Referral of proposed action

Project title: Kingtree–1 & Ironstone-1 Exploration Wells

1 Summary of proposed action

1.1 **Short description**

PTTEP Australasia (Ashmore Cartier) Pty Ltd (PTTEPAA) in its capacity as operator under the AC/P24 Joint Venture and owner of AC/P40, is proposing to drill two exploration wells: Kingtree-1, in permit area AC/P24; and Ironstone-1, in permit area AC/P40 (Figure 1). PTTEP Australia Timor Sea Pty Ltd (PTTEPAT) holds a 90% interest in the AC/P24 title with Bengal Energy Ltd holding the remaining 10% interest[1]. Permit area AC/P40 is 100% owned and operated by PTTEPAA.

The proposed wells are located in Commonwealth waters approximately 600 km west of Darwin, 765 km north-east of Broome and 250 km south of the Indonesian coastline (Figure 2). The exploration wells (the operation) are targeting an oil resource with a target drilling depth up to 1,500 mAHD below the seabed. The water depth at both well locations is approximately 105 m. The operation will be undertaken by the Ocean Patriot semi-submersible Mobile Offshore Drilling Unit (MODU), which is owned and operated by Diamond Offshore (Australia) LLC. No well testing is planned and the wells will be plugged and abandoned at the end of the operation.

Drilling is scheduled to commence in the third quarter (Q3) of 2011 and is expected to continue for a total of 21 days per well, subject to weather conditions and delays.

1.2 **Latitude and longitude**

Table 1 Proposed Surface location

	Latitude	Longitude
Kingtree-1 Location	11º 46´ 29.1" S	125º 23´ 23.8" E
	8 697 244 mN	760 451 mE
Ironstone-1 Location	11º 55´ 49.1" S	125º 16´ 19.1" E
	8 680 137 mN	747 448 mE

1.3 **Locality and property description**

The operation will take place in the Commonwealth waters within petroleum permit areas AC/P24 and AC/P40. The operation is located in the Timor Sea, approximately 600 km west of Darwin, and 765 km north-east of Broome (Figure 2). The operation is equidistant (approximately 250 km) from the Indonesian and Australian mainland. The permits are administered by the Northern Territory (NT) Department of Resources (DoR) as the Designated Authority.

The water depth at the permit location is approximately 105 m.

The specific well locations are more accurately defined by the coordinates presented in Section 1.2 above. Ironstone-1 is approximately 21 km south-west of Kingtree-1.

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

The proposed well sites will temporarily occupy a seabed area encompassing the well location and the footprint of the eight anchors required to anchor the Ocean Patriot in place (each disturbing approximately 25m^2 of seabed) during the drilling campaign. Notionally, the anchors will spread in an even radial pattern extending about 1,500m^2 from the Ocean Patriot centre. Based on this radial pattern, approximately 2.12 km^2 of seabed will be occupied during the operation.

1.5 **Street address of the site**

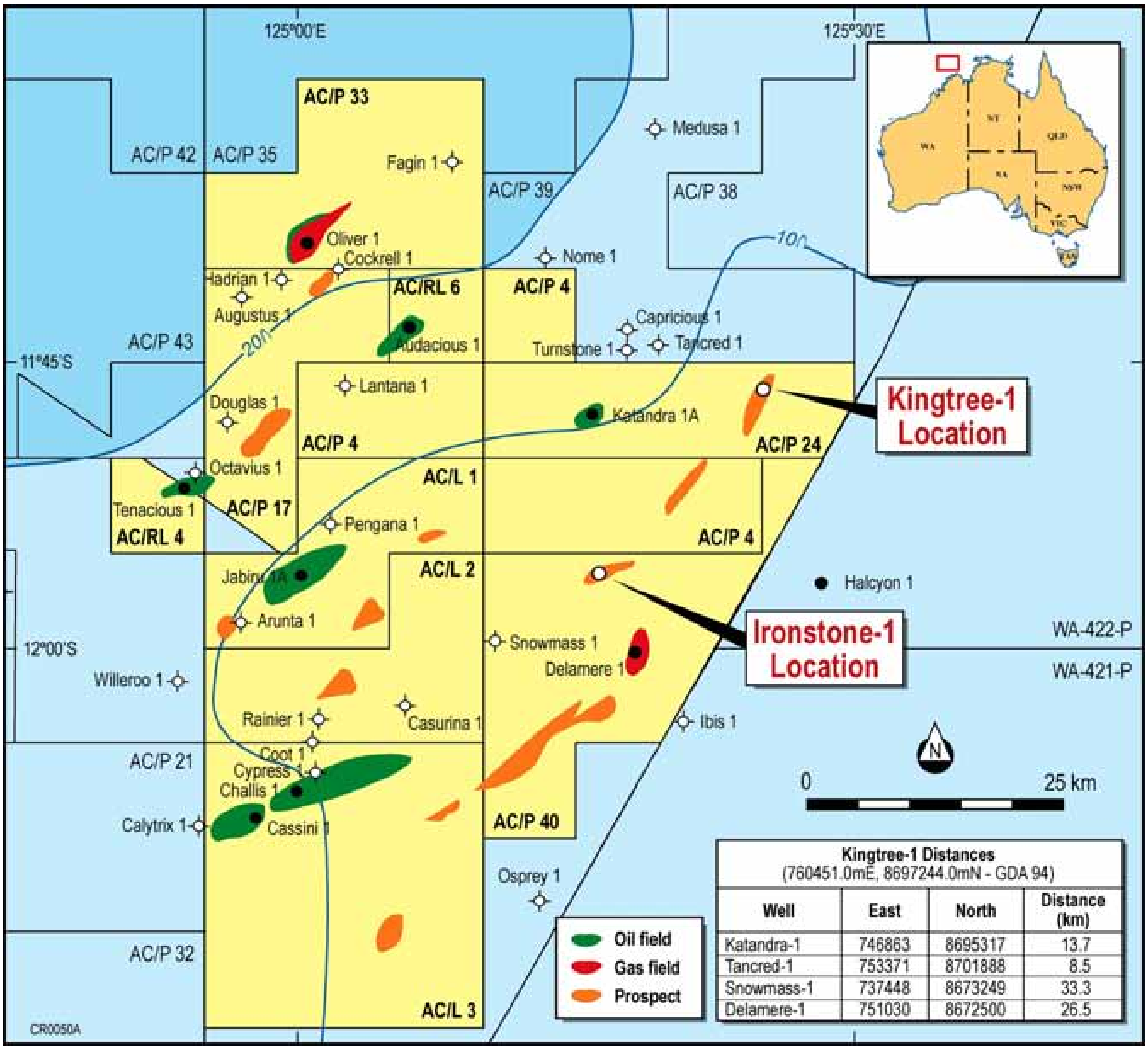
Not Applicable.

1.6 **Lot description**

Petroleum Permit AC/P24 and AC/P40.

[1] Nippon Oil Exploration (Dampier) Pty Ltd (Nippon) elected to withdraw from the AC/P24 exploration permit at the end of the permit year 4 (7 January 2011) and transferred its interest to PTTEP AT. Note, as at 23 March 2011 the Transfer has been approved but has not yet been registered.

1.7	**Local Government Area and Council contact (if known)**	Not Applicable.	
1.8	**Time frame**	Drilling is scheduled to commence in Q3, 2011, and take approximately 21 days per well. This timeframe may be extended if adverse weather conditions or other delays are encountered, however, as the operation is planned to be completed outside the cyclone season, this is not expected.	
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**	X	No
			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)



Kingtree-1 Distances
(760451.0mE, 8697244.0mN - GDA 94)

Well	East	North	Distance (km)
Katandra-1	746863	8695317	13.7
Tancred-1	753371	8701888	8.5
Snowmass-1	737448	8673249	33.3
Delamere-1	751030	8672500	26.5

Figure 1 Location and permit area

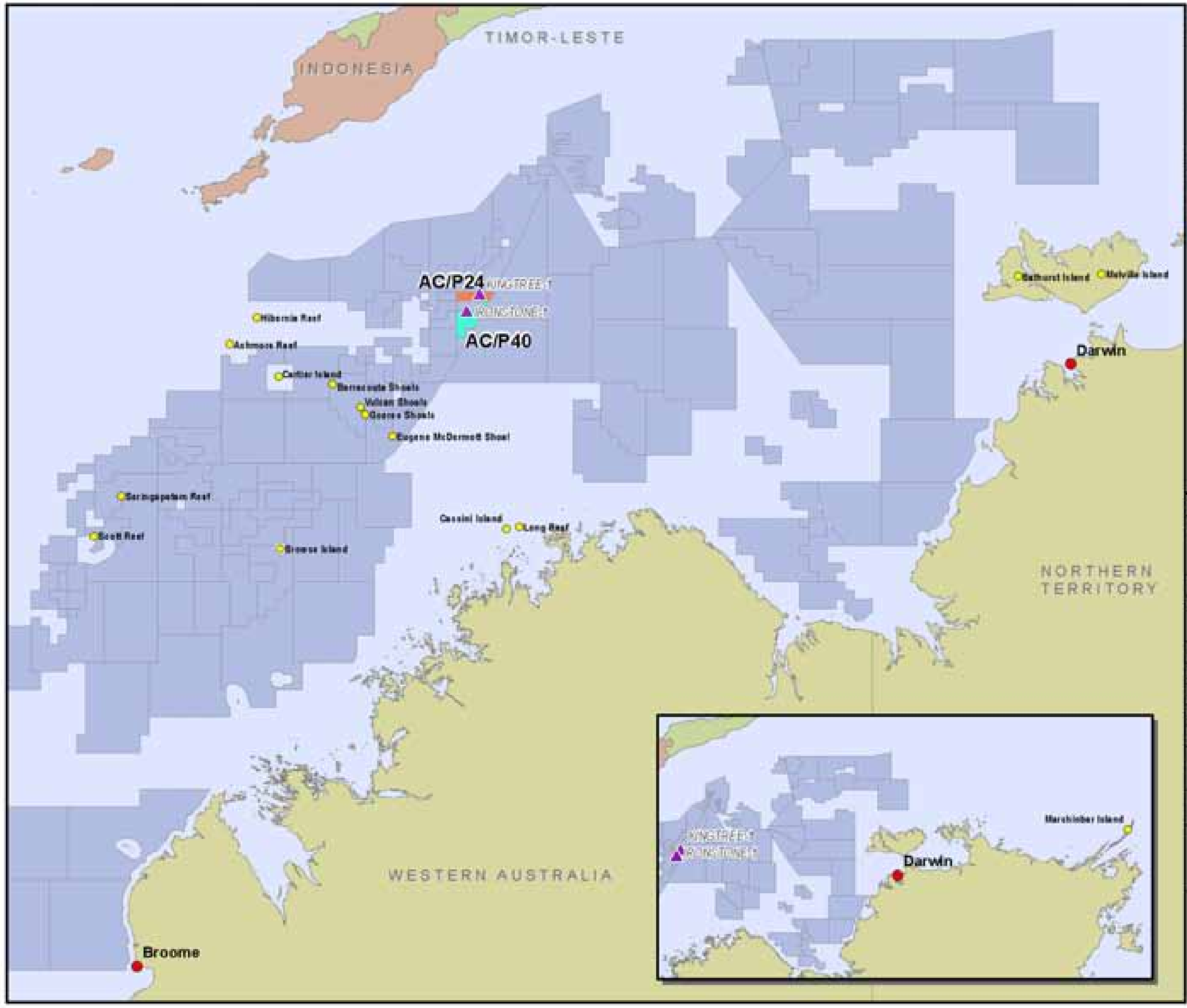


Figure 2

Regional Context

Client	PTTEP AAA		
Project	Kingtree-1 Exploration Drilling Program		
Drawing No	0119757p_G016_RD.mxd		
Date	14/03/2011	Drawing Size	A4
Drawn By	DN	Reviewed By	AT
Projection	GDA 94		
Scale	Refer to scale bar		

Maps and figures contained within this document may be based on third party data, may not be to scale and is intended for use as a guide only

2 Detailed description of proposed action

2.1 Description of proposed action

Description of MODU and Mobilisation

The drilling contractor selected to execute the operation is Diamond Offshore (Australia) LLC, a company incorporated in Delaware, and hereafter referred to as Diamond Offshore. Diamond Offshore currently operates 46 MODU's across the world. The semi submersible MODU 'Ocean Patriot' will be used to drill the wells, supported by the Diamond Offshore office based in Bentley, Perth, Western Australia (WA). The MODU was built in France in 1983 and can operate in water depths of up to 460 m and drill to depths of up to 9,150 m.

The Ocean Patriot obtains buoyancy and stability from pontoons located below sea level, which are ballasted and watertight. The operating deck is elevated above the sea level on 6 structural columns which connect the pontoons to the operating deck. The Ocean Patriot is held in place by 8 anchors. The Ocean Patriot has been operating in Australian waters since at least 2008 and will be mobilizing for this operation from other operations for PTTEPAA in the Timor Sea.

The Ocean Patriot will be mobilised to the drill sites in accordance with the move procedure implemented by Diamond Offshore. The MODU is likely to be towed with one anchor handling vessel (AHV) on tow bridle and a secondary AHV following the tow. The exact tow configuration is yet to be decided and is dependent on the final drilling schedule for the Ocean Patriot.

A site survey has been undertaken to investigate seabed conditions and the information gained will be used in the final positioning of the anchoring spread.

During drilling operations a standard 500 m safety exclusion zone will be in place. A Notice to Mariners will be issued for the operation and will be available to notify vessels which may be operating in nearby waters.

Target Formation Characteristics

The proposed Kingtree-1 exploration well is targeting oil potentially contained in a Triassic sequence between 1,300 and 1,400 mAHD[2] (primary target) and in Berriasian sands approximately 1,290 and 1,300 mAHD. The Ironstone-1 exploration well is targeting oil in the Upper Vulcan Formation between 1,338 and 1,358 mAHD (primary target) and the Pollard Formation between 1,358 and 1,458 mAHD.

The stratigraphy of all formations above the target formations has been determined to an accuracy of 25 m total vertical depth. The Kingtree and Ironstone prospects are located on trend with the Challis Oil Field and the target formations are capped by cretaceous shales. Geological analysis indicates that the wells will be of normal temperature (up to 70℃) and pressure (up to 2,216 psi)[3]. The geological information and reservoir characteristics for the two wells have been estimated from the results of seismic survey and by analysing the results of previous drilling in the area, particularly the Katandra-1a well, approximately 13 km west of Kingtree-1 and Delamere-1 , approximately 8 km south-east of Ironstone-1 (see Figure 1). These wells have a very similar target depth and stratigraphy to the Kingtree-1 and Ironstone-1 wells respectively and thus form a good analogy. A seismic anomaly at Kingtree-1, indicating the possibility for shallow gas, was identified for the originally proposed surface location. The drilling plan has been adjusted to avoid this surface location after an assessment of the shallow gas risk was undertaken (the surface location was moved by approximately 500 m). No seismic anomalies are present at the proposed Ironstone-1 location.

Although the expected geology and formation characteristics likely to be encountered by the Kingtree-1 and Ironstone-1 exploration wells can be predicted with a reasonable level of confidence, due to the information available from previously drilled wells in the vicinity, the operation has been conservatively designed and takes into account the inherent uncertainty in all exploration wells.

The target formations are on trend with the Challis Oil Field. An oil discovery at Kingtree-1 or Ironstone-1 is predicted to have similar hydrocarbon characteristics to those observed for the Challis Field. Gas may also be contained in the reservoirs. Table 2 provides a summary of the characteristics of Challis crude oil, together with the characteristics of oil and condensate from other PTTEP operations and marine diesel for comparison. Challis Crude is a light to medium crude and is slightly lighter and more volatile than Montara Crude.

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[2] AHD is Australian Height Datum, where 0 mAHD represents sea level.

[3] High-pressure, high-temperature wells are defined as a well having an undisturbed bottom hole temperature of greater than 300oF [149oC] and a pressure of at least 10,000 psi [69 MPa]. (Department of Trade and Industry, UK)

Table 2 Summary of expected hydrocarbon characteristics

Name	Oil Group	Density @15°C	Viscosity (cSt) @20°C	Pour Point °C	Flash Point	Comment
Challis Crude Oil	II	0.8275	3.04	-9°C	-9°C	Extreme fire hazard. 2% wax
Jabiru Crude Oil	II	0.8142	3.7	18°C	-18°C	Extreme fire hazard. 6% wax
Montara Crude Oil	III	0.851	Solid	27°C	<25°C	11% wax
Condensate	I	0.78 – 0.82	<2.0	< -20°C	<0°C	Extreme fire hazard.
Marine Diesel	III	0.89	<4	-6°C - 0°C	60°C	None

The seabed at the Kingtree-1 and Ironstone-1 well locations consists of low relief, unconsolidated, calcareous fine sandy silt with minor shell fragments. The seabed surrounding the well locations is relatively flat, shoaling very gently (less than one degree) generally to the southeast. There are no significant seabed features around the well locations and the seabed grab sample obtained from Kingtree-1 does not indicate any significant biogenic activity.

Drilling Method

Drilling will be undertaken 24 hours per day, 7 days per week and is expected to continue for a total of 21 days per well, dependent on weather conditions and operational efficiency. Relocating the MODU between the two wells will take approximately two days. Water depth at the well location is approximately 105 m.

The Kingtree-1 well is planned as a directional well, drilled vertically for approximately 1,050m and then directionally at a gradient of approximately 46°. Total measured depth (that is the total length of the well) will be approximately 1,700 m and the total vertical depth will be approximately 1,500 mAHD. The Ironstone-1 well is planned as a vertical well, drilled to a total vertical depth of approximately 1,460 mAHD. Both wells will use a similar casing design.

The first and the largest section of the well is established from the seabed and as drilling progresses, the well is drilled deeper into the formations and the cased sections become progressively smaller in diameter. A summary of each section, including the hole size and expected cuttings volume for each well, is provided in Table 3. The first (top hole) section of the wells will be drilled riserless to a depth of approximately 150 m. The 445 mm (17½“) surface hole will also be drilled riserless with cuttings from this hole section deposited on the seabed immediately around the well.

