a safety management system that aims for zero incidents. All our processes are developed to ensure the best safety practices are achieved and these are reviewed on regular basis. We communicate to all parties our safety culture and we audit all contractors to ensure they reach the same standard. Carnarvon is currently developing a drilling safety management system that will tie in with our OPEP and SMS.	x	
7.4	**Has the party taking the action previously referred an action under the EPBC Act, or been responsible for undertaking an action referred under the EPBC Act?** **Provide name of proposal and EPBC reference number (if known)**		x

8 Information sources and attachments

8.1 References

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8.2 Reliability and date of information

Source of the information

Information regarding the presence of Matters of National Environmental Significance was obtained through the EPBC Act Protected Matters Interactive Search Tool. This information was supplemented with results from a literature review. The information provided in **Section 2, 3, 4 and 5** is summarised from the Carnarvon Petroleum Ltd EP and OPEP submitted to the WA DMP and:

- APASA, 2014. Carnarvon Petroleum Drilling EP-490-491. Quantitative Spill Risk Assessment, and
- Department of Parks and Wildlife, 2014. Pilbara region Oiled Wildlife Response Plan. Western Australian Government.

Sources of information and data presented in **Sections 4 and 5** are referenced where appropriate and references are provided in **Section 8.1**.

How recent the information is

- Both the APASA OSTM and the DPaW Pilbara Oiled Wildlife Response Plan were published in 2014.
- The northwest bioregional marine plan and species report cards were published in 2012.
- Related references on baseline span from 2015 back to the 1980's.

How the reliability of the information was tested
All literature reviews and assessment and interpretation of OSTM with relevance to MNES was undertaken by suitably qualified and experienced personnel and led by a senior scientist with a PhD qualification in Environmental and Marine Science and 15 years' combined experience across industry, government and academia.

Any uncertainties in the information
There are none that the Proponent is aware of. Records from the EPBC Act Protected Matters Interactive Search Tool and Conservation Values Atlas have the caveats that are stated on entering the database.

8.3 Attachments

		✓ attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	In body of text – location of permit areas
	GIS file delineating the boundary of the referral area (section 1)	✓	Attached - prospect map
	figures, maps or aerial photographs showing the location of the project in respect to any matters of national environmental significance or important features of the environments (section 3)	✓	Sensitivity Map Report by RPS
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	X	N/A
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	X	Under assessment by WA DMP (Generic EP and OPEP)
	copies of any flora and fauna investigations and surveys (section 3)	X	Summarised in body of text
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	X	In body of text – Oil Spill trajectory modelling summary
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	X	In body of text – consultation feedback summary

9 Contacts, signatures and declarations

Project title:

9.1 Person proposing to take action

1. Name and Title:	Philip Huizenga – Chief Operating Officer
2. Organisation (if applicable):	Carnarvon Petroleum Ltd
3. EPBC Referral Number (if known):	
4: ACN / ABN (if applicable):	60 002 688 851
5. Postal address	Level 2, 76 Kings Park Road, West Perth, WA 6005, Australia.
6. Telephone:	08 9321 2665
7. Email:	phuizenga@cvn.com.au
8. Name of designated proponent (if not the same person at item 1 above and if applicable):	
9. ACN/ABN of designated proponent (if not the same person named at item 1 above):	

I qualify for exemption from fees under section 520(4C)(e)(v) of the EPBC Act because I am:

□ an individual; OR

□ a small business entity (within the meaning given by section 328-110 (other than subsection 328-119(4)) of the *Income Tax Assessment Act 1997*); OR

□ not applicable.

If you are small business entity you must provide the Date/Income Year that you became a small business entity:

I would like to apply for a waiver of full or partial fees under Schedule 1, 5.21A of the EPBC Regulations. Under sub regulation 5.21A(5), you must include information about the applicant (if not you) the grounds on which the waiver is sought and the reasons why it should be made:

□ not applicable.

Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence. I agree to be the proponent for this action. I declare that I am not taking the action on behalf of or for the benefit of any other person or entity.
Signature	 Date 01 Feb 2016

9.2 Person preparing the referral information (if different from 8.1)

Name	Andrew Morgan
Title	Environmental Advisor
Organisation	add isrm Pty Ltd
ACN / ABN (if applicable)	15 144 784 109
Postal address	Level 5, 1008 Hay Street, Perth, WA 6000
Telephone	08 9322 1180
Email	andrew.morgan@addenergygroup.com
Declaration	I declare that to the best of my knowledge the information I have given on, or attached to this form is complete, current and correct. I understand that giving false or misleading information is a serious offence.
Signature	 Date : 01 Feb 2016

REFERRAL CHECKLIST

HAVE YOU:

- ✓❑ Completed all required sections of the referral form?
- ✓❑ Included accurate coordinates (to allow the location of the proposed action to be mapped)?
- ✓❑ Provided a map showing the location and approximate boundaries of the project area?
- ✓❑ Provided a map/plan showing the location of the action in relation to any matters of NES?
- ✓❑ Provided a digital file (preferably ArcGIS shapefile, refer to guidelines at Attachment A) delineating the boundaries of the referral area?
- ✓❑ Provided complete contact details and signed the form?
- ✓❑ Provided copies of any documents referenced in the referral form?
- ✓❑ Ensured that all attachments are less than three megabytes (3mb)?
- ✓❑ Sent the referral to the Department (electronic and hard copy preferred)?

Attachment A

Geographic Information System (GIS) data supply guidelines

If the area is less than 5 hectares, provide the location as a point layer. If the area greater than 5 hectares, please provide as a polygon layer. If the proposed action is linear (eg. a road or pipline) please provide a polyline layer.

GIS data needs to be provided to the Department in the following manner:

- Point, Line or Polygon data types: ESRI file geodatabase feature class (preferred) or as an ESRI shapefile (.shp) zipped and attached with appropriate title
- Raster data types: Raw satellite imagery should be supplied in the vendor specific format.
- Projection as GDA94 coordinate system.

Processed products should be provided as follows:

- For data, uncompressed or lossless compressed formats is required - GeoTIFF or Imagine IMG is the first preference, then JPEG2000 lossless and other simple binary+header formats (ERS, ENVI or BIL).
- For natural/false/pseudo colour RGB imagery:
    - If the imagery is already mosaiced and is ready for display then lossy compression is suitable (JPEG2000 lossy/ECW/MrSID). Prefer 10% compression, up to 20% is acceptable.
    - If the imagery requires any sort of processing prior to display (i.e. mosaicing/colour balancing/etc) then an uncompressed or lossless compressed format is required.

Metadata or 'information about data' will be produced for all spatial data and will be compliant with ANZLIC Metadata Profile. (http://www.anzlic.org.au/policies_guidelines#guidelines).

The Department's preferred method is using ANZMet Lite, however the Department's Service Provider may use any compliant system to generate metadata.

All data will be provide under a Creative Commons license (http://creativecommons.org/licenses/by/3.0/au/)