The 311 mm (12¼”) intermediate section will intersect the target formation and a blow-out preventer (BOP) and riser system will be installed before commencing this section. A 216 mm (8½”) contingent hole may be needed if a fault is intersected and 244 mm (9 $^{5}/_{8}$“) casing is committed. The riser will be connected to the MODU and all cuttings will be taken on board and will pass through mud recovery equipment such as a shale shaker and centrifuge to recover and reuse as much WBM as possible before discharging the cuttings, together with any residual WBM that adheres to the cuttings, overboard.

Table 3 Indicative drilling summary for Kingtree-1 and Ironstone-1

Hole Size	Well Interval	Cuttings Volume (approx.)	Drilling Fluid	Cuttings Discharge	Depth[1] (approx.)
915 mm (36”)	Top hole	112 m^3	Seawater with high viscosity sweeps	Seabed (riserless)	150 mMD
445 mm (17½ “)	Surface hole	137 m^3	Seawater with high viscosity sweeps	Seabed (riserless)	1,050 mMD
311 mm (12¼“)	Intermediate hole	34 m^3 (11 m^3 if contingent hole drilled)	WBM	Sea surface (riser in place)	Kingtree-1: 1,700 mMD or 1,500 mTVD (best case). Ironstone-1: 1,460 mTVD
216 mm (8½“)	Contingent hole	11 m^3	WBM	Sea surface (riser in place)	From approximately 1,200 m to total depth, if required.

1. mMD: metres measured depth (below sea bed); mTVD: metres true vertical depth. All depths are against AHD (i.e., sea level).

Cement is used to secure the steel casing in the well bore, and cementing chemicals are used to modify the technical properties of the cement slurry. During cementing operations, the majority of these chemicals are left down hole but a small quantity of cement may be discharged onto the seabed around the top of the casing for the tophole section. Careful estimates of the final drill hole volume will be made during drilling, and the volume of cement used will be adjusted accordingly to minimise the risk of excess cement being pumped out of the hole onto the seabed.

The Kingtree-1 and Ironstone-1 exploration wells will be subject to a barrier analysis to ensure that two, tested barriers are in place at all times. As one of the barriers to prevent a hydrocarbon release, a BOP will be installed and pressure tested at the start of drilling for the intermediate hole section. The BOP consists of a series of hydraulically-operated valves and rams which are open to allow the mud to circulate during drilling, but can be quickly closed around the pipe if excessive pressure (a 'kick') enters the well. If a kick occurs, the rams can be closed to prevent the overpressure reaching the rig. The last line of defence are the shear rams which, if necessary, cut through the drill string and seal the well completely.

As part of its maintenance programme, Diamond Offshore is planning to replace the BOP on the Ocean Patriot prior to commencing its contract with PTTEPAA. The new BOP will be will have 15,000 psi Hydril Rams with 10,000 psi Cameron Annulars. It is PTTEPAA's requirement that the inspection and compliance auditing of all key MODU components (including the BOP) is undertaken by a third party recognised inspector prior to the commencement of a new contract. The inspection and maintenance records of this new BOP will be checked by a third party inspector as part of PTTEPAA's acceptance process. In addition, testing of the BOP will be performed for the design pressure of the wells, which will be verified by PTTEPAA.

Mud-logging will be undertaken during drilling to evaluate the formations. This will involve the collection and processing of cuttings samples, analysis of mud gas, monitoring and recording of all drilling parameters, pit levels and pressure detection. Any wireline logging is contingent on intersecting hydrocarbons, obtaining poor LWD/MWD (logging while drilling/measurement while drilling) data or encountering formation tops that are significantly different to those prognosed. Wire line logging, if it occurs, would be undertaken at the end of drilling. If wire-line logging is required, a check-shot survey may be performed.

No well testing is planned for this operation.

Drilling Fluids

For each well, a drilling fluids program is developed with a fluid specified for each given hole section. The fluids have a range of physical and chemical properties which must be maintained to ensure that the mud system can function adequately. The function of the drilling fluid is to cool and lubricate the drill bit, provide hydraulic horsepower, transport the cuttings to the surface (when a riser is in place) and prevent the bore-hole from caving in behind the drill bit. Drilling fluids also provide the hydrostatic pressure necessary to prevent fluids from entering the well bore and is the primary method of well control. Drilling fluid is pumped down the drill string to the drill bit and returns to the surface through the space between the drill string and the sides of the well (annulus).

Drilling fluid composition and weight has been planned based on information obtained from nearby offset wells (i.e., Katandra-1a and Delamere-1) and takes into account the expected pore-pressure. This design is conservative and the drilling fluid is designed to be over-balanced (in excess of 1,000 kPa or 145 psi above the expected pore pressure) as per the PTTEP Well Engineering Standard (D41-502433). During drilling, mud weight and well pressure are continuously monitored to indicate if drilling has encountered any areas of over-pressure in the well and mud weight needs to be increased. Continuous well and drilling fluid monitoring will indicate if a permeable zone at a higher pressure than can be managed by the current drilling fluid is encountered. Should this occur, the BOP will be activated and drilling suspended until the well pressure can be analysed and the drilling fluid system adjusted to manage the new pressure (i.e., the mud weight is increased). PTTEPAA has specific and agreed well shut in procedures ('hard shut-in') that are accepted for all foreseen situations and regular well control drills are conducted to train crews to shut-in wells in the shortest possible time. These procedures are contained in the PTTEPAA Well Control Manual (D41-504389).

The Kingtree-1 and Ironstone-1 wells will be drilled with either seawater and high viscosity sweeps or a water-based mud (WBM), no synthetic-based mud (SBM) is planned to be used. The mud to be used for each section is detailed in Table 3.

High viscosity sweeps are a gel of pre-hydrated bentonite. Benonite is a naturally occurring clay that is environmentally benign. WBM consists of between 92-98% fresh or saline water (not sea water), with the remaining 2-8% made up of drilling fluid additives including barite (a weighting agent), potassium chloride brine (KCl) and glycol. These additives are either completely inert in the marine environment, naturally occurring benign materials or are readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment.

The first two well sections (914 mm (36") and 445 mm (17 ½")) will be drilled using seawater and high viscosity sweeps. Subsequent well sections (311 mm (12¼") and optional 216 mm (8½")) will be drilled with WBM. Cuttings will be discharged at the seabed (for the riserless sections) or disposed of overboard. The total volume of cuttings discharged overboard will be approximately 271 m^3 to 283 m^3 (see Table 3). As WBM has a limited 'shelf life' once mixed, any WBM left on the MODU at the cessation of drilling will be discharged overboard.

Well Completion

As Kingtree-1 and Ironstone-1 are exploration wells, once drilling and logging activities have been completed the wells will be plugged and abandoned.

Well Blowout Prevention

Well design and construction is being managed through the PTTEPAA Drilling Management System (D41-502432) which is supported by four main documents:

- Drilling Project Planning Process (D41-502434);
- Well Engineering Standards (D41-502433);
- Drilling Operations Manual (D41-504390); and
- Well Control Manual (D41-504389).

One of the primary aims of the Drilling Management System is to ensure well integrity and prevent an uncontrolled hydrocarbon release. The Drilling Project Planning Process details how well operation hazards are identified in each phase of well activity, specifically: how geological hazards are identified in the well proposal and basis of design; how well hazards are indentified and appropriate risk assessments undertaken; and required qualifications and competency for personnel.

The Well Control Manual provides a fundamental and comprehensive list of safety measures to be performed to prevent loss of well control incidents. This document will be bridged with the drilling contractor's well control manual. Any differences between the well control manuals will be identified and common procedures to be used agreed. These procedures will be formalised in a well control bridging document.

The following is a summary of the measures that will be put in place to prevent a blowout from occurring:

- formation pressures are estimated from sub-surface modelling and offset well data (e.g., Katandra-1a and Delamere-1);
- drilling mud provides the primary barrier while drilling using mud weight to overbalance formation pressure;
- drilling mud chemicals are provided by a recognised industry contractor who also provide trained personnel who mix and maintain the mud according to plan;
- in any unplanned well control event, pressure over mud weight, and hydrocarbon influx, are contained by the casing and BOP;
- the BOP stack is pressure tested in accordance with industry standards and procedures. It is pressure tested on surface prior to installation and again on initial installation on the well, which also tests the wellhead connection with the BOP. The BOP is also regularly function tested during drilling and all tests recorded;
- in the event of any malfunction of the BOP, the well will be suspended with down hole barriers (minimum of two, as per PTTEPAA DMS requirements) and the BOP stack can be recovered and repaired on surface;
- two cement abandonment plugs will be installed across the reservoir (if hydrocarbons are discovered) and the casing shoe before the riser is displaced to seawater. The BOP will only be removed once the reservoir has been sufficiently isolated and the abandonment plug has been tested to confirm its integrity; and
- drilling contractor's employees are trained and certified to industry standards and PTTEPAA requirements, as stipulated in the DOM. This is a mandatory qualification.

A blowout (uncontrolled release of hydrocarbons) spill scenario has been modelled (Section 3.2(c)) to understand the potential impact of a major loss of well control.

Supply Base, Support Vessels and Helicopters

Darwin will be used as a logistics and supply base for the operation. Refuelling and resupply of AHV will occur out of the Darwin port. Emergency medical facilities are available at Darwin (NT), Derby, Broome, Wyndham and Kununurra (WA). Figure 3 shows the location of Darwin port and other key logistics bases in relation to the Kingtree-1 exploration well. The same logistics base and support facilities will be used for Ironstone-1.

Personnel transfer to the MODU will be undertaken by fixed wing aircraft from Darwin to the Truscott Air Base and then by helicopter from Truscott Air Base to the MODU. Personnel transfer will occur during day light hours where possible, but may occur at night in the event of an operational emergency, medical evacuation or other non-routine circumstance. There will be approximately 5 helicopter flights to the Ocean Patriot per week. This will service regular crew change requirements and facilitate the transfer of specialist personnel required to carry out short term duties. Helicopters will also be on standby to provide medical evacuation or unplanned demobilisation (for instance, in the case of impending bad weather or cyclone) as required.

During the operation there will be three support vessels servicing the MODU. Support vessels will be supplied and crewed by Swire Pacific Offshore (Swire) and will consist of one V-class and two W-class vessels. The names of these vessels have not yet been confirmed but all vessels will have dynamic positioning systems. While the Ocean Patriot is on location at the drill site one vessel will always remain on station.

Management Systems and Framework

The drilling operations will be managed in accordance with the PTTEPAA Environment Policy and the Diamond Offshore Environment Policy (Annex A).

PTTEPAA operates within a comprehensive Drilling Management System (see above) as part of its Integrated Management System (IMS). Through these procedures and guidelines, all wells and drilling activities are designed following consistent risk assessment methods and with a minimum standard of information required to allow well engineering and design to proceed. PTTEPAA's approach to managing well safety has recently been reviewed and strengthened with the Drilling Management System and all supporting documents fully revised (February 2011).

Diamond Offshore operates under their Global Excellence Management System (GEMS). GEMS outlines minimum environmental standards for achieving environmental excellence on all Diamond Offshore operated MODUs. This includes Diamond Offshore's environmental management system, operations policies and procedures, health and safety policies and procedures, risk assessments, personnel management and training.

The PTTEPAA and Diamond Offshore safety management systems will apply as specified in the Safety Case applicable to this activity.

2.2 Alternatives to taking the proposed action

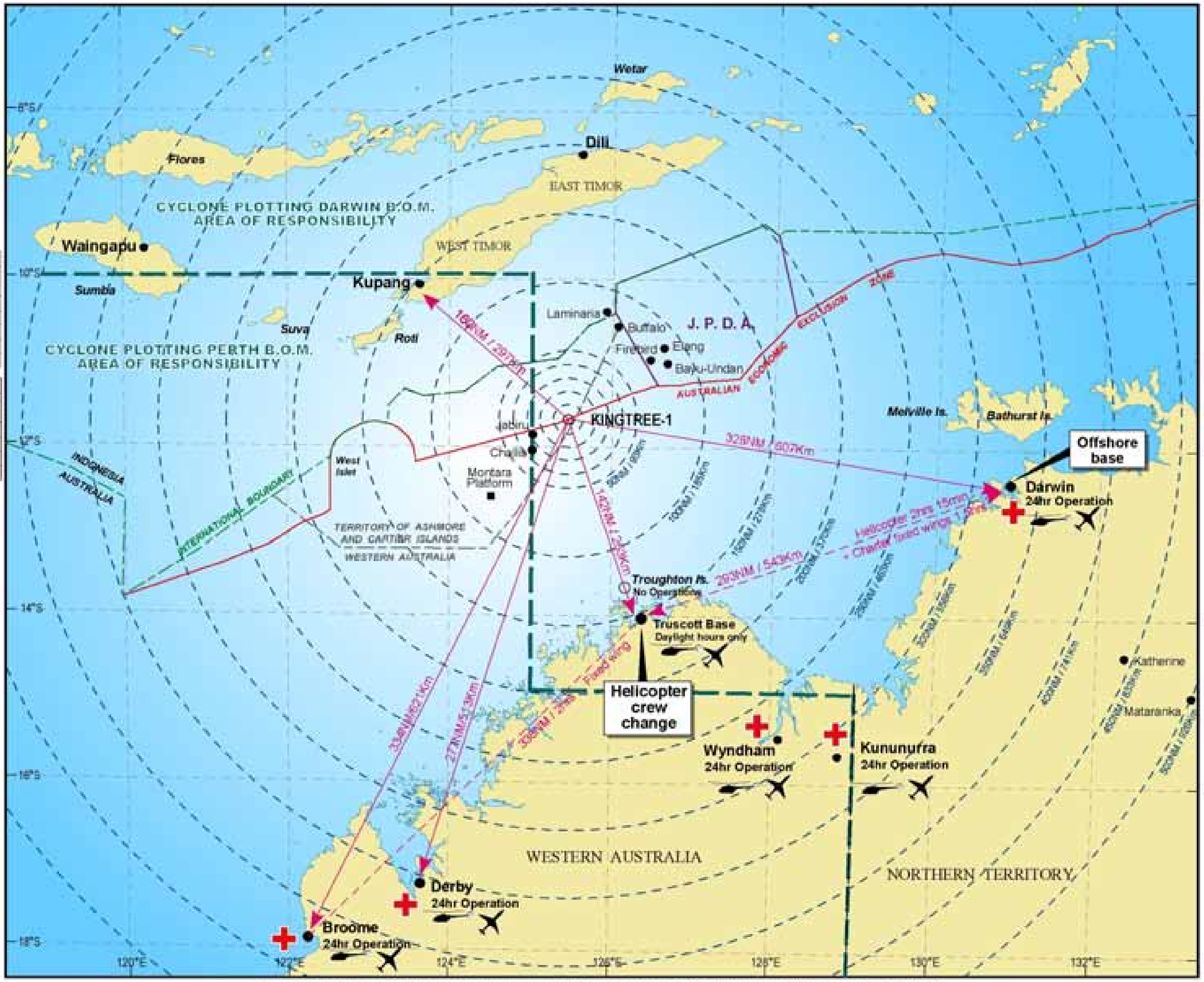
Petroleum permits are issued to the private sector by Commonwealth and State government agencies to facilitate exploration and development of hydrocarbon reserves within Australia. As the joint or sole permit holder for AC/P24 and AC/P40; PTTEPAT and PTTEPAA have an obligation to undertake exploration of these permit areas and quantify the nature and extent of potential reserves.

2.3 Alternative locations, time frames or activities that form part of the referred action

There are no alternative locations, timeframes or activities. This operation relates to PTTEPAA's commitments under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) as operator of AC/P24 and AC/P40. In addition, as with all resource projects, the precise location of the disturbance is related to the location of the target resource.

PERSONNEL (Distance and Flight Time)			
FROM	TO	NM	HRS
Truscott	Kingtree-1	142	1.10
Darwin	Truscott (fixed wing)	293	1.50
Truscott	Jabiru	153	1.25
Truscott	Challis	142	1.10
Truscott	Montara	137	1.10

VESSELS (Distance and Sailing Time)			
FROM	TO	NM	HRS (@ 12 kts)
Darwin	Kingtree-1	328	27.0
Darwin	Montara	373	31.0
Darwin	Challis	344	29.0
Darwin	Jabiru	344	29.0



PTTEP Australasia

LOGISTICS MAP - DRILLING CAMPAIGN 2011
KINGTREE-1

CR0044B

Figure 3 Kingtree-1 Logistics

2.4 Context, planning framework and state/local government requirements

The objective of the operation is to determine hydrocarbon occurrence in two potential oil fields. The operation will be undertaken in accordance with current legislative and regulatory requirements. In addition to the EPBC Act, major relevant Commonwealth legislation and regulations are:

- *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGSA);
- Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS(E) Regulations); and
- Petroleum (Submerged Lands) Act Schedule – Specific Requirement as to Offshore Petroleum Exploration and Production 1995.

PTTEPAA will prepare an Environment Plan (EP) for the operation, in accordance with the OPGGS(E) Regulations, for submission to and approval by DoR, as the delegated authority. The EP assesses the aspects and potential impacts of the operation in a risk-based context. An implementation strategy will be outlined in the EP, detailing the specific environmental management measures, environmental performance objectives, defined roles and responsibilities and reporting requirements.

In addition, the operation is supported by a Well Operations Management Plan (WOMP), Oil Spill Contingency Plan (OSCP), Safety Case and Emergency Response Plan.

2.5 Environmental impact assessments under Commonwealth, state or territory legislation

PTTEPAA's proposed exploration well will be located within Commonwealth waters, and therefore is outside of State jurisdiction.

2.6 Public consultation (including with Indigenous stakeholders)

Indigenous stakeholders are not likely to be affected by the proposed action due to the distance offshore; therefore consultation has not, and is unlikely to, be undertaken with Indigenous stakeholders.

During December 2010 – March 2011 PTTEPAA consulted with the Department of Sustainability, Environment, Water, Population and Communities (SEWPAC) and DoR to outline the operation and discuss the possibility of this EPBC Act referral.

In addition, PTTEPAA will inform both the WA Department of Fisheries and the Fisheries division within DoR of the operation and seek their input on the most appropriate measures to minimise any potential disruption to fishing activities.

2.7 A staged development or component of a larger project

The proposed operation is intended to investigate if future full field development is a viable option. Such full field development would be subject to a separate EPBC Act referral at an appropriate time and once an investment decision has been reached by PTTEPAA.

3 Description of environment & likely impacts

3.1 Matters of national environmental significance

3.1 (a) World Heritage Properties

Description

The proposed area for the drilling activity is not located in or adjacent to any World Heritage Properties. The nearest World Heritage Area is the Kakadu National Park, located over 700 km east of the nearest well location.

Nature and extent of likely impact

The operation will not have an impact on any World Heritage properties.

3.1 (b) National Heritage Places

Description

There are no places in the vicinity of the operation that are listed on the National Heritage List. However, there are three registered places and two indicative places on the Register of the National Estate. Two of these places are also listed on the Commonwealth Heritage List (SEWPAC, 2011a). A list of these places and a brief description of each are provided Section 3.3(h).

Nature and extent of likely impact

The proposal will not have an impact on any listed National Heritage Places. Potential impacts to places on the Commonwealth Heritage List and/or the Register of the National Estate are discussed in Section 3.3(h).

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

Description

Kingtree-1 and Ironstone-1 are approximately 256 km and 235 km north-east of the Ashmore Reef National Nature Reserve (Ramsar Site 1220), which was listed as a Ramsar wetland on 21 October, 2002 (see Figure 2).

Ashmore Reef, together with Cartier Island and Hibernia Reef, represent the only fully emergent reefs in the north-eastern Indian Ocean. Ashmore Reef is the only one of these reefs with vegetated islands (Commonwealth of Australia, 2002). The Ashmore islands are considered to be important seabird rookeries as they support an estimated 50,000 breeding pairs of seabirds of various species. The islands are also an important staging point for many migratory shorebirds. Flocks of migratory waders (estimated to total at least 8,000 birds at any one time) use the islands and sand cays as feeding and resting areas. For instance, the Grey-tailed Tattler (*Tringa brevipes*) and the Ruddy Turnstone (*Arenaria interpres*) have been recorded at the Ashmore islands during their migration, in numbers of international significance (more than 1% of the East Asian –Australasian Flyway population) (Commonwealth of Australia, 2002). In addition, 30 species of shorebird have been recorded at least once on Ashmore Reef, representing nearly 70% of the species that regularly migrate to Australia (Commonwealth of Australia, 2002).

A further description of Ashmore Reef National Nature Reserve, including its marine values, is provided in Section 3.3(d).

Nature and extent of likely impact

Routine operation of the exploration drilling program will have no impact on the Ashmore Reef National Nature Reserve. The potential impacts of a non-routine event, particularly a severe loss of well control incident, including the likelihood of contact with Ashmore Reef, are described in Section 3.2.

3.1 (d) Listed threatened species and ecological communities

Description

A search of the SEWPAC protected matters database was conducted to identify those threatened species and Threatened Ecological Communities (TECs) that have previously been recorded within a 10 km radius of the proposed well locations (and the area between them). A copy of these searches is provided in Annex B to this referral.

A total of nine threatened species are listed on the EPBC Protected Matters database that may occur within a 10 km radius of the proposed well locations. The search also identified that there are no listed TECs or recorded sensitive environments within the area. Table 4 provides a summary of all species identified in the EPBC Act Protected Matters Report.

Table 4 EPBC listed species that may occur around the proposed operation

Scientific Name	Common Name	Threatened Species Status	Listed Migratory Species	Listed Marine Species
Mammals				
Balaenoptera musculus	Blue Whale	Endangered	x	Cetacean
Megaptera novaeangliae	Humpback Whale	Vulnerable	x	Cetacean
Balaenoptera bonaerensis	Antarctic Minke Whale, Dark-shoulder Minke Whale	-	x	Cetacean
Balaenoptera edeni	Bryde's Whale	-	x	Cetacean
Orcinus orca	Killer Whale, Orca	-	x	Cetacean
Physeter macrocephalus	Sperm Whale	-	x	Cetacean
Tursiops aduncus	Spotted Bottlenose Dolphin (Arafura / Timor Sea populations)	-	x	Cetacean
Delphinus delphis	Common Dolphin, Short-beaked Common Dolphin	-	-	Cetacean
Feresa attenuata	Pygmy Killer Whale	-	-	Cetacean
Globicephala macrorhynchus	Short-finned Pilot Whale	-	-	Cetacean
Grampus griseus	Risso's Dolphin, Grampus	-	-	Cetacean
Kogia breviceps	Pygmy Sperm Whale	-	-	Cetacean
Kogia simus	Dwarf Sperm Whale	-	-	Cetacean
Peponocephala electra	Melon-headed Whale	-	-	Cetacean
Pseudorca crassidens	False Killer Whale	-	-	Cetacean
Stenella attenuata	Spotted Dolphin, Pantropical Spotted Dolphin	-	-	Cetacean
Stenella longirostris	Long-snouted Spinner Dolphin	-	-	Cetacean
Stenella coeruleoalba	Striped Dolphin, Euphrosyne Dolphin	-	-	Cetacean
Steno bredanensis	Rough-toothed Dolphin	-	-	Cetacean
Tursiops truncatus s. str.	Bottlenose Dolphin	-	-	Cetacean
Ziphius cavirostris	Cuvier's Beaked Whale, Goose-beaked Whale	-	-	Cetacean
Reptiles				
Caretta caretta	Loggerhead Turtle	Endangered	x	x
Chelonia mydas	Green Turtle	Vulnerable	x	x
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle, Luth	Endangered	x	x
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	x	x
Lepidochelys olivacea	Olive Ridley Turtle, Pacific Ridley Turtle	Endangered	x	x
Natator depressus	Flatback Turtle	Vulnerable	x	x

Scientific Name	Common Name	Threatened Species Status	Listed Migratory Species	Listed Marine Species
Various sea snakes	(refer *Annex B*)		-	12 Listed
Sharks				
Rhincodon typus	Whale Shark	Vulnerable	x	-
Isurus oxyrinchus	Shortfin Mako, Mako Shark	-	x	-
Isurus paucus	Longfin Mako	-	x	-
Birds				
Calonectris leucomelas	Streaked Shearwater	-	x	x
Puffinus leucomelas	Streaked Shearwater	-	x	-
Fish				
Various pipefish, pipehorse, seahorse	(refer *Annex B*)	-	-	31 listed

The nine threatened species listed in Table 4 are discussed briefly below on the basis that they may occur at or near the proposed Kingtree–1 or Ironstone-1 well locations at various times of the year.

Mammals (Whales and Cetaceans)

Twenty cetacean species (13 whales and 8 dolphins) are identified from the EPBC Act Protected Matters Report as potentially utilising the area within 10km of the operation. Of these, two species are listed as threatened under the EPBC Act and may occur at or around the well locations:

- Blue Whale (endangered/migratory); and
- Humpback Whale (vulnerable/migratory).

Blue Whale (Endangered/Migratory)

Blue Whales (*Balaenoptera musculus*) are widely distributed throughout the worlds' oceans. It is generally accepted that there are two subspecies in the Southern Hemisphere: the southern blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda*) (SEWPAC, 2011b). In general, the Southern Blue Whale is found south of latitude 60°S and Pygmy Blue Whales are found north of latitude 55°S (SEWPAC, 2011b), making it highly likely that any blue whales frequenting the waters surrounding AC/P24 and AC/P40 would be Pygmy Blue Whales.

Blue Whale migration is thought to follow deep oceanic routes, although little is known about their precise migration routes (SEWPAC, 2011b). Sea noise loggers set at various locations along the coast of WA have detected an annual northbound and southbound migration of Pygmy Blue Whales past Exmouth and the Montebello Islands and locations to the north (McCauley & Jenner, 2010). Pygmy Blue Whales appear to migrate south from Indonesian waters passing Exmouth through November to late December each year. Observations suggest most Pygmy Blue Whales pass along the edge of the continental shelf out to water depths of 1,000 m, but centred near the 500 m depth contour. The northern migration passes Exmouth over an extended period ranging from April to August (McCauley & Jenner, 2010).

The Perth Canyon is the only area so far identified off the WA coast where Pygmy Blue Whales aggregate with some predictability. The area represents a significant feeding ground for Pygmy Blue Whales between January and April (McCauley & Jenner, 2010). Blue whales are believed to calve in tropical waters in winter and births peak in May to June, however the exact breeding grounds of this species are unknown (Bannister et al, 1996).

AC/P24 and AC/P40 do not include any recognised Blue Whale migratory routes or known feeding, breeding or resting areas. However, Blue Whales may occasionally pass through the drilling area.

Humpback Whale (Vulnerable/Migratory)

Humpback whales (*Megaptera novaeangliae*) also have a wide distribution and have been recorded from coastal areas off all Australian states, except the NT (Bannister et al, 1996). Humpback whales migrate north and south along the eastern and western coasts of Australia from calving grounds in the tropical north to feeding grounds in the Southern Ocean (DEH, 2006A). Peak migration off the north-western coast of Australia occurs from late July to early September. From June to mid-September the inshore waters (landward of the 100m isobath) between the Lacepede Islands and Camden Sound are used as a calving area for this species (Jenner et al. 2001). The SEWPAC Protected Matters database indicates that Humpback whales may frequent the area around the proposed well locations (see Annex B), with the operation located near the northern terminus of the species' mapped migratory pathway off Western Australia. However, as shown in Figure 4, the operation is located outside of the recognised Humpback whale migratory routes.

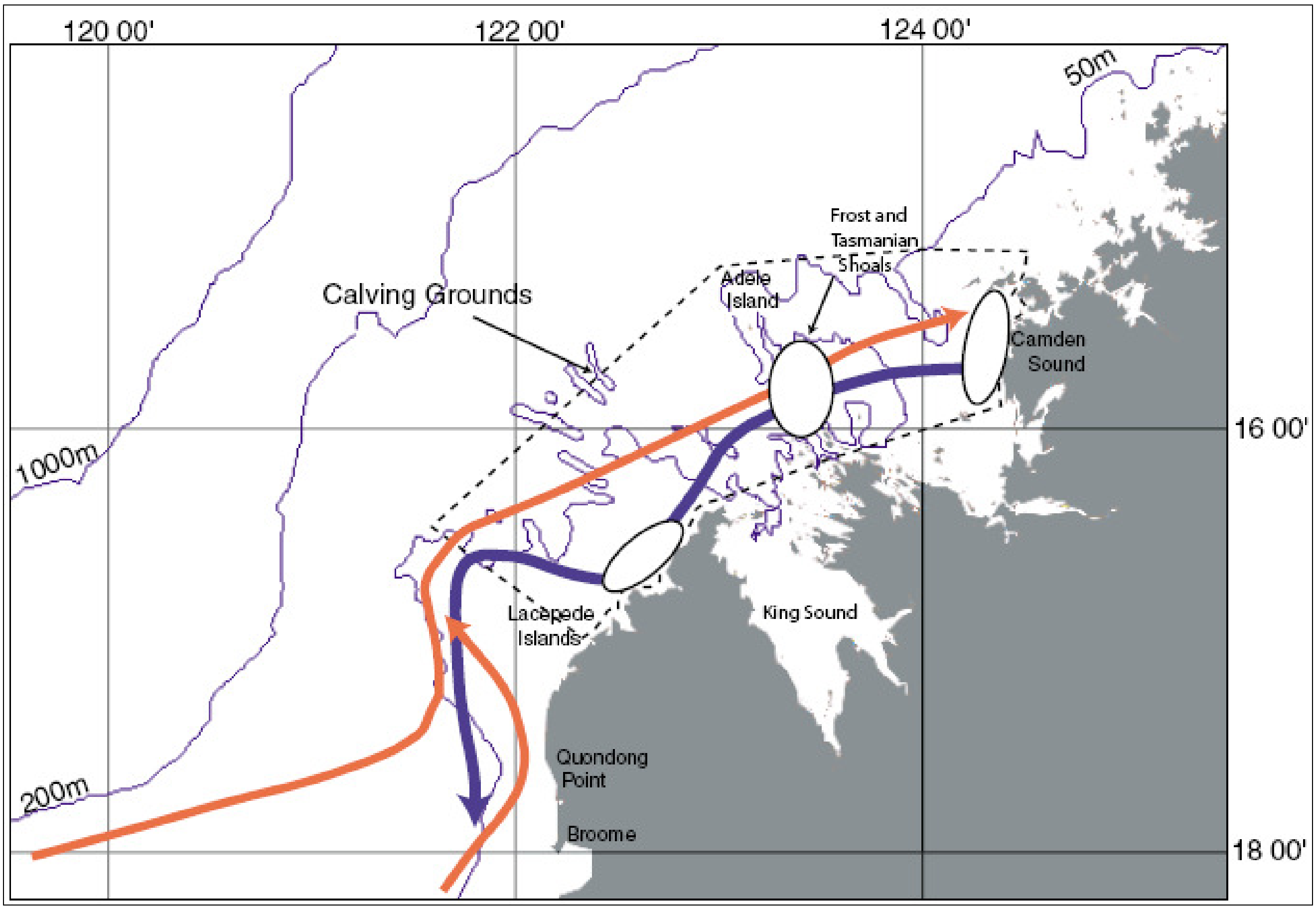


Figure 3 **Humpback Whale calving grounds and migratory routes**

Reptiles

Six species of marine turtles listed as threatened and migratory under the EPBC Act (refer Table 4) may occur at or near the proposed well locations and have the potential to be effected by the operation. AC/P24 and AC/P40 do not contain any emergent land, shallow sub-tidal features or other habitats frequented by turtles. Marine turtles undertake extensive migrations however, and low numbers of individuals may transit the area. The nearest known turtle breeding, nesting, or feeding grounds are located over 200 km south-west of the operation in the reserves of Ashmore Reef and Cartier Island. The likelihood of encountering significant numbers of turtles is considered to be extremely low. The six turtle species are briefly described below.

Green Turtle (Vulnerable/Migratory)

Green turtles are found in tropical and subtropical waters throughout the world (Marquez 1990; Bowen et al. 1992) but normally remain within the northern and southern limits of the 20°C isotherm (Marquez 1990). The closest known breeding/nesting grounds to the operation are the Ashmore Reef and Cartier Island Reserves, over 200 km south-west. The reserves protect important habitats for feeding and breeding marine turtles, including green turtles (Guinea 1995, Environment Australia 2003).

The life cycle of a Green Turtle includes a pelagic (open ocean) phase and a coastal phase. Green Turtle hatchlings actively swim out to sea and as juveniles are carried passively by ocean currents, feeding opportunistically and often associated with floating rafts of *Sargassum* (a marine plant). This pelagic phase lasts for five to ten years before adult Green Turtles swim to coastal feeding grounds (usually seagrass or algae beds) and breeding sites (sandy beaches). Adult Green Turtles may undertake extensive migrations (in the order of hundreds of kilometres) between feeding and breeding grounds, however no well defined migratory routes are known (SEWPAC, 2011b).

Flatback Turtle (Vulnerable/Migratory)

The Flatback turtle is found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya. It is the most widely spread nesting marine turtle species in the NT (Chatto & Baker 2008), nesting on a wide variety of beach types around the entire coastline. The Flatback Turtle also nests in the Kimberley Region of WA, with Cape Dommett (Bowlay & Whiting 2007) and Lacrosse Island important nesting areas.

Juvenile Flatback Turtles do not undergo a pelagic dispersal phase. Flatback Turtles prefer soft-bottomed habitat in turbid, shallow inshore waters. This species has been recorded at depths ranging from approximately 10 to 40 m (SEWPAC, 2011b).

Hawksbill Turtle (Vulnerable/Migratory)

Hawksbill turtles have a global distribution throughout tropical, sub-tropical and temperate waters (Marquez, 1990). There is no known nesting or breeding areas in or near the operation. Nesting is mainly concentrated on subtropical beaches (Marquez, 1990). In WA, low intensity nesting occurs on Muiron Island and the beaches of North West Cape, while in the NT, nesting occurs at Coburg Peninsula and between Nhulunbuy and northern Blue Mud Bay (East Arnhem Land) (DEH, 2005). Hawksbill turtles are also found in the reserves of Ashmore Reef and Cartier Island where they feed throughout the year (Guinea 1995).

Similarly to Green Turtles, juvenile Hawksbill Turtles spend their juvenile stage (five to ten years) drifting on ocean currents, often associated with floating rafts of *Sargassum*. Adults tend to forage in tropical tidal and sub-tidal coral and rocky reef habitat where they primarily feed on sponges and algae. Hawksbill Turtles are also occasionally found within seagrass habitats of coastal waters, as well as the deeper habitats of trawl fisheries (SEWPAC, 2011b).

Leatherback Turtle (Endangered/Migratory)

The Leatherback turtle has the widest distribution of any marine turtle, and can be found in tropical, subtropical and temperate waters throughout the world (Marquez, 1990). Nesting occurs on tropical beaches and subtropical beaches (Marquez 1990) but no major centres of nesting activity have been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland and the NT (Limpus & McLachlan, 1994).

The Leatherback Turtle is a highly pelagic species with adults only going ashore to breed. Leatherback Turtles feed mainly on pelagic, soft-bodied marine organisms such as jellyfish, which occur in greatest concentrations in areas of upwelling or convergence (SEWPAC, 2011b). No known areas of upwelling or natural nutrient concentration are known to occur at or around the well location (CSIRO, 2004).

Loggerhead Turtle (Endangered/Migratory)

The Loggerhead turtle has a global distribution throughout tropical, sub-tropical and temperate waters (Marquez 1990). Nesting is mainly concentrated on sub-tropical beaches (Marquez 1990). The closest known breeding/nesting grounds to the operation are on Muiron Island and the beaches of the North West Cape (Baldwin et al. 2003), approximately 1,500 km south-west. Loggerhead turtles have been recorded in the reserves of Ashmore Reef and Cartier Island (Guinea 1995).

Similarly to Green Turtles, juvenile Loggerhead Turtles spend their juvenile stage drifting on ocean currents. This can be for up to 15 years and Loggerhead Turtles enter benthic foraging habitat as adults at a larger size than other hard-shelled sea turtles. Loggerhead Turtles choose a wide variety of tidal and sub-tidal habitat as feeding areas including rocky and coral reefs, muddy bays, sand flats, estuaries and sea grass meadows. Loggerhead Turtles show a relatively high degree of fidelity to both their foraging and breeding areas (SEWPAC, 2011b).

Olive Ridley Turtle (Endangered/Migratory)

The Olive Ridley Turtle has a circum-tropical distribution, with nesting occurring throughout tropical waters (except the Gulf of Mexico) and migratory circuits in tropical and some subtropical areas (Pritchard, 1969). The Olive Ridley Turtle is also the smallest of the Australian sea turtles. No concentrated nesting has been found in

Australia, although low density nesting occurs along the Arnhem Land coast of the NT, including the Crocodile, McCluer and Wessel Islands, Grant Island and Cobourg Peninsula (Chatto & Baker, 2008).

Similarly to Green Turtles, juvenile Olive Ridley Turtles spend their juvenile stage drifting on ocean currents; however, the duration of this pelagic stage is unknown. Both immature and adult Olive Ridley Turtles have been recorded foraging in shallow, benthic habitats across the north of Australia. Foraging habitat can range from several metres in depth to over 100 m, however most records have been between 11 and 40 m. Olive Ridley Turtles are rarely recorded in coral reef habitat or shallow inshore seagrass flats (SEWPAC, 2011b).

Sharks

Whale Shark (Vulnerable/Migratory)

The Whale Shark (*Rhincodon typus*) is listed as threatened and migratory under the EPBC Act and may occur at or near the well locations. Whale Sharks are generally found in areas where the surface temperature is 21°C to 25°C, preferably with cold water of 17 °C or less upwelling into it, and salinity of 34 to 34.5 parts per thousand (ppt) (Pogonoski et al., 2002). Whale Sharks have a broad distribution in tropical and warm temperate seas. In Australian waters, they are known to aggregate at Ningaloo Reef (approximately 1,500 km south-west of the operation) and in the Coral Sea (approximately 2,400 km east of the operation) between March and July. The Whale Shark is a highly migratory fish and only visits Australian waters seasonally (SEWPAC, 2011b). Whale Sharks are not known to feed or breed in AC/P24 or AC/P40.

Nature and extent of likely impact

While the EPBC Act Protected Matters Search Tool has identified that some threatened species may migrate through or forage within or adjacent to the operation, the habitat within the permit area is not considered to be critical to the survival of these species.

Pygmy Blue Whales are unlikely to be encountered at or near the well location due to the relatively shallow depth of the well location (100 to 120 m) and the preferred migratory route of Pygmy Blue Whales along the 500 m depth contour (McCauley and Jenner, 2010). The proposed operation will be outside the expected breeding period for Blue Whales (May to June). Similarly, Humpback Whales are unlikely to be encountered as the well location is well north of known calving grounds at Camden sound is at the most northern terminus of the species' mapped migratory pathway in Australia (Jenner et al, 2001).

Threatened turtles, with the exception Flatback Turtles, may pass occasionally through the area, either as juveniles or as adults. However, the well locations are not in the vicinity of any known foraging or nesting grounds and during normal operations the exploration drilling program is unlikely to have a significant impact on these species.

Whale sharks are not known to feed or breed in the area and it is unlikely that any will be encountered by the operation.

It is highly unlikely that any of the proposed activities associated with routine operations will impact listed threatened species. Potential impacts to the marine environment are described in section 3.1 (f), including potential impacts due to the physical presence of the MODU, discharge of cuttings, routine discharge of waste and light and noise emissions. Underwater noise is the only aspect that may potentially affect a listed threatened species. However any impacts from underwater noise are likely to be minor and will only affect occasional cetaceans that pass through the area of drilling activity.

The potential impacts of a non-routine event, particularly a severe loss of well control incident, including the likelihood of contact with reefs, shoals and islands and the potential consequences on threatened species, are described in Section 3.2.

3.1 (e) Listed migratory species

Description

A total of 18 migratory species are listed in the EPBC Act Protected Matters Report that may occur within a 10 km radius of the proposed operation. Nine of these species are also listed as threatened species under the EPBC Act, for which the potential impacts have been discussed above in Section 3.1 (d). Migratory species are unlikely to be restricted in their movements although there may be minor disturbance to their migratory routes behaviours associated with vessel movements and drilling activity.

Cetaceans

In addition to the Humpback Whale and Blue Whale, which are discussed above, four migratory cetacean species have the potential to occur within a 10 km radius of the well locations.

Both the Bryde's Whale (*Balaenoptera edeni*) and the Killer Whale (*Orcinus orca*) are distributed widely in Australian waters but have not been recorded off the NT. The Sperm Whale (*Physeter macrocephalus*) is a cosmopolitan species occurring in deep water off the continental shelf (beyond 200 m depth). In WA, Sperm Whales occur mainly between Cape Leeuwin and Esperance (Bannister et al. 1996).

Antarctic Minke Whales (*Balaenoptera bonaerensis*) are found throughout much of Australia's coastal waters. This species' winter breeding areas are thought to be relatively dispersed in open ocean areas throughout tropical and sub-tropical latitudes, but they congregate in Antarctic waters during the summer feeding season.

Bottlenose dolphins (genus *Tursiops*) are distributed continuously around the Australian mainland. However, the taxonomic status of many populations is unknown and the Arafura/Timor Sea populations of *T. aduncus* (Spotted Bottlenose Dolphin) are considered to be distinct (SEWPAC, 2011b). In Australia, the Spotted Bottlenose Dolphin is restricted to inshore areas such as bays and estuaries, near shore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands (SEWPAC, 2011b). Movement patterns of the Spotted Bottlenose Dolphin in Australia and South Africa are variable, and include year-round residency in small areas, long-range movements and migration (SEWPAC, 2011b).

It is possible that all five migratory marine mammal species discussed above may traverse AC/P24 and/or AC/P40 but they are not expected to be present in significant numbers.

Sharks

In addition to the Whale Shark, two migratory shark species have the potential to occur within a 10 km radius of the well locations.

Shortfin Mako is widely distributed around Australia, occurring off all states and the entire coast except for Arafura Sea, Gulf of Carpentaria and Torres Strait (Cailliet et al 2004). The Shortfin Mako is a coastal, oceanic species occurring in depths to at least 500 m (Cailliet et al 2004). The Shortfin Mako is a fast, powerful and active species, seldom occurring where water temperature is less than 16°C.

The Longfin Mako is distributed throughout northern Australia in temperate and tropical waters; however the exact range of occurrence of this species in Australia is poorly known (Reardon et al, 2006). The Longfin Make appears to be a pelagic, deep-dwelling shark, although both sightings on the ocean surface and the species' diet suggest a much greater depth range (Reardon et al, 2006). This species is often mistaken for the Shortfin Mako.

Neither species has key breeding or feeding habitat in Australian waters and specific migratory routes have not been identified (Cailliet et al 2004; Reardon et al, 2006).

Birds

Although the search of the EPBC database revealed two bird species that could occur within AC/P24, these are synonyms for the same species. *Calonectris leucomelas* is the currently accepted scientific name for the species. The Streaked Shearwater is listed on the China-Australia Migratory Bird Agreement (CAMBA) as *Puffinus leucomelas*, and the Japan-Australia Migratory Bird Agreement (JAMBA) as *Calonectris leucomelas*. This species may overfly AC/P24 and/or AC/P40 (see Annex B).

Nature and extent of likely impact

It is highly unlikely that any of the proposed activities associated with routine operations will impact listed migratory species. Potential impacts to the marine environment are described in section 3.1 (f), including potential impacts due to the physical presence of the MODU, discharge of cuttings, routine discharge of waste and light and noise emissions. None of these activities is likely to have a significant impact on migratory species.

The potential impacts of a non-routine event, particularly a severe loss of well control incident, including the likelihood of contact with reefs, shoals and islands and the potential consequences on migratory species, are described in Section 3.2.

3.1 (f) Commonwealth marine area

(If the action is in the Commonwealth marine area, complete 3.2(c) instead. This section is for actions taken outside the Commonwealth marine area that may have impacts on that area.)

Description

Not applicable, see Section 3.2(c).

Nature and extent of likely impact

Not applicable, see Section 3.2(c).

3.1 (g) Commonwealth land

(If the action is on Commonwealth land, complete 3.2(d) instead. This section is for actions taken outside Commonwealth land that may have impacts on that land.)

Description

Not applicable.

Nature and extent of likely impact

Not applicable.

3.1 (h) The Great Barrier Reef Marine Park

Description

Not applicable.

Nature and extent of likely impact

Not applicable.

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

Not applicable.

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

Not applicable.

3.2 (c)

Is the proposed action to be taken in a Commonwealth marine area?		No
	X	Yes (provide details below)

If yes, nature & extent of likely impact on the whole environment (in addition to 3.1(h))

The key potential impacts to the marine environment resulting from the proposed operation relate to the following activities:

- physical presence of the Ocean Patriot;
- discharge of cuttings to the marine environment;
- routine disposal of waste;
- light and noise emissions; and
- non-routine discharges (including diesel spill and/or an uncontrolled release of hydrocarbons);

The following provides a description of the potential impacts associated with the activities outlined above.

Physical Presence of the Ocean Patriot

The proposed well sites will temporarily occupy a seabed area encompassing the drill hole location and the footprint of the eight anchors required to anchor the Ocean Patriot in place (each disturbing approximately 25 m^2 of seabed) during the operation. Notionally, the anchors will spread in an even radial pattern extending about 1,500 m^2 from the Ocean Patriot centre. Based on this radial pattern, about 2.12 km^2 of seabed will be occupied during the operation.

Any disturbance associated with the eight anchors of the Ocean Patriot semi-submersible MODU will be localised and temporary. Soft bottom benthic habitats have a widespread distribution within and outside the proposed operations location. These organisms will recolonise any areas disturbed by the anchors.

Discharge of Cuttings

Both wells will be drilled using seawater with high viscosity sweeps for the tophole and surface sections and WBM for the intermediate section (see Section 2.1). No SBM is planned to be used. Cuttings from the tophole and surface sections will be discharged directly to the seabed. Cutting from these sections will settle immediately around the drill hole. Cuttings from the intermediate section and the contingent section (if drilled) will be taken up to the MODU via the riser and passed through a mud recovery system to recover as much WBM as practicable before being discharged overboard. Discharged cuttings from the intermediate section will include small volumes of WBM that adheres to the cuttings. These cuttings will settle on the seabed in the immediate vicinity of the MODU (likely within a one to two kilometre radius, depending on the effect of currents), resulting in localised burial of benthic organisms, alteration of the benthic substrate and increased turbidity in the water column.

Potential impacts to the seabed include smothering of sediment dwelling (benthic and pi-benthic) fauna and substrate modification. Additionally, elevated turbidity may cause a localised and temporary decrease in water quality, however, tidal and ocean currents will facilitate the dispersion and dilution of discharged cuttings, reducing water column turbidity and reducing smothering or significant alteration of benthic communities.

Routine Waste Discharge

Routine discharges from drilling are not expected to result in any discernable environmental impact. Routine waste streams expected on the MODU are:

- treated sewage and food wastes;
- solid domestic waste;
- bilge water and deck drainage; and
- excess cement and WBM.

The MODU is equipped with appropriate drainage, sewage and waste disposal systems that meet the requirements of all applicable legislation.

Sewage and other wastewater from the crew accommodation are discharged into the sea from the MODU via the sewage treatment plant. The quantities of treated sewage are small in comparison to the dilution available and they are therefore considered to be of no environmental concern.

All domestic wastes and general rubbish generated during drilling operations will be segregated and bagged, or stored in skips onboard the MODU. All solid wastes are returned to shore for disposal. The only exception to this is food waste, which may be discharged to sea provided it is macerated to no greater than 25 mm prior to being discharged.

All waste hydrocarbons or chemicals (e.g., engine oil, grease, paint, degreasers etc) are stored on board in appropriately labelled and bunded containers for onshore disposal by a licensed contractor.

Any drainage water from areas that may be contaminated with traces of oil (e.g. bilge and machinery space drainage, drilling area drainage) will be treated in an oil / water separator to remove free oil. Oil recovered from the separator system is returned to shore for disposal with other hydrocarbon wastes by a licensed contractor. The water is cleaned to a standard of below 15 parts per million (ppm) of oil in water, before being discharged overboard, in accordance with MARPOL 73/78 Annex I (as implemented in Commonwealth waters by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*); The volumes of water discharged from this source are small and are not considered to be of environmental concern. Bilge or deck water that is contaminated and cannot be treated and disposed in accordance with MARPOL 73/78 Annex I must be contained and disposed of onshore.

Any excess WBM left at the end of drilling will be discharged overboard as it cannot be reused and is degrades quickly once mixed. PTTEPAA will aim to minimise the amount of WBM remaining at the end of drilling, without increasing the risk of running out of WBM during drilling. Any excess, mixed cement will also be discharged as it cannot be reused. PTTEPAA's preference is to hand on any remaining dry bulk material (including cement, barite and bentonite) for use in another drilling operation, however this may not be possible and small quantities of bulk cement, barite and/or bentonite may be discharged overboard at the end of the operation. These substances are environmentally benign and apart from some short-term (likely a period of hours) localised increase in turbidity, there are not expected to be any environmental effects from this discharge. The quantity of bulk materials remaining at the end of the operation will be minimised and discharge will be avoided where practicable.

Light and Noise Emissions

For safety and navigational purposes lighting on the MODU and the supply vessels will be required at all times from dusk to dawn. There is potential for the light to attract migratory seabirds as well as fish and turtles in the area; however, the impact would be small and short term (approximately 21 days) and has not been evident from similar drilling activities. There are no turtle nesting sites in the vicinity of the operation and as such there will be no impact on the breeding of migratory turtles.

Excessive continuous noise above a tolerable threshold for marine fauna may result in damage to the auditory system, behavioural change, avoidance, temporary shift in hearing thresholds and interference with acoustic signals (McCauley et al., 2003). For marine fauna that are reliant on auditory sense, 120 dB re 1 µPa is the currently accepted noise threshold above which avoidance and or behavioural changes commence.

Noise will be generated during the operation from a number of sources, in particular: vessel engines; cavitations caused by the rotation of propellers; the bit, drill string and associated equipment; and machinery operated on the decks and working areas of the MODU and supply vessels. Table 5 shows typical sound intensity and frequency characteristics for a range of industrial and natural sources.

Table 5 Noise characteristics

Source	Sound Intensity (dB re 1 µPa)	Dominant Frequency (Hz)
Natural Noises		
Ambient sea sound[1]	80 – 120	Varied
Undersea earthquake[1]	272	50
Seafloor volcanic eruption[1]	255+	Varied
Lightning strike on sea surface[1]	250	Varied
Breaching whale[1]	200	10-100
Bottlenose dolphin click[1]	Up to 229	Up to 120,000
Humpback whales (fluke and flipper slaps) [2]	192	30 – 1,200
Humpback whale song[3]	179	50 – 10,000
Sperm Whale clicks[1]	Up to 235	100 – 30,000
Blue whale vocalisations[1]	190	12 – 400
Anthropogenic Noises		
MODU [2]	145 maximum	20-1,000 (15-30 dominant)
Seismic acoustic source[4]	200+	< 200
Vertical Seismic Profiling	190	200
Vessels – tug/barge[4]	171	100 – 2000
Helicopter flyover[4]	Varies on type and size of helicopter and height above sea level	20

Compiled from: APPEA (2004)[1], Thompson and Cummings (1986)[2], McCauley & Jenner (2001) [3], WCDS (2003) [4].

Marine operations conducted on the decks and working areas of the vessel introduce strong sounds of varying characteristics into the water column, largely at low frequencies. The sound pathway produced will be predominately from above rather than through the water. A significant proportion of the sound will be reflected at the air and water interface and would not penetrate the water column.

The operation is not located within key habitat for feeding or breeding for any of the listed cetaceans identified in Table 4, nor does it lie within known major migratory pathways. Noise associated with drilling operations (drilling MODU, AHVs and helicopter movements), as detailed in Table 5 above, is unlikely to result in any significant disturbance to cetacean species, if present in the vicinity. Any impact from underwater noise is likely to be minor and will only affect occasional cetaceans that pass through the drilling area.

Non-routine Discharge

Non-routine Discharge Scenarios

The key non-routine discharge considered for the operation is the unexpected and uncontrolled release of hydrocarbons into the environment. PTTEPAA has considered three scenarios as being representative of the range of possible hydrocarbon spill scenarios, these are:

1. an instantaneous, 10 m^3 diesel spill, representing a potential refuelling incident;
2. an instantaneous, 80 m^3 diesel spill, representing a potential ship collision with rupturing and loss of fuel from a supply vessel; and
3. A prolonged 80 day release of crude oil at a rate of 400 bbl per day (approximately 70 m^3 per day), representing a potential blowout. This is considered to be a credible worst-case scenario.

Likelihood of Occurrence

Given the management and mitigation measures in place (see Chapter 4), which have been reviewed and strengthened by PTTEPAA since the Montara incident in 2009, the likelihood of any of these three scenarios occurring is considered to be low.

Refuelling of the MODU will occur at sea between the MODU and a support vessel. PTTEPAA has chosen Swire Pacific Offshore (Swires) to supply support vessel services due to the company's commitment to health and safety performance and sustainability. Based on currently available reporting, Swires had zero significant oil or chemical spills from any of Swire's 70 operating vessels world wide and reported a 30% decrease in health and safety incidents in 2009 (Swire Pacific Offshore, 2009). As such, the likelihood of a refuelling incident occurring is considered to be unlikely.

The rate of vessel collisions in Australia has remained consistently low over the past five years, with a maximum of one vessel and facility collision per million hours in any given year (NOPSA, 2010). The proven safety and performance standards of both Diamond Offshore and Swires, together with the short duration of the operation, further reduces the likelihood of a vessel collision occurring.

The likelihood of a worst case blowout scenario occurring is also low. The probability of a well blowout is estimated at 4.59×10^{-4} in Australia, this includes all available data on exploration and production wells, including the Montara incident in 2009 (ConocoPhillips, 2010). The International Association of Oil and Gas Producers (OGP) have also published an analysis of the frequency of loss of well control incidents in the North Sea and the US Gulf of Mexico. While these results are not from Australia, they are valid as Australian standards of oil and gas exploration and production are equivalent to North Sea Standards. For exploration drilling of a normal well (not HPHT), the average frequency of a blowout is $3.1x10^{-4}$ per well drilled and the average frequency of a well release[4] is $2.5x10^{-3}$. If oil wells are considered specifically (that is, gas wells are discounted), the average frequency is reduced to $2.5x10^{-4}$ for a blowout and $2.0x10^{-3}$ for a well release (OGP, 2010).

The risk of a blowout is lower again for the Kingtree-1 and Ironstone-1 exploration wells, as the likelihood of a) discovering hydrocarbons and b) discovering significant quantities of hydrocarbons is low. PTTEPAA does, however, recognise that the possibility of a loss of well control, including a blowout, is a real scenario and has significantly strengthened the well management and safety measures in place to prevent a loss of well control incident occurring. The detail of these management measures is contained in the Drilling Management System (see Section 2.1). In addition, the likely outcomes of each scenario have been modelled in order to assist in oil spill contingency planning and to assess the potential environmental impacts of these scenarios, should they occur.

[4] The OGP report defines a well release as 'an incident where hydrocarbons flow from the well at some point where flow was not intended and the flow was stopped by the use of the barrier system that was available on the well at the time of the incident. A blowout is considered to be 'an incident where formation fluid flows out of the well or between formation layers after all the predefined technical well barriers, or the activation of the same, have failed.' (OGP, 2010).

Spill Modelling Method

Spill modelling for each scenario was carried out by Asia-Pacific Applied Science Associates (APASA) using a purpose developed oil spill trajectory and fate model, OILMAP. OILMAP is a stochastic model that uses location specific weather inputs and hydrocarbon characteristics to determine the probability that any given location (defined in the model as a grid cell[5]) will encounter the hydrocarbons released under each scenario.

Only one well location, Kingtree-1, was modelled due to the close proximity (21 km) of the two proposed exploration wells. Results from modelling of a spill at Kingtree-1 can be interpolated to Ironstone-1 as the drilling and crude oil characteristics of both wells are the same and the weather dataset is applicable to both locations.

A flow rate of 400 bbls per day is considered to be a credible, worst-case scenario, based on lessons learnt from the Montara incident. The theoretical maximum flow rate is higher than this but is not considered realistic as it assumes that there is zero restriction of flow anywhere in the well, including the annulus, casing and well head structures (including BOP). There are many variables that may influence the flow rate of a well, including but not limited to the actual pressure, porosity and volume of the target reservoir, collapse (bridging) of the well bore, cement that will be in place between the casing and the conductor (the annulus), the well head and well platform structures, including the BOP. These variables make it difficult to model predicted flow rate and ultimately the decision on flow rate is somewhat arbitrary and the precise number will always be arguable. However, the flow rate of 400 bbls per day is based on PTTEPAA's experience at Montara and is considered to be a credible worst case scenario.

The model takes into account the entrainment, evaporation and spreading of the hydrocarbon (spreading assumes an even coverage of each grid cell) but can not account for sequestering of the hydrocarbon in seabed sediments or the natural decay of the hydrocarbon (by bacteria and other processes). The model also assumes that no spill response is undertaken.

As the model will track hydrocarbon concentrations to very low levels, a threshold concentration is required, below which it is considered that any residual hydrocarbons will have no impact and is unlikely to be detectable. A threshold concentration of 0.1 g/m^2 has been used for the Kingtree-1 modelling, which is equivalent to a silvery sheen as per the Bonn Agreement Oil Appearance Code. For comparison, the estimated minimum thickness of oil that will result in harm to seabirds is approximately 10 to 25 g/m^2 (APASA, 2011). Consequently, the threshold concentration of 0.1 g/m^2 is a conservative indication of the extent of visible surface oil, not the extent of potential environmental impact. Scenario 3 was also modelled using a higher threshold concentration of 1 g/m^2.

For each diesel spill scenario (Scenario 1 and 2), 100 simulations were run during each season. Each simulation used a randomly selected time period over which to model the scenario from the weather dataset for the appropriate season.

For the loss of well control scenario (Scenario 3), 20 simulations were run during each season. As the time over which Scenario 3 was modelled (90 days compared to approximately 5 to 9 days for Scenario 2), 20 simulations is considered adequate to provide a representative sample of all possible weather conditions in that season.

The outputs of the stochastic model provide the following information:

- the probability that a grid cell may be exposed to an oil slick (and therefore the probability of shoreline exposure); and
- the minimum time before exposure could occur at a given grid cell;

The stochastic model does not represent the extent of any one spill event but rather provides a summary of the number of individual simulations for a given scenario and season.

Spill Modelling Results - Scenario 1 and 2

The stochastic modelling of Scenario 1 and 2 indicated that a surface release of diesel fuel would move with the net currents and wind in a generally north-east direction in the summer and a south-west direction in the winter. There was zero predicted shoreline, reef or shoal exposure to hydrocarbons in either summer or winter conditions for both Scenario 1 and Scenario 2. Visual plots of the probability of exposure for Scenario 1 and 2 above the threshold concentration of 0.1 g/m^2 for any given location are shown in Figure 5.

Under Scenario 1, grid cells up to 66 km from the release site (during winter) had a 1% to 10% probability of experiencing surface hydrocarbons above the threshold criteria of 0.1 g/m^2. Travel distances of this magnitude are attributable to a small number of simulations and are likely due to entrainment of the diesel in the water

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[5] Each grid cell has the following dimensions: Scenario 1 and Scenario 2 grid cells are 1 by 0.8 km; Scenario 3 at 0.1 g/m^2 threshold, grid cells are 3.3 by 1.6km (summer); and 4 by 2.5km (winter); and Scenario 3 at 1 g/m^2 threshold, grid cells are 1.5 by 1.5 km.

column during high wind conditions and subsequent resurfacing when the wind abated. Under Scenario 1, the diesel slick did not persist in the water column (above the threshold concentration) for more than 6 days in any of the 200 simulations.

Under Scenario 2, grid cells up to 175 km from the release site (during summer) had a 1% to 10% probability of experiencing surface hydrocarbons above the threshold criteria of 0.1 g/m^2. Again, travel distances of this magnitude are attributable to a small number of simulations and are likely due to entrainment of the diesel in the water column during high wind conditions and subsequent resurfacing when the wind abated. Under Scenario 2, the diesel slick did not persist in the water column (above the threshold concentration) for more than 9 days in any of the 200 simulations.

There is not expected to be any shoreline contact if Scenario 1 or Scenario 2 occurred at the Ironstone-1 well location as the distance between the nearest sensitive receptor (Barracouta Shoal) and the nearest grid cell with some probability (less than 10%) of oil exposure exceeding the threshold concentration of 0.1 g/m^2 is greater than 21 km.

<u>Spill Modelling Results - Scenario 3</u>

The stochastic modelling of Scenario 3 indicated that a seabed release of crude oil would move predominately to the north-east during the summer months but with a number of simulations taking a westerly track. During the winter months, hydrocarbon movement was nearly all to the west.

As the model predicted that there was a probability that coastal contact at an oil concentration of 0.1 g/m^2 would occur (see discussion below), this scenario was re-run using a threshold concentration of 1 g/m^2. This concentration is described as ‘rainbow sheen’ under the Bonn Agreement Oil Appearance Code and is still considered conservative in terms of environmental impact. For instance, it is an order of magnitude lower than the concentration at which oil is considered to have a significant impact on seabirds (see Spill Modelling Method above). The modelling results for both summer and winter using a 1 g/m^2 threshold show that there is zero predicted contact (in summer or winter) with any shoals, reefs or shorelines at concentrations of 1 g/m^2. Visual plots of the probability of exposure for Scenario 3 above the threshold concentrations of 0.1 g/m^2 and 1 g/m^2 for any given location are shown in Figure 6.

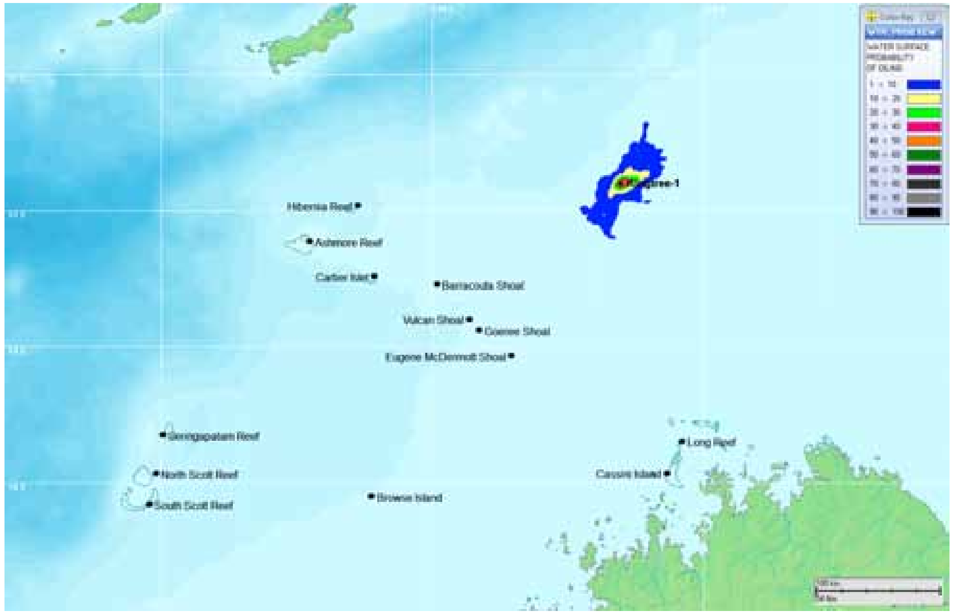

Figure 5a **Probability of exposure exceeding 0.1 g/m² (Scenario 1, summer)**

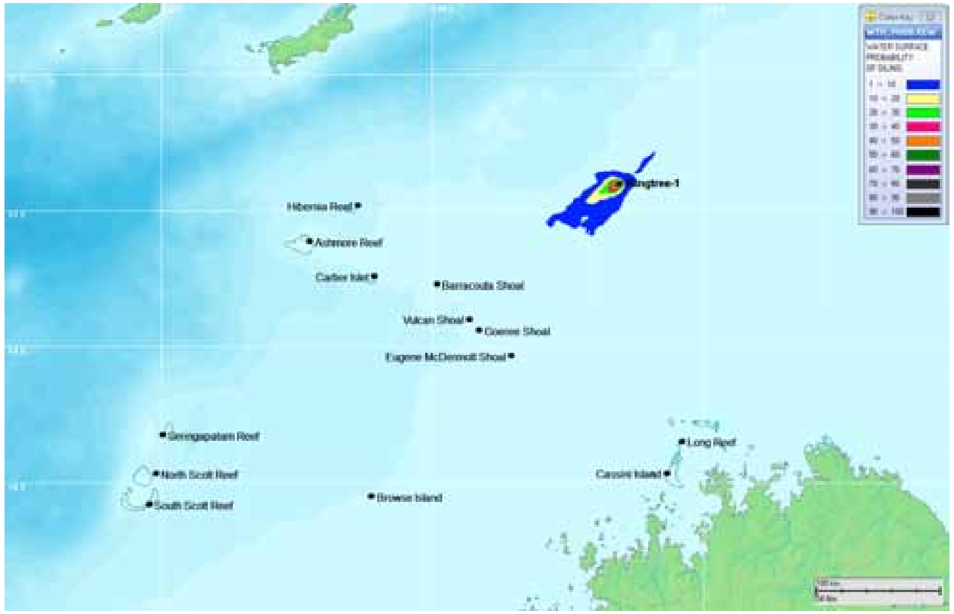

Figure 5b **Probability of exposure exceeding 0.1 g/m² (Scenario 1, winter)**

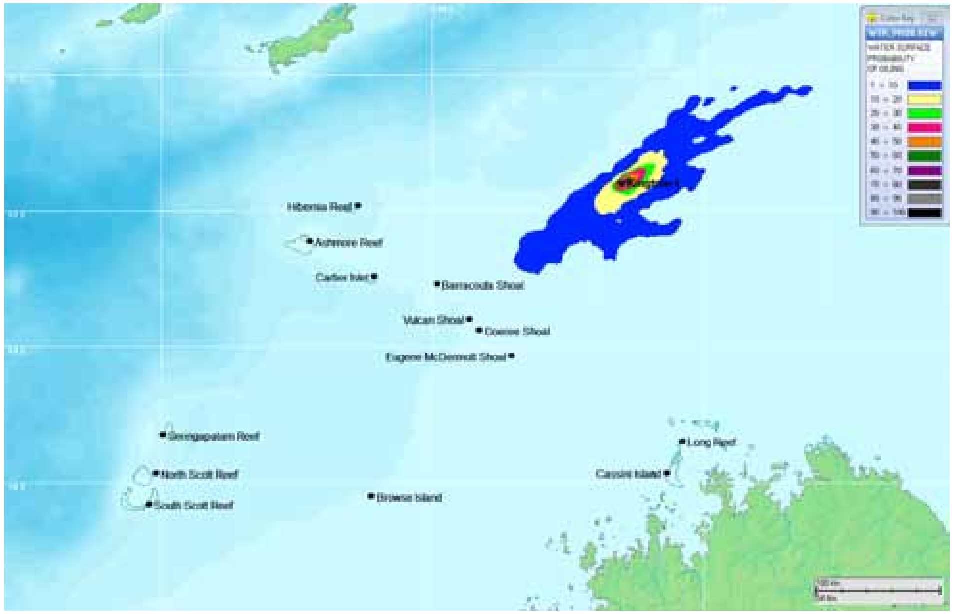

Figure 5c **Probability of exposure exceeding 0.1 g/m² (Scenario 2, summer)**

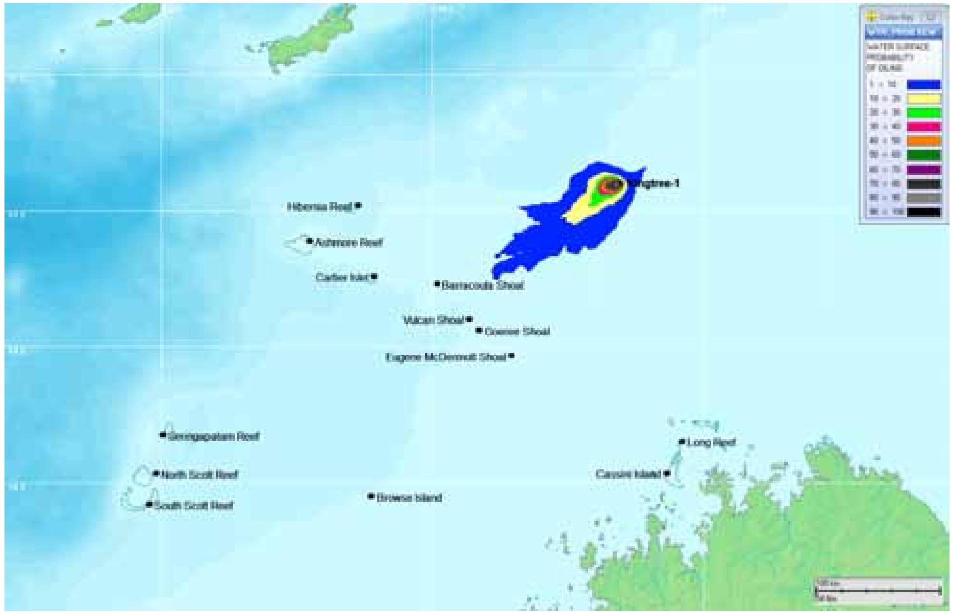

Figure 5d **Probability of exposure exceeding 0.1 g/m² (Scenario 2, winter)**

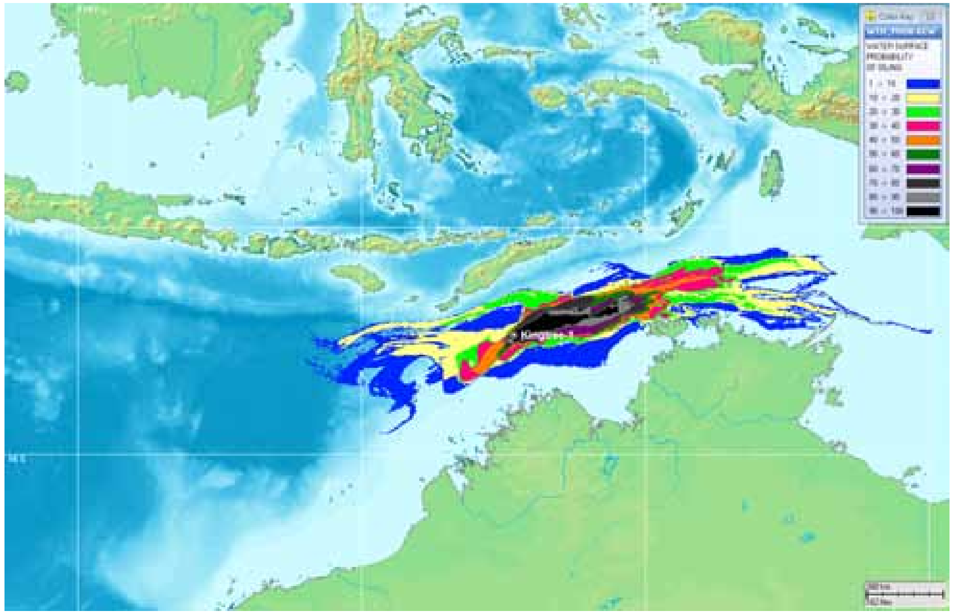

Figure 6a Probability of exposure above 0.1 g/m^2 (Scenario 3, summer conditions)

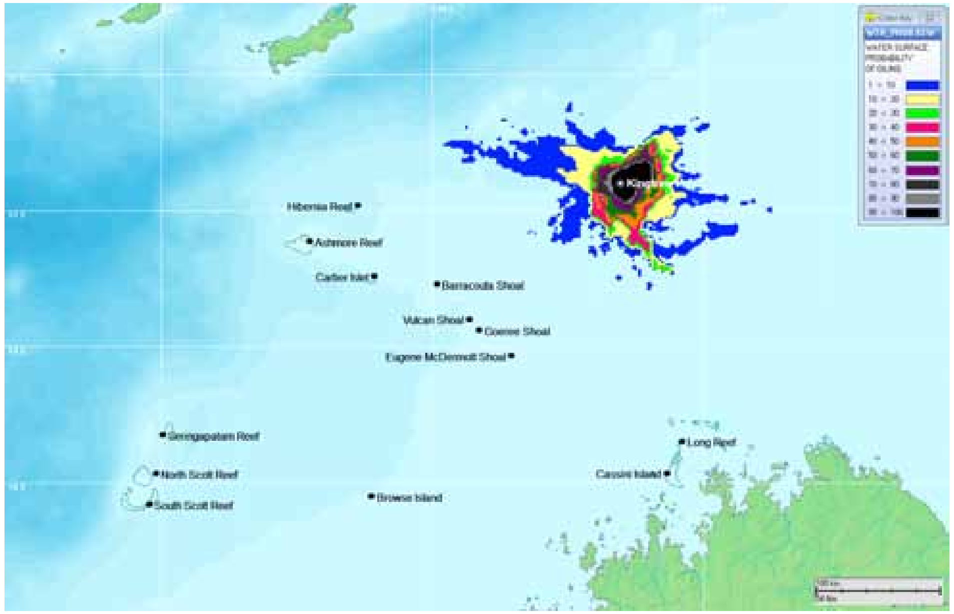

Figure 6b Probability of exposure above 1 g/m^2 (Scenario 3, summer conditions)

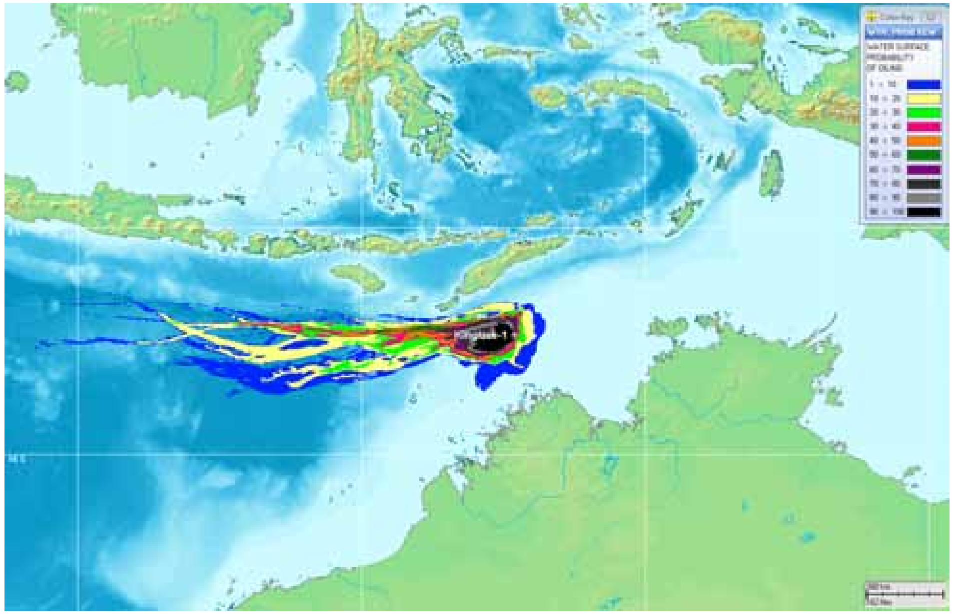

Figure 6c Probability of exposure above 0.1 g/m^2 (Scenario 3, winter conditions)

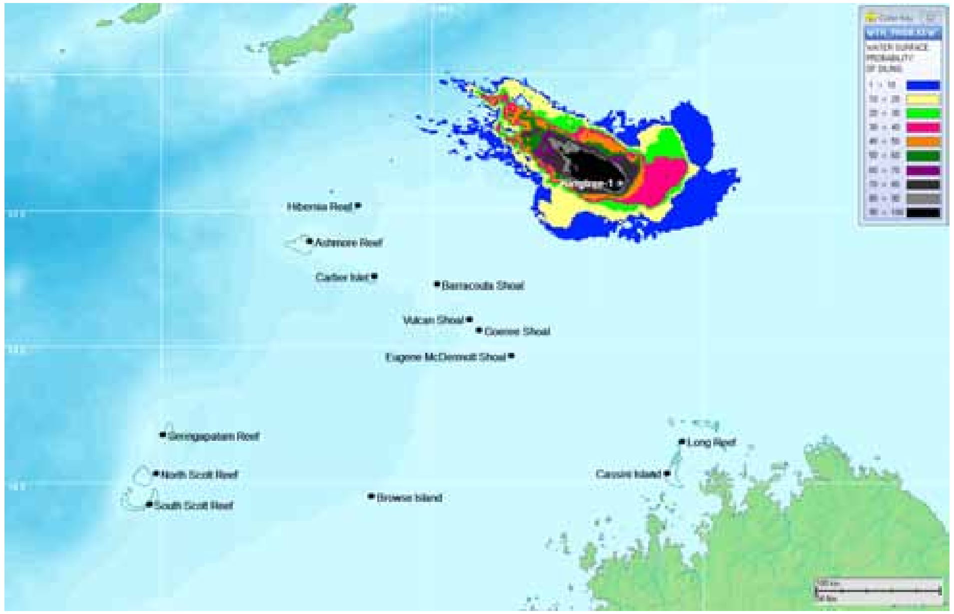

Figure 6d Probability of exposure above 1 g/m^2 (Scenario 3, winter conditions)

North-east of the well location during the summer months (November to February), there is some probability of shoreline exposure on mainland Australia or coastal islands. In particular, Melville Island, Bathurst Island, Coburg Peninsula and Marchinbar Island may experience hydrocarbon exposure above the threshold level of 0.1 g/m^2 (that is, a silvery sheen). Of these locations, Melville Island had the highest probability of exposure at 37%; however the earliest time before shoreline exposure for summer simulations was 20 days. This is a significant amount of time over which natural decay of hydrocarbons can occur and spill response can take place and it is likely that any shoreline exposure would consist of waxy residue, rather than a slick (APASA, 2011).

During the summer period, approximately 70% of simulations made some landfall (assuming no spill response is undertaken). The maximum total mass of oil on shore from any single simulation during the summer period was 246 tonnes. The average predicted total mass of oil on shore was 110 tonnes.

During the winter months (April to August), when the operation is likely to take place, there was zero predicted shoreline contact at any of the above locations. No other mainland or coastal regions were predicted to have hydrocarbon contact in either summer or winter.

West of the well location there are several islands, reefs and shoals that can be considered environmentally sensitive locations and that may experience some shoreline contact under Scenario 3, these are:

- Cartier Island, Ashmore Reef and Hibernia Reef (collectively referred to below as the Ashmore/Cartier Group);
- Seringapatam Reef, North Scott Reef and South Scott Reef (collectively referred to below as the Scott Reef Group);
- Barracouta, Vulcan, Goeree and Eugene McDermott shoals (collectively referred to below as the group of shoals); and

A description of each of these locations is provided in Section 3.3(d) below

During the summer months, the Ashmore Cartier Group was predicted to be exposed to shoreline contact above the threshold criteria of 0.1 g/m^2 (but below 1 g/m^2) by approximately 20% of simulations, with a minimum time to exposure of 35 days. Any shoreline exposure after this length of time is likely to be patchy, waxy residue not an oil slick.

During the winter months, the Ashmore Cartier Group was more likely to be exposed to shoreline contact above the threshold criteria of 0.1 g/m^2 with approximately 70% of simulations indicating contact. Using a threshold criteria of 1 g/m^2 there was zero predicted shoreline contact, in either season, at the Ashmore Cartier Group. The highest likelihood of contact was to Hibernia Reef. Cartier Island and Ashmore Reef had a probability of exposure of 30% to 40%. The minimum time until exposure is predicted to be 12 days. Over this time, and given the distance from the release site (approximately 220 to 256 km), hydrocarbon contact is likely to be patchy (less than 10% coverage, based on recent observations of the Montara incident). The maximum estimate of oil on shore at the Ashmore/Cartier Group during winter was 306 tonnes – representing a ‘direct hit’, worst case scenario. The average estimate of oil on shore was 95 tonnes.

The Scott Reef Group was exposed to hydrocarbon concentrations above the threshold level (0.1 g/m^2) in 5% of summer simulations and in zero simulations under winter conditions. The minimum time before exposure in the summer simulations was 70 days and over this timeframe there is expected to be negligible impact to this reef system. Using a threshold criteria of 1 g/m^2 there was zero predicted shoreline contact, in either season, at the Scott Reef Group.

The group of shoals had some probability of exposure to hydrocarbons above the threshold concentration (0.1 g/m^2) during both winter and summer. In summer, the likelihood of contact ranged from less than 10% at Eugene McDermott Shoal to between 40% and 50% at Vulcan Shoal and Goeree shoal. During winter, the probability of exposure was less over all, with a likelihood of less than 10% at all shoals, except the Barracouta Shoal, which had a probability of exposure between 50% and 60%. The minimum time to exposure of the group of shoals is predicted to be over 30 days in summer and approximately 10 days to Barracouta Shoal in winter (but at least 30 days to Vulcan Shoal and 70 days to the remaining shoals). The model also assumes that the location of the shoals is at the water surface (as it is a two-dimensional model). In reality, these shoals are permanently below the sea surface, on average at a depth of 20 to 30 m, which will further reduce the likely impact in the event of an oil spill. Using a threshold criteria of 1 g/m^2 there was zero predicted contact, in either season, at this group of shoals.

Browse Island was not exposed to shoreline contact in either winter or summer conditions. The Kimberley coastline was also not exposed to shoreline contact in either winter or summer conditions (APASA, 2011).

Should Scenario 3 occur at Ironstone-1, there is unlikely to be any discernable difference in the results of the modelling as the scale of the distance between the locations (approximately 20 km) is dwarfed by the scale of potential, albeit low level, exposure (hundreds of kilometres).

Contingency Planning and Oil Spill Response Strategy

The spill risk during the drilling program will be managed via a number of operational control measures, based on the risk control hierarchy of avoid risk, reduce risk and manage risk. The drilling Basis of Design and Well Operations Management Plan (WOMP) for the Kingtree–1 well includes a risk assessment and control measures to prevent loss of well control such as casing design, mud weight, and the provision of a blow-out preventer (BOP) (see Section 2.1).

Should a loss of well control occur, additional response measures include a relief well contingency plan with a proposed well location and trajectory based on technology proven from the Montara incident. This includes the necessary arrangements for the availability of the long lead equipment and tools that may be required for the relief well operations. The compatible rig availability in Australia and in the region will also be validated prior to commencement of the drilling programme.

PTTEPAA has prepared an Oil Spill Contingency Plan (OSCP) for the drilling programme. The Kingtree-1 OSCP has been developed based on the corporate OSCP and provides project specific information to assist with the response in the event of a spill. The OSCP details the response required from PTTEPAA, as the operator; the government and third parties through the National Response Plan (NatPlan); and the Australian Marine Oil Spill Centre (AMOSC). Spill response is based on a number of tiers. Each tier is defined according to the level of resources committed, support agencies and the agency assuming the role of Combat Agency. The tiers are defined as:

- Tier 1 response – The spill would be managed by PTTEPAA. The incident can be controlled by the resources available at the drilling site or may require the assistance of the PTTEPAA Emergency Management Team and offsite PTTEPAA resources;

- Tier 2 response – The spill requires wider industry and/or State Government assistance in addition to the PTTEPAA response. In agreement with PTTEPAA, the Combat Agency role may be assumed by the nominated Government Combat Agency under the relevant Port, State on National Plan; and

- Tier 3 response – The response will be managed by nominated Government Combat Agency. PTTEPAA may seek assistance from Oil Spill Response and East Asia Response Ltd (OSRL/EARL) as requested by the Combat Agency.

In all oil spill situations, monitoring of the spill is vital to determine the trajectory, volumes and weathering state of slicks of oil spilled from the MODU or vessels. These need to be determined in order to assess the possibility of response methods and to determine, or predict potential, impacts on sensitive resources. Monitoring of any spill at the Kingtree-1 or Ironstone-1 exploration wells can be undertaken using vessels, aerial surveillance and/or satellite tracking buoys.

If conditions allow, containment and recovery offshore is the preferred response method for crude oil spills that could impact shorelines or sensitive resources. In this situation, monitoring and surveillance remains the highest priority but containment and recovery measures should also be put in place, if it is safe to do so and if it is likely to be effective.

Specifically, there is some possibility that shoreline contact between 0.1 and 1 g/m^2 could occur at the following locations:

- Melville Island, Bathurst Island, Coburg Peninsula and Marchinbar Island;
- Ashmore/Cartier Group; and
- Scott Reef Group.

Precisely which locations could be contacted in any particular spill scenario depends on the weather and current conditions at the time of the spill and not all of the above locations would be contacted in any one incident. For all locations, however, PTTEP AA's spill response strategy the same: monitor and observe the slick to determine its trajectory and, if shoreline contact appears likely, concentrate resources to contain and recover the spill offshore. Spill containment and recovery offshore is the preferred option as onshore clean up and response would be a challenge due to the remote shorelines and islands of the Timor Sea. As shoals are permanently submerged, they are not considered shorelines and as such are less at threat from an oil spill. Shorelines and reefs will be prioritised over shoals.

PTTEPAA has reviewed and strengthened its capacity to manage and implement a Tier 1 response. PTTEPAA has a structured and trained Emergency Management Team within the PTTEPAA head office and an

Emergency Response Team on board the MODU. The Tier 1 oil spill response equipment that will be stored offshore (on a support vessel or the MODU) and therefore immediately available to the Emergency Response Team is listed in Table 6, the shaded cells indicated which equipment is relevant to oil spill response for the Kingtree-1 and Ironstone-1 exploration wells.

Table 6 Tier 1 oil spill response equipment and use

Equipment Type		Spill Type			
		Gas Only	**Gas and Condensate**	**Gas, Condensate, Diesel and Oil**	**Crude Oil Only**
Containment and Recovery	Boom	No	No	200m inflatable (Harbour grade)	
	Skimmer	No		1 x Brush or Combination Brush/Disc. Minimum $10m^3$/hour capacity. Note: Preferably, pump should be skimmer mountable.	
	Storage	Storage for diesel or lube contaminated sorbent		Storage (temp on deck + in hull) to a minimum of $100m^3$	
Sorbent	Boom	50m of 200mm diameter plus storage			
	Pads/mats/other	400 pads (4 x 100 pad packs) plus storage			
Dispersant Application System	Dispersant	$5m^3$ Type 3 (Concentrate)		$10m^3$ Type 3 (Concentrate)	
	Spay boom system	No		Yes	N/A
	Eductor system	Eductor suitable for use with vessel fire and deluge system			

Given that the OSCP will be implemented as soon as PTTEPAA is aware that a loss of well control incident has occurred, the probability and extent of shoreline contact predicted by the spill modelling will be further reduced.

Potential Impacts of Hydrocarbon Spills on Matters of National Environmental Significance

Any hydrocarbon spill has the potential to have an impact, depending on the magnitude of the spill and its proximity to sensitive environmental receptors. If a significant hydrocarbon spill did occur, all threatened and migratory species of marine mammals, turtles, birds and sharks will be at risk to varying degrees. The impact of spills on the marine environment is dependant on the chemical and physical properties of the hydrocarbon. The aromatic component of oil is the most toxic and this toxicity decreases as oil weathers (IPIECA, 1991). However, weathered oil can still be toxic if ingested and also has detrimental physical effects on some species and habitats (IPIECA, 1991; NOAA, 2010).

Below is a summary of the potential impacts of a hydrocarbon spill on listed species of National Environmental Significance (NES). The following information is interpreted from AMSA (2011). The effect of oil spills on wildlife and habitats include:

- Physical and chemical alteration of habitats;
- Physical smothering effects on flora and fauna; and
- Alteration to biological communities as a result of the effects on key organisms.

Cetaceans: The Humpback Whale (threatened) and Blue Whale (endangered) are listed as threatened, migratory species which may transit the proposed drilling location. Four additional migratory species of cetacean have the potential to move though the area and an additional 15 species of listed cetaceans (whales and dolphins) may also be present. The feeding and behavioural difference between species of marine mammal mean that oil spills may have varying impacts, depending on seasonality and grouping of individuals. In the event of a large oil spill, there is a risk that Humpback or Blue Whales in the area will be affected. However, it is unlikely that any of the species of cetacean listed will be impacted due to their migratory patterns and distributions.

Turtles: Turtles may be affected by a hydrocarbon spill through contamination of their food supply, absorption through the skin and ingestion of oil at the surface. Six species of turtle listed as threatened and migratory, as described in Section 3.1(d) above, may be present in the vicinity of the well location. Individual turtles exposed to high concentrations of un-weathered oil are likely to be affected by the toxicity of the oil and mortality of individuals could be caused as a result. Weathered oil is much less toxic and is less likely to have a harmful effect (IPIECA, 1991). The concentrations at which oil affects the health of turtles is unknown as very few toxicity studies have been carried out on sea turtles, most species of which are considered rare or endangered (NOAA, 2010). Oil spills may also affect turtle eggs if through the toxicity of oil washed up on sand. Again, the toxicity of weathered oil is much less than that of 'fresh' oil and the exact concentrations at which beach oil becomes harmful is not known, however, studies following the 1979 Ixtoc 1 well blowout in the Bay of Campeche, Mexico, concluded that concentrations of 7.5 ml of oil per kilogram of sand did not significantly reduce survival of turtle eggs (NOAA, 2010). The toxicity characteristics and weathered state of the oil in question will also affect these results and beached oil had the greatest effect if deposited directly onto a nest of eggs: the study found that oil deposited even a few weeks prior to the nesting season had little effect on egg development and hatchling fitness (NOAA, 2010).

Sharks: Whale sharks are not known to breed or feed in the area; however this migratory species may transit the proposed drilling location. Although there is a risk that in the event of a large oil spill the whale shark would be impacted, it is unlikely due to the small number of migratory individuals which may pass through the area.

Birds: The migratory Streaked Shearwater may overfly the proposed drilling area. In the event of a large oil spill transiting birds may be affected.

In addition to the impacts to threatened or migratory species described above, Table 7 provides an overview of the potential impacts of hydrocarbon spills on other wildlife and key habitats.

Table 7 Potential Impact of Oil in Wildlife/Habitats

Wildlife/Habitat	Potential Effect of Oil
Seabirds and migratory birds	External effects - Impact on feathers including reduction in insulation and waterproofing properties, matting resulting in reduced flying ability and loss of buoyancy. This will reduces the ability to feed and may result in starvation. Internal effects – Direct ingestion resulting in damage to red blood cells, liver metabolism, tissues and intestines. Reduced reproductive ability and fertility of eggs may also occur resulting in effect on reproduction.
Marine Mammals	External effects – Limited impact on skin of smooth skinned species compared to those with fur/hair. Change in skin conductance resulting in hypothermia, eye and skin lesions. Coating of baleen inhibiting feeding. Vapours may affect eyesight, interruption of mother – young bond (Pinnipeds). Internal effects – Direct ingestion resulting in damaged airways and lungs, contamination of food supply leading to internal digestive damage.
Turtles	External effects – Irritation of mucus membranes (eyes, nose and throat) leading to inflammation. Absorption of oil through the skin. Penetration of oil through shell membranes of eggs on nesting sites inhibiting development. Internal effects – Contamination of food supply resulting in ingestion leading to damage of internal organs, direct physical ingestion of oil leading to damage of airways and lungs.
Fish	External effects – Effect of dispersed oil on eggs, larvae and young fish including larval abnormalities. Internal effects – Damage to olfactory cells, reduced sperm activity and fertilisation success, reduced growth starvation due to a reduction in available prey.
Marine Invertebrates	Recorded effects on marine invertebrates include: altered fertilisation, cleavage and larval development, retarded growth and inhibited moulting in some larval crab stages, reduced spawning activity in muscles.
Coral Reefs	Recorded effects on coral include: tissue death, impaired feeding response, impaired polyp retraction, larval death, premature extrusion of planulae and change in calcification rates.

Source: AMSA, 2011.

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(i))

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(j))

3.3 Other important features of the environment

3.3 (a) Flora and fauna

The operation is located in the North-west Shelf Transition Bioregion and is part of the North-west Marine Region Planning Area. The biological communities of the North-west Shelf Transition Bioregion are typical of Indonesian/West Pacific tropical flora and fauna (DEWHA, 2008). Softer, silty substrates are generally sparsely covered by sessile filter-feeding organisms (such as gorgonians, sponges, ascidians and bryozoans) and mobile invertebrates (such as echinoderms, prawns and detritus feeding crabs) (DEWHA, 2008). Primary productivity in the area round the Kingtree-1 and Ironstone-1 well locations is likely to be low, as the deeper Commonwealth waters of the North-west Shelf Transition Bioregion are generally thought to be nutrient-limited and reliant on physical drivers, such as seasonal winds, to resuspend benthic deposits and release nutrients into the water column (DEWHA, 2008).

The EPBC Protected Matters Report for the operation identified 18 species (including marine mammals, marine reptiles, sharks and birds) listed as ‘Threatened’ and/or ‘Migratory’ (Table 4) which may occur within or transit through the area (see Section 3.1(d) and 3.1 (e)). A further 58 listed cetacean or marine species may utilise the area (see Annex B). The listed marine species consist mainly of sea snakes (12 species), pipefish (27 species) and seahorses (4 species). The listed cetacean species consist of seven whale and eight dolphin species. Permit areas AC/P24 and AC/P40 do not contain habitats likely to be critical to any of these species, including EPBC Act listed threatened and migratory species. These permit areas have no other known important or unique aspects regarding flora or fauna.

3.3 (b) Hydrology, including water flows

Water circulation in the deep open waters within AC/P24 and AC/P40 is influenced by the Timor Current which is an oceanic current that runs south-west in the Timor Sea between the Indonesia archipelago and Australia. The Timor current is a major contributor to the Indonesian Through-flow that transports water from the Pacific Ocean to the Indian Ocean. The currents carry warm, low salinity water in a south-westerly direction from February to June (Holloway and Nye, 1985; Holloway, 1995). These features have been taken into account in the oil spill modelling.

3.3 (c) Soil and vegetation characteristics

Not applicable given the offshore deepwater environment.

3.3 (d) Outstanding natural features

The closest areas of regional environmental significance are the banks, shoals and reefs associated with the northern and north-western edge of the continental shelf. These areas provide shallow sub tidal and intertidal habitats and are considered of ecological significance due to their regional uniqueness and their patchy distribution. These areas are described below and are shown in Figure 2.

Ashmore/Cartier Group

This group of reefs and islands consists of Cartier Island, Ashmore Reef and Hibernia Reef.

Ashmore Reef National Nature Reserve (Ashmore) is located approximately 256 km and 235 km south-west of Kingtree-1 and Ironstone-1 respectively. Ashmore covers 583 km^2 and includes two extensive lagoons, shifting sand flats and cays, seagrass meadows and a large reef flat covering an area of 239 km^2. Within Ashmore are three small islands known as East, Middle and West Islands (SEWPAC, 2011c).

Cartier Island Marine Reserve (Cartier) is located approximately 200km south-west of Ironstone-1 and about 150 km south-west of Ashmore Reef. Covering an area of 167 km^2, Cartier includes an un-vegetated sand island (Cartier Island) and the area within a 4 nautical mile radius of the centre of the island, to a depth of 1 km below the seabed. The area around the island includes a variety of habitats including a mature reef flat, a small submerged pinnacle, known as Wave Governor Bank and two shallow pools to the north-east of the island (SEWPAC, 2011c).

Ashmore and Cartier support large numbers of marine species including sea snakes, dugongs, reef building corals, fish and other marine invertebrate fauna. The reserves also provide important seabird and marine turtle nesting sites and provide staging points and feeding areas for large populations of migratory shorebirds. Ashmore was designated a Ramsar Wetland of International Importance in 2002 due to the importance of its islands providing a resting place for migratory shorebirds and supporting large seabird breeding colonies (SEWPAC, 2011c).

Scott Reef Group

This group of reefs consists of Seringapatam Reef, Scott Reef North and Scott Reef South. Seringapatam Reef, the closest in the group, is located over 390 km south-west of the operation.

Seringapatam Reef is an annular shaped, emergent shelf atoll located on the edge of the broad continental shelf, approximately 300 km from mainland north-western Australia. The reef formation, which covers an area of approximately 55 km^2 (5,500 ha), rises abruptly from the seabed with its narrow reef rim enclosing a relatively deep lagoon (maximum depth of 30 m). The lagoon is connected to the ocean by a narrow passage in the north-east part of the reef (SEWPAC, 2011a).

Scott Reef is located approximately 23 km south of Seringapatam Reef. Scott Reef includes North Scott Reef and South Scott Reef, both of which are emergent shelf atolls. North Scott Reef is an annular reef, approximately 16 km long and 14 km wide, which encloses a 21-m deep lagoon. South Scott Reef is a crescent shaped reef that forms an arc with arms approximately 27 km apart that subtend North Scott Reef and partly enclose a deep (up to 55 m) lagoon.

Seringapatam Reef and Scott Reef are characterised by environmental conditions that are rare for shelf atolls, including clear, deep oceanic water and large tidal ranges (SEWPAC, 2011a). Coral communities extend over a large depth range, due to the clear offshore water, and exhibit highly developed zonation as a result of exposure to strong wave action on exposed outer slopes and wide tidal ranges (SEWPAC, 2011a). The characteristics and geographical location of these reefs provide conditions suitable for species at, or close to, the limits of their geographic ranges as well as some species not previously recorded in WA (SEWPAC, 2011a). Sandy Islet, a small sand cay on the north-east of South Scott Reef, is used by migrating sea-birds and is a known nesting site for turtles.

Shoals

This group of shoals, shown on Figure 2, includes:

- Vulcan Shoal;
- Barracouta Shoal;
- Goeree Shoal; and
- Eugene McDermott Shoal.

These shoals are small, sub-tidal sea mounts or pinnacles rising from the seabed abruptly to a horizontal shelf plateau generally 20 to 30 m below the water surface but with occasional elevated areas. These features do not reach the water surface and are thus not considered to be islands. The dominate substrate on these shoals is rocky rubble with varying proportions of patchy coarse sand, isolated larger rocks, and live coral outcrops. The shoals are biologically diverse as they support phototrophic organisms such as algae (Halimeda) and sea grass as well as filter feeding organisms, corals (predominately soft corals) and sponges.

3.3 (e) Remnant native vegetation

Not applicable.

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

The water depth in permit areas ranges from approximately 100 to 120 m. The water depth at the well locations is approximately 105 m.

3.3 (g) Current state of the environment

The marine environment in the vicinity of the well locations is essentially undisturbed other than low level of fishing activities, shipping and oil and gas exploration activities. There are no marine pest species known or recorded from the area.

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

There are three listed places on the Commonwealth Heritage List in the region of the operation (SEWPAC, 2011a). These places are also registered on the Register of the National Estate. In addition, there are a further three places listed on the Register of the National Estate, one registered place and two indicative places. Each of these places is described in Table 8.

Table 8 Summary of places on the Register of the National Estate

Heritage Place	Register of the National Estate	Commonwealth Heritage List	Distance from well location	Description
Ashmore Reef National Nature Reserve	Registered (ID 14689)	Listed Place (ID 105218).	256 km south-west	A shelf edge atoll in the Timor Sea. Comprises a platform reef with extensive areas of coral reefs and sand banks and includes three low, vegetated islands.
Cobourg Peninsula (Gurig) National Park and Cobourg Marine Park	Indicative (ID 16110)	Not listed.	755 km east	Important for its natural values and historic sites, and significance to Aboriginal people. The proposed marine area consists of a diverse range of landscapes including many inlets, coastlines, coastal beaches and islands, coral reefs and extensive areas of mangroves and seagrass beds.
Cobourg Peninsula Historic Sites Precinct	Indicative (ID 16392)	Not listed.	755 km east	Consists of the following sites: Victoria Settlement, Fort Wellington Settlement, Smith Point (Beacon and Health Camp), Black Point Priest Cottage, Record Point Macassan Site, Middle Head garden, Victoria Settlement gardens, Spear Point ruins, Coral Bay convalescent station ruins and the wreck of the 'Orontes'.
Cobourg Peninsula Wildlife Sanctuary (former)	Registered (ID 1)	Not listed.	755 km east	As per the Cobourg Peninsula (Gurig) National Park and Cobourg Marine Park.
Seringapatam Reef and Surrounds	Registered (ID 17567)	Listed Place (ID 105243)	414 km south-west	A small circular reef with a diameter of approximately 9.4 km. There are no emergent sand cays but the reef platform is exposed at low tide.
Scott Reef and Surrounds and Commonwealth Area	Registered (ID 17566 and 102517)	Listed Place (ID 105480)	425 km south-west	A large, emergent shelf atoll located on the edge of the broad continental shelf. Consists of two reefs (North Scott Reef and South Scott Reef) with the permanently emergent Sandy Islet located at South Scott Reef.

Source: SEWPAC, 2011a.
Registered: The place is in the Register of the National Estate.
Indicative: Place has been nominated but a decision on whether the place should be entered in the Register has not been made.
Listed Place: Gazetted as a place on the Commonwealth Heritage List.

The Australian National Shipwreck Database lists ten shipwrecks in the Timor Sea (Table 9). None of these shipwrecks is located within AC/P24 or AC/P40 and the operation does not occur within a known shipwreck protected zone. The site surveys did not identify any ship wrecks at either well location.

Table 9 Shipwrecks in the Timor Sea

Id	Vessel name	Vessel type	Year wrecked	Wreck location
3365	Ann Millicent	Unknown	1888	southern tip of Cartier Reef
3374	Bathurst Island - perahu 1	Perahu	1917	N.W. side of Bathurst Island
3401	Caprice	Unknown	1964	100 km north of Darwin
3404	Charity	Sailing vessel	1897	unknown
3423	Dolphin IV	Motor vessel	1965	off Cape Hay
3424	Don Isidro	Motor vessel	1942	North of Cape Fourcroy, Bathurst Island
3432	Editha	Sailing vessel	1963	Cape Hay
3438	Erang Polea	Perahu	1886	North side of Melville Island
3442	Faith	Sailing vessel	1897	Between Darwin and Western Australia
3445	Florence D	Twin screw steamer	1942	60nm (?) NW Bathurst Island

Source: SEWPAC, 2011d

3.3 (i) Indigenous heritage values

Not applicable.

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

The EPBC Protected Matters Database Search did not highlight any State, Territory or Commonwealth reserves within the search area (see Annex B). The closest marine reserves to the operation are the Commonwealth managed Ashmore Reef National Nature Reserve and Cartier Island Marine Reserve, located approximately 235 km south-west (see Section 3.3(d)). Other reserves or recommended reserves in the region include:

- Sandy Islet, East Hook and the intertidal reef flat of South Scott Reef are included as an area of 'reserved land' (formally 'C' Class Nature Reserve) vested in the WA Conservation Commission.
- The area extending three nautical miles from the low water mark around South Scott Reef ('State Waters'), which has been recommended by the Marine Parks and Reserves Selection Working Group for consideration as a marine reserve (CALM, 1994).
- The Kimberley, Kimberley North and Bonaparte areas for further assessment, which have been identified as part of the proposed Commonwealth Marine Reserves Network in the North-west Marine Region (DEWHA, 2009).

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

The drilling activities proposed are located within the AC/P24 and AC/P40 petroleum permit areas.

3.3 (l) Existing land/marine uses of area

Commercial Fisheries

General commercial fisheries currently operating in the offshore waters of the Timor Sea are:

- The Northern Demersal Scalefish Fishery;
- The Northern Prawn Fishery;
- The Northern Shark Fishery;
- The Southern Bluefin Tuna Fishery;
- The Western Skipjack Tuna Fishery; and
- The Western Tuna and Billfish Fishery.

The proposed drilling activity is unlikely to have any significant impact on fishing activities, which are normally of low intensity in this area. WA Fisheries will be notified of the drilling programme prior to commencement of activities.

Shipping

Coastal shipping traffic is common to offshore areas. There are no known, recognised shipping routes through AC/P24 or AC/P40 however trading vessels may pass through the general area. There is a well frequented shipping route north of the operation, from Darwin to various Asian ports.

Tourism

The explorations drilling program is unlikely to impose on tourism activities due to its distance from the coastline where most of the tourism activities usually occur. Supply vessels to be utilised for the drilling programme will run out of the established port facility at Darwin and are unlikely to significantly impact on tourism.

Oil and Gas Exploration and Production

Petroleum exploration of the Bonaparte Basin commenced in the late 1940s, with reconnaissance work in the onshore area (DMP, 2011). This has included extensive petroleum exploration over the past decades within the Territory of Ashmore and Cartier Islands Offshore Area. For the period 2010 – 2014, a minimum nominated expenditure of a total A$775 million has been committed on petroleum projects within the Territory of Ashmore and Cartier Islands Offshore Area comprising drilling of 27 wells and acquiring 4,950 kilometres of 2D and 6,002 square kilometres of 3D seismic data (DoR, 2011a).

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

None known other than those referenced in section 3.3 (l) above.

4 Measures to avoid or reduce impacts

Table 10 below provides a summary of the potential environmental impacts arising from the various activities, sources or events relating to the project and the proposed management approach to be undertaken to avoid significant impacts to matters of National Environmental Significance.

PTTEPAA's permit areas (AC/P24 and AC/P40) are predominantly located in deep water environments where low light and nutrient availability result in largely homogenous benthic habitats with low biological productivity. The implementation of management measures outlined in Table 10 below will seek to ensure that all risks of environmental impact are reduced to As Low As Reasonably Practicable (ALARP).

Given the offshore deep water location proposed, and the management procedures that will be implemented (refer Table 10), it is unlikely that any significant environmental impacts will occur as a result of the proposed exploration drilling within the AC/P24 and AC/P40 permit areas.

Table 10 Summary of Environmental Risk, Potential Effects and Management Approach

Activity, Event or Source	Potential Environmental Effect	Mitigating Factors and Management Measures
Physical Presence		
Presence of anchors	• Localised loss, disturbance and/or smothering of seabed features and benthic habitat. • Reduction in water quality (i.e. Total Suspended Solids).	• Locations of anchoring areas will be selected to avoid any sensitive features of the seabed. • Support and supply vessels will not routinely anchor on location – they will use positioning thrusters.
Interference/collision with marine fauna	• Vessel strike resulting in injury or mortality. • Physiological effects or disruption to behavioural patterns of marine fauna.	• The drilling programme in AC/P24 is located outside known migration, breeding and feeding locations of listed cetacean species. • The operation is of short duration (approximately 21 days). • Opportunistic cetacean sightings will be recorded using the SEWPAC Cetacean Sightings Application database (http://data.aad.gov.au/aadc/ammc/index.cfm).
Movement of vessels	• Disruption to commercial, recreational and indigenous fishing and/or vessel operation.	• WA and NT fisheries departments will be notified prior to commencement of drilling programme.
Emission of Greenhouse Gases (GHG)	• Contribution to greenhouse effect through increase in emissions (including GHG, NOX and SOX).	• The MODU will service all engines and equipment according to the manufacturer's maintenance schedule to ensure they operate at optimum efficiency. • No flaring will be undertaken as there is will be no well testing.
Noise (from FLNG facility, support/supply vessels, helicopters)	• Disturbance to EPBC Act listed marine fauna including seabirds.	• Equipment will be designed to normal industry standards, which includes specifications for noise levels, and standard installation and drilling facilities will be used (see Table 5). • The operation of support vessels and helicopters will be consistent with Part 8 of the EPBC Regulations 2000 for managing interaction with cetaceans.

Activity, Event or Source	Potential Environmental Effect	Mitigating Factors and Management Measures
Overboard discharge of drill cuttings and adhered WBM	• Localised impact on water quality. • Suspended sediments in the water column, increased turbidity, potential impacts on pelagic marine fauna • Potential smothering of benthic habitat • Alteration of seabed structure in the immediate vicinity of discharge (cuttings piles on seabed)	• Either seawater with high-viscosity sweeps or water-based mud's (WBM's) will be used. • The volume of WBM required will be calculated as accurately as possible to minimise the volume of WBM required to be discharged at the end of the drilling programme. • There are no known significant seabed features near the well location. • Once the riser is in place, cuttings will be treated through the shakers and centrifuges to ensure maximum retention of fluids within the active mud system for re-use, thereby minimising losses overboard with the cuttings.
Routine waste discharges		
Grey water/ sewage disposal	• Localised reduction in water quality - nutrient enrichment	• All sewage will be managed and disposed of in accordance with MARPOL 73/78 Annex IV (as implemented in Commonwealth waters by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*); • All sewage and putrescibles waste treatment systems will be International Maritime Organization (IMO) compliant and fully operational during drilling • All vessels will only use biodegradable detergents (e.g., soaps, laundry detergents). • When <12 nm from land, there will be no overboard sewage discharge (treated or untreated) from any vessel.
Discharge of oily water from bilges and decks	• Localised chronic/ acute toxic effects to local organisms.	• Bilge water will be treated and disposed in accordance with MARPOL 73/78 Annex I (as implemented in Commonwealth waters by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*); • All bilge discharges will be treated to <15 ppm hydrocarbons; the MARPOL 73/78 standard for oily water discharge. • Bilge or deck water that is contaminated and can not be treated and disposed in accordance with MARPOL 73/78 Annex I must be contained and disposed of onshore; • Fuels, oils or chemicals stored within contained areas to capture spills and leaks. • Decks on the drill rig and support/supply vessels will not drain directly to sea – a drain system ensures deck waters are diverted to bilge water tank for treatment via an oily water separator (OWS) prior to ocean discharge. • If safe, stormwater from areas where there is potential for hydrocarbon or chemical spillage will be contained and treated according to MARPOL 73/78 standard prior to discharge. • Deck and bilge water quality from the Ocean Patriot and on the support/supply vessels will be automatically monitored. If 15 ppm limit is breach (as notified by alarm), water will be directed inboard (to pontoons on the Ocean Patriot, or storage tanks in the vessels).
Putrescible galley wastes disposal (from MODU and support vessels)	• Localised reduction in water quality through nutrient enrichment • Localised change in	• All discharges will be recorded in the MODU Refuse Discharge Logbook and maintained on vessel for two years. • In waters >12 nm from land (i.e. PTTEPAA's permit area), putrescible waste will be macerated to <25 mm prior to discharge, in line with MARPOL requirements. • There will be no disposal of putrescible galley waste when vessels are <12 nm from land.

Activity, Event or Source	Potential Environmental Effect	Mitigating Factors and Management Measures
Non-putrescible solid waste and waste oil disposal	• Localised marine pollution • Ingestion of solids by fauna, leading to injury or death	• All discharges will be recorded in the MODU Refuse Discharge Logbook and maintained on vessel for two years. • Non-putrescible solid waste (paper, metal, non-organic waste, etc) to be stored on board in covered skips before being shipped to shore via supply vessels for disposal/ recycling. • Waste oil will be collected and segregated from other wastes to be shipped to shore for disposal/ recycling. • PTTPE will operate an 'avoid, reduce, recycle and/or reuse' policy whenever possible. • All outdoor waste receptacles will be covered (e.g., skip bin with lid).
Non-Routine Activities		
Well blowout resulting in release of hydrocarbons into the environment	• Acute toxic or chronic effects on marine organisms (especially larvae and plankton) • Localised/widespread and short/long term reduction in water quality	• The basis of design and WOMP for the Kingtree–1 well includes a risk assessment and control measures to prevent loss of well control, such as provision of a blowout preventer (BOP). This includes a relief well contingency plan. • Appropriate drilling fluid weight will be used specific to the known reservoir pressure. • Operations on the drilling floor will only be undertaken by fully trained, certified and experience personnel (e.g., drillers, tool pushers, etc). • An OSCP will be in place for the project. • The following Tier 1 spill response equipment will be located offshore: - 200 m inflatable boom (harbour grade); - Brush or combination brush/disc skimmer with a minimum capacity of 10 m3/hr; - Storage for recovered oil (minimum capacity of 100 m3); - 50 m of 200 mm sorbent boom - 400 sorbent pads; and - Dispersant application system with spray boom and eductor systems plus 10 m3 of type 3 dispersant (concentrate). • PTTEPAA will engage additional incident response logistical support through Oil Spill Response Limited (OSRL), who will support AMOSC during an incident response. • Well-specific oil spill modelling has been undertaken (refer to Section 3.2) and provides a good indication of where oil spill response resources would be required in the unlikely event of an acute or worst-case well blowout.

Activity, Event or Source	Potential Environmental Effect	Mitigating Factors and Management Measures
Vessel collision resulting in a hydrocarbon spill (all vessels)	• Acute toxic or chronic effects on marine organisms (especially larvae and plankton) • Localised/widespread and short/long term reduction in water quality	• All vessels will be equipped with sophisticated navigation aids and competent crew maintaining 24 hour visual, radio and radar watch for other vessels. • Third party vessels will be made aware of the MODU location through adherence to maritime standards requiring notification of vessel presence via Notice to Mariners and pre-drilling fisheries notification and consultation. • All vessels will be equipped with navigation lighting and movements of vessel will comply with maritime standards and Australian Maritime Safety Authority (AMSA) standards. • All incidents will be reported to the relevant regulatory authorities in accordance with PTTEPAA's Emergency Response Plan (ERP)/Oil Spill Contingency Plan (OSCP). • Modelling indicates that the worst case diesel spill (total loss of a supply vessel tank) will degrade rapidly and is unlikely to be present as a sheen beyond 175 km from the drilling location and would not impact any shoreline.
Fuel loss during refuelling transfer (all vessels)	• Acute toxic or chronic effects on marine organisms (especially larvae and plankton) • Localised/widespread and short/long term reduction in water quality	• Refuelling of the Ocean Patriot and supply/support vessels will take place in accordance with vessel-specific refuelling procedures. However, as a minimum, the following procedures will be adhered to: - Refuelling only during the day. - Use of dry-break couplings. - Use of floats on fuel hoses. - Automatic shut-down of pumping in the event of a fuel spill. • Weather monitoring will be undertaken prior to engaging in transfer activities and re-fuelling will not take place if weather exceeds that which is safe to transfer fuel between vessels.
Introduction of Invasive Marine Species through ballast water and/or vessel hulls	• Negative effects on native flora/fauna species from competition, predation or disease • Changes in ecosystem species composition.	• PTTEPAA will adhere to AQIS Australian Ballast Water Management Requirements and quarantine requirements for vessels associated with the drilling activity.
Vessel distress due to a cyclone, resulting in a hydrocarbon or chemical spill (all vessels)	• Acute toxic or chronic effects on marine organisms (especially larvae and plankton) • Localised/widespread and short/long term reduction in water quality	• PTTEPAA have a Cyclone Management Plan in place. In the event of a cyclone, its path will be tracked by the MODU and the Cyclone Management Plan implemented if warranted, including cessation of drilling, securing all deck cargo and evacuating personnel.

5 Conclusion on the likelihood of significant impacts

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

X	No, complete section 5.2
	Yes, complete section 5.3

5.2 Proposed action IS NOT a controlled action.

In PTTEPAA's opinion, the proposed operation is not a controlled action, as it would not have significant impact on matters of national environmental significance, protected under the EPBC Act. Justification for this opinion is provided below. In determining the likelihood of significant impacts, PTTEPAA has had regard to EPBC Act Policy Statement 1.1 (DEH, 2006b).

Listed Threatened Species

While the EPBC Act Protected Matters Report identified nine threatened species (four endangered species and five vulnerable species) and 18 migratory species that have the potential to occur or travel through the drilling area, the impact on these species due to the proposed operation is anticipated to be minimal. Of the species which are likely to occur within the area, all are highly mobile and able to move away from AC/P24. There is also no critical habitat for these species in or near AC/P24 that would be affected under routine operations. In addition, PTTEPAA has outlined significant management measures (see Section 4) to mitigate potential impacts on listed species. Therefore, PTTEPAA believe that under routine operations, the Kingtree-1 Exploration Well is unlikely to have a significant impact on threatened or migratory species as it will not:

- Lead to a long-term decrease in the size of a population;
- Reduce the area of occupancy or fragment and existing population;
- Adversely affect nesting, breeding or feeding habitat for an endangered species;
- Substantially modify, destroy or isolate an area of important habitat;
- Seriously disrupt the lifecycle of an ecologically significant proportion of a migratory species;
- Introduce invasive species or disease that may cause the species to decline; or
- Interfere with the recovery of the species.

Under a worst-case, non-routine scenario (i.e., a blowout), threatened species may be affected directly by the toxic effects of spilt hydrocarbons or indirectly by a reduction in prey and food availability and, for turtles, the presence of low concentrations of hydrocarbons on shore at nesting sites. The extent of this potential impact is likely to be low and modelling results indicate that harmful concentrations of oil will not:

- Reach shore at key nesting sites;
- Reach shore in a concentration or volume that may affect nesting; or
- Reach shore during the nesting season.

Thus, even under a non-routine scenario, the operation is unlikely to have a significant impact on endangered or migratory species.

Wetlands of International Importance

The Ashmore National Nature Reserve, located 256 km south-west of the proposed operation, is listed as a Ramsar wetland. Under routine operations there will be no impact to this location.

Under a worst-case, non-routine scenario (i.e., a blowout), there is some possibility that there will be shore line contact of hydrocarbons at this location. However, extent of this potential impact is likely to be low (concentration of oil will be less than 1 g/m^2) and it is not certain if oil will reach shore at all, given that oil spill response will take place which will further reduce the probability of shore line contact. If oil does reach the shore, it is unlikely to be in a concentration or volume that may affect the ecological values of the island and is unlikely to:

- Destroy or substantially modify and area of wetland;
- Result in a substantial and measurable change in the hydrological regime of the wetland;

- Seriously affect the habitat or lifecycle of native species dependant on the wetland;
- Result in a substantial and measurable change in the water quality of the wetland; or
- Result in an invasive species becoming established.

Thus, even under a non-routine scenario, the operation is unlikely to have a significant impact on a wetland of international importance.

The Commonwealth Marine Environment

Under routine operations, the anchoring of the MODU within AC/P24, and the installation of subsea infrastructure associated with a single, short duration exploration well is likely to have limited, localised impacts in the deep water environment.

As the MODU and all support vessels are currently working in Australian waters and will be working in the Timor Sea immediately prior to this operation, there is no real chance that the operation will result in a known or potential pest species becoming established in the area.

The well is being drilled on an area of the seabed which is relatively flat and devoid of the geological features and complexity of habitat. The benthic habitat at the well location is widespread and the operation will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat.

The operation is not located within any known key breeding or feeding habitat for any marine species, including cetaceans. Further, the operation is not located on any known migratory path for marine species. As such, the operation is not expected to have an adverse effect on a population of a marine species or cetacean, including its life cycle and spatial distribution.

The operation is not expected to result in a substantial change in air or water quality. Discharge of cuttings and any residual WBM adhered to the cuttings, or discharge of a small quantity of WBM at the end of the operation, may result in a short-term, localised increase in turbidity. However, dilution effects in the deep, open waters of the well location mean that there is no real chance of adverse impacts on biodiversity or ecological integrity. Under extreme, abnormal circumstances, water quality may be affected but this is likely to be short-term and is unlikely to adversely impact biodiversity or ecological integrity due to the distance of the well from any islands, coastline, reefs or shoals.

The operation is unlikely to result in persistent organic chemicals, heavy metals or other potentially harmful chemicals accumulating the marine environment as the drilling fluid is WBM and only very small quantities of chemicals or other hazardous substances are kept on the rig and are highly unlikely to be released into the marine environment.

The operation is not near any known shipwreck sites and is unlikely to encounter any unknown sites due to the lack of geological features for a ship to be wrecked on.

Under a worst-case, non-routine scenario (i.e., a blowout), there may be some impact on water quality and resulting affects on individual animals however there is still unlikely to be a substantial, adverse effect at a population level due to the distance of the well offshore. Impacts would be further reduced due to implementation of the OSCP. As such, the proposed operation is unlikely to have a significant impact on the Commonwealth marine environment.

Conclusion

Given the above, it is concluded that this operation is not likely to have significant impact on any matters of national environmental significance.

6 Environmental record of the responsible party

		Yes	No
6.1	**Does the party taking the action have a satisfactory record of responsible environmental management?** **Provide details** PTTEPAA has operated oil production and exploration assets in the Timor Sea for many years. PTTEPAA currently operates seven exploration permits, five production licences and seven retention licences. These include the Jabiru and Challis-Cassini oil fields, located in AC/L1 and AC/L3 respectively. Throughout the life of the Jabiru and Challis fields and operatorship under PTTEPAA, PTTEPAA has responsibly managed all environmental risks, potential impacts and reporting procedures in compliance with approved Environment Plans. **Montara Incident** PTTEPAA owns and operates 100% of the Montara Development Project, which comprises the Montara (AC/L7), Skua and Swift/Swallow (AC/L8) oil fields. On 21 August 2009 an uncontrolled release of oil and gas occurred from the H1-ST1 well located in the Montara oil field at the Montara Wellhead Platform in the Timor Sea, offshore north West Australia. The well subsequently ignited on 1 November 2009 before being killed via an intersecting relief well on 3 November 2009 (Incident). During the period of the Incident, from 21 August – 3 November 2009, a likely 400 barrels per day of light crude oil were released into the ocean; however during the initial stages it could have been as high as 1000-1500 barrels per day. Environmental impacts appear to have been limited by oil evaporation, natural degradation, dispersant spraying and skimming. PTTEPAA responded quickly and responsibly to the Incident and has at all time cooperated with all relevant government departments and agencies. In particular PTTEPAA: • Implemented the approved Oil Spill Contingency Plan (OSCP); • Met all costs arising from the Incident; • Entered into and implemented an environmental monitoring programme; and • Developed and implemented an Action Plan to prevent the recurrence of a major accident event. In accordance with the OSCP, PTTEPAA promptly notified the appropriate authorities of the Incident. On the day of the Incident, PTTEPAA formerly handed over Combat Agency to AMSA under the National Plan to Combat Pollution of the Sea by Oil and Other Noxious and Hazardous Substances. As the Combat Agency, AMSA assumed control of the response operation and PTTEPAA provided logistical resources support. As part of its response, AMSA conducted: • aerial surveys and water, oil and wax sampling; • oil trajectory modelling; • satellite imagery analysis; • oil recovery operations; and • dispersant operations PTTEPAA agreed a 'Monitoring Plan for the Montara Well Release Timor Sea' (the Monitoring Plan) with SEWPAC (formerly called Department of Environment, Water, Heritage and the Arts) on 9 October 2009. The Monitoring Plan consists of five (5) operational monitoring studies which were implemented during the response to the Incident and seven (7) ongoing scientific monitoring studies. PTTEPAA has committed to paying the costs of the studies.	X	

	PTTEPAA, with the guidance and support of the Commonwealth Government, has developed an Action Plan to prevent the recurrence of a major accident event such as the Incident. The Action Plan comprehensively addresses the key concerns and findings of the Montara Commission of Inquiry and the concerns of other regulators such as the National Offshore Petroleum Safety Authority and SEWPaC Key aspects of the Action Plan address improvements to the Drilling Management System, the drilling organisation, training and competence, oil spill contingency planning, and corporate governance. PTTEPAA, through its responsible and proactive response to the Incident has shown its commitment to responsible environmental management.		
6.2	**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**
6.3	**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?** **If yes, provide details of environmental policy and planning framework** The PTTEPAA HSE Policy and the Diamond Offshore Environmental Policy are included in Annex A.	**X**	
6.4	**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)** PTTEPAA has previously referred the following activities under the EPBC Act; • EPBC/2002/755 – Montara Field Development • EPBC/2003/942 – Decommissioning of Challis Oil Field • EPBC/2011/5840 – Cash-Maple Appraisal Drilling Programme	**X**	

7 Information sources and attachments

(For the information provided above)

7.1 References

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7.2 Reliability and date of information

This referral was compiled using information sourced from an extensive selection of scientific papers, published reports, books, government websites and field surveys. All information used has undergone technical, scientific, peer and public review, resulting in a referral which contains not only the most current information available but information of a high quality nature.

7.3 Attachments

		attached	Title of attachment(s)
You must attach	figures, maps or aerial photographs showing the project locality (section 1)	✓	Location and Permit Area (see page 3)
	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)	✓	Regional Context (see page 4)
If relevant, attach	copies of any state or local government approvals and consent conditions (section 2.5)	NA	
	copies of any completed assessments to meet state or local government approvals and outcomes of public consultations, if available (section 2.6)	NA	
	copies of any flora and fauna investigations and surveys (section 3)	NA	
	technical reports relevant to the assessment of impacts on protected matters that support the arguments and conclusions in the referral (section 3 and 4)	NA	
	report(s) on any public consultations undertaken, including with Indigenous stakeholders (section 3)	NA	

8 Contacts, signatures and declarations

Project title: Kingtree – 1 and Ironstone-1 Exploration Wells

8.1 Person proposing to take action

Name	Ian Paton
Title	Exploration and Development Manager
Organisation	PTTEP Australasia (Ashmore Cartier) Pty Ltd
ACN / ABN (if applicable)	2700 421 0164
Postal address	Level 1, 162 Colin St, West Perth 6005 | PO Box 7311, Cloisters Square 6850
Telephone	+61 8 9483 9483
Email	ian.paton@au.pttep.com
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading. I agree to be the proponent for this action.
Signature	[signature] Date 15/4/11

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

Name	Robin Wright
Title	SSHE and Approvals Manager
Organisation	PTTEP Australasia (Ashmore Cartier) Pty Ltd
ACN / ABN (if applicable)	2700 421 0164
Postal address	Level 1, 162 Colin St, West Perth 6005 | PO Box 7311, Cloisters Square 6850
Telephone	+61 8 9483 9483
Email	robin.wright@au.pttep.com
Declaration	I declare that the information contained in this form is, to my knowledge, true and not misleading.
Signature	[signature] Date 21-4-